Social Responsibility and Science in Innovation Economy

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Introduction

The idea of the science of science emerged in Poland in the first decades of the 20th century in response to both the practical and theoretical needs of Polish science in view of its integration after the division into three partitions: Austrian, Prussian and Russian. Stanisław Michalski, who was the mastermind of the science of science program sponsored by the J. Mianowski Fund, managed to engage the most prominent Polish scientists with the science of science foundational program. The outcomes of the early theoretical deliberations were disseminated by the journal "Nauka Polska." Most notably, the papers by F. Znaniecki (Znaniecki 1925, 1982), Maria Ossowska and Stanisław Ossowski (Ossowska and Ossowski 1935, 1964). From the perspective of the emerging field of studies on science they characterize science as constituted by the cognitive value and essentially contributing to human culture. The core disciplines within the science of science are thus grouped into "epistemological" and "anthropological" studies. The more practically oriented studies on science policy and organization as well as its economic performance are therefore secondary to the humanistic reflection on science. Michalski planned to institutionalize the professional research on science in the late 1930s and towards that end, in 1936, he established the journal "Organon." However, his development plans were almost totally ruined with the advent of WWII and subsequent communist domination over Polish science with the exception of the Science of Science Committee at the Polish Academy of Science and its journal "Zagadnienia Naukoznawstwa – The Problems of Science of Science Quarterly."

In a sense, his plans were revived thirty years later in the UK with the establishment of the Science Policy Research Unit (SPRU in short) in Sussex and the journals "Minerva" (which published the translation of the Ossowscy's paper) and "Research Policy." C. Freeman, the founder of SPRU, recognized, however, its legacy in the economic approach to science, which was first initiated by J. Schumpeter and later on, elaborated by prominent economists, affiliated at the US National Bureau of Economic Research. In that tradition studies of science have become a part and parcel within the broader field of economic policy. Thus, the priorities within the science of science had a natural tendency to focus on innovation studies (Fagerberg et al. 2013, Kawalec 2016).

However, this tendency was accompanied by inherent problems, such as market failures of innovation (Kawalec 2013), which steadily established 'economization of science' (Mirowski 2011). Scientific community has now realized that it may threaten the integrity and the very ideals of science as "markets [...] can equally well be deployed to produce ignorance" (Mirowski 2011: 318). Therefore, it is natural that the humanistic reflection – called for by the founders of the Polish science of science research – gains more prominence within the more recent science of science research interests. This is reflected, for example, in the emergence of such domains as research ethics, responsible innovations, epistemic authority of experts (Wierzchosławski 2014) and methodological pluralism (Kawalec 2012).

The rationale for the series of lectures "Social Responsibility and Science in Innovation Economy" delivered at the John Paul II Catholic University of Lublin in Poland between 2011 and 2015 by prominent scientists was to reflect this tendency in science of science studies. The invited lecturers represent a high profile expertise in their own fields of scientific research, but, at the same time, they have also demonstrated an advanced interest in the widely understood aspects of social responsibility within their fields of interest. The present collection reflects the chronological order of the introductory courses delivered within the framework of the project *"Best Practices" in Strategic Transformation of the KUL* cofounded by the European Structural Funds for the students of the KUL involved in the interfaculty Ph.D. program MISD. The students who represented the humanities: theology, philosophy, law, sociology and pedagogy had thus a unique opportunity to be engaged in detailed application of ethical and socially responsible reflection in some of the most innovative research domains of the modern economy.

The volume opens with the paper of Mirosław Skibniewski *Achieving Excellence in Project and Program Management in Poland through Creation of a Dedicated Center for Project and Program Management*, who focuses his attention on the problem of governmental and industrial projects failures, and considers institutional devices which might improve the procedures of undertaken projects as far as their financial (budget) and temporal (project deadline) aspects are concerned. The problems, he claims, are due to lack of professional knowledge and sufficient management skills, and the problems in questions might be solved by establishment of a Center for Project and Program Management, which objectives include serving educational and research needs by dissemination of recent achievements in methods and information technologies. He develops an outline of such a center in the context of management in global, national and regional economy trends, drawing the structure of projected institutions, considering its activity dynamics and possible collaborative networks from North America and Western Europe, focusing

his attention on mechanism and governmental frameworks required for the best outcomes in undertaken (conducted) projects.

While Skibniewski considers the institutional design of projects management, Bernhard Callebaut focuses his attention on axiological and anthropological aspects of social and economic development: *The Ecological Challenge as a Call for Another Humanism. An Interdisciplinary Approach in Five Lessons*. Callebaut notices that crucial problems of ecological and economical crisis, which tackled (post)modern European societies, require a new approach, and a discursive change. There is an urgent demand for anthropocentrism of solidarity and conceptual switch in understanding our social and economic relations and mechanism, which govern them. The main resources of the projected new approach might be found not only in modern philosophy and social sciences, but also (and for all) in Christian theology and forms of life, which might be found in communitarian life-world. In modern secular world theological reflection (trinitarian aspect of God) co-resonates with modern sociological insights, as both points at the intersubjective dimension of human relations. Following his claims, a communitas bounds together in the various forms of social interaction that involve this obligatory and obliging gift exchange; as opposed to immunitas, i.e. remaining outside such a social structure of obligation, service or duty. The interactive nature of the social has a significant impact upon the economic life. It might be understood in terms of market-centric system in which interpersonal relationships in the market are instrumentalized towards the exchange of goods and services, and in this model the real scarce good becomes an authentic human relationship. He states that in keeping a relational communitas, we need not settle for the model of asymmetric, power based on social relationships. If we understand that this crisis of ours is about the failure of a social model of mutual indifference, a global relational crises, than the way is open to rethink relationship, reciprocity, fraternity as essential categories also for the economics. His aim is to put agape (love and friendship as a key-form of intersubjective relation) at the center of public and private life, not as a rare element of the only private sphere. And that would be the most intelligent and cultural advanced goals economics and social sciences should have in mind. Taking this for granted, he suggests a new understanding of "charismatic economy" understood as an institutional dimension relevant to understanding of economic and social life. Considering the three terms of the expression 'Economy of Communion in Liberty' on the one hand, the company is integrated in a free-market economy, but on the other hand, it receives charismatic inspiration that provides an impulse towards communion. In that context he refers to the communal practices of the Focolare Movement in Italy and all over the world as a case study. Another case study of agape practices implemented to political action might be a fine-grained

analysis of Jean Monnet diplomatic activity in promoting mutual reconciliation and establishing economic cooperation between post-war European states, France and Germany in particular. The two case studies have to provide an empirical content for the theoretical framework, i.e. abstract and general ideas about actual possibility of human sustainable development floating in the air.

The next essay, *Value Sensitive Design and Responsible Innovation* by Jeroen van den Hoven, considers an important problem of balancing opposing values in technology innovations policy context. Hoven observes that due to innovative technologies policy households may profit significant profits (electric energy savings), and reduce greenhouse effect of global warming. However, the new technological devices, which enable energy consumption (precise prediction of energy peaks), might also provide a lot of secret information about energy users (e.g. what film he or she has been watching last night). A similar case of value conflict has been in the case of Electronic Patient Record System in the Netherlands, which in spite of 10 years of R&D preparations, consultations with stakeholders and costly investments, has not been finally accepted by the upper house in the Dutch parliament. The above mentioned cases point out a more general question, which has been discussed by van der Hoven: innovation R&D faces the dilemma of coordination of different social values: privacy right against economic efficiency or public benefits. He discusses problems of theoretical and empirical approaches to values, coordination of various life forms, and balancing of axiological discrepancy, which is faced in pluralistic societies. He claims that early and serious attention to moral considerations in design and R&D may not only have good moral outcomes, but may also lead to good economic outcomes. It is claimed that economic growth and sustainability might be resolved by sustainability technology, that we have to think of ethical considerations and moral values in terms of requirements in design and R&D at an early stage, value discourse should therefore not be treated as an abstract one, but needs to be operationalized in practical terms of the methodology of Value-Sensitive Design. It should be noticed that articulation and transparency concerning values are important to innovation processes, since it allows us to detect dubious value commitments and allows us to design for shared public value commitments. It means that values and moral considerations incorporated in technology can affect the set of affordances and constraints of users. It is more significant that contemporary moral philosophers are much more aware of this and want their ideas to have an impact in the real world of technology, policy, and economics. The reason for this is that world of technology is a world of probabilities, ignorance and uncertainty. That is why ethics and the law have a special role to play in innovation design and R&D at the very early stage of its development, and it makes possible to think about in terms of responsible innovation. Hoven

suggests that a core conception of responsible innovation is a transition to a new situation, and which has its defining characteristic that allows us to meet more obligations and honour more duties than before.

Ibo van de Poel's contribution, *Design for Values,* might be read as a road map of designing (projecting) problems in axiological contexts. It continues and extends some essential intuitions covered by van den Hoven. Van de Poel starts with the discussion of values typology and values hierarchy, focusing on *for the sake of* as a model of relating general values to specific design requirements that can guide the design process. The aim of conceptual tools he proposed is to be used in translation of abstract values into more specific design requirements. They may also be used to reconstruct for the sake of which values certain design requirements are pursued. He discusses a problem of specification relation, which implies certain value judgements, and he proposes certain criteria for adequacy of a specification (in question). The criteria should enable one to choose between competing reasonable specifications and to deal with disagreements between the different parties involved in design about the specification to be used in the actual design process. The reconstruction of a values hierarchy makes the translation of values into design requirements not only more systematic, but it makes them also explicit, debatable, and transparent. Moreover, van de Poel claims a values hierarchy may be helpful in pinpointing where exactly there is disagreement about the specification of values in design, it makes also those choices more transparent to outsiders. Transparency seems a minimal condition in a democratic society that tries to protect or enhance the moral autonomy of its citizens, especially in cases that design impacts on the life of others than the designers, as is often the case. The last claim is very important for a better understanding of a special role of science in liberal democracy.

Frank Guldenmund's contribution, *Organisational Safety Culture Principles*, refers to a holistic dimension of human existence pointing at significance of cultural patterns of organizational frames we live and act in. Guldenmund starts with an observation that culture is a prerequisite for human beings to be able to live, to understand their surroundings, to work together. He provides an extended analysis of culture definitions, which might be found in various theories, taking into account many aspects, and dimensions from the point of which the concept is discussed. Conceptually, culture can be grasped as a group's shared understanding of reality, as a way of looking at and experiencing that reality and all the things that happen in it. Culture researchers try to describe conceptual schemes (constructs) through which a particular group experiences its reality on different levels. The core of culture represents the basic assumptions taken for granted by the group that helps them understand reality. Built onto these are various norms, rituals, institutions, symbols and behaviours, which are particular expressions of the core.

He distinguishes three ways of approaching culture – the academic, analytical and pragmatic, and discusses them extensively. It should be also mentioned that the culture development process might be used to formulate general intervention strategies that could influence the different steps of this process. In general, several interventions working at the same time might be more effective that carrying them out in succession or doing a few.

A well-known chemist working in the field of environmental studies, Maria K. Doula, in her paper *Soil: Threats and Protection. Sustainable Agriculture,* provides an extended presentation of agricultural sciences in the context of global threats – soil degradation in the context of climate change and technological pollution. Her contribution is an example of a diagnosis, which is provided by a scientific analysis in order to find remedies to environmental questions by applying required policies supporting sustainable agriculture in the EU. She starts with a scientific description (definition) of the soil, as an extremely complex and variable medium. She notices that soil is subject to a series of degradation processes or threats. These include erosion, decline in organic matter, local and diffuse contamination, sealing, compaction, decline of biodiversity, salinization, floods and landslides. A combination of some of these threats can ultimately lead arid or sub-arid climatic conditions to desertification. However, since soil is a dynamic and living resource, which needs minimal and suitable conditions to carry out its indispensable functions for its conservation, to produce food and for supporting the environment quality, there is a vital challenge of its reasonable use and protection for the sake of the future generations. The author discusses problems of costs of soil degradation, its significance for human health, and variety of questions in the context of global climate changes as well as global economy processes. She focuses her attention on the challenges for both scientific diagnosis and political issues of soil remediation. That means, the issue goes beyond the regional scope of applied sciences activity, but it demands actions at the national and supranational level. As Doula mentions, the EU authorities have paid their attention to the objective already and many policies (like Soil Thematic Strategy and a proposal for a Soil Framework Directive programs) have been introduced in order to cope with the problems of soil degradation in the context of environment, economy and society challenges. At a strategic level, remediation of contaminated sites supports the goal of sustainable development through: (a) the act of conserving land as a resource; (b) prevent spreading of pollutants to the air, soil and water; (c) reducing the pressure on development. The idea is that negative impacts should not exceed the benefits of a remediation. The second part of Doula's paper covers a topic of human agricultural activity. From the historical point of view, agriculture was the key development that led to the rise of human civilisation, with the husbandry of domesticated animals and

plants (i.e. crops) creating food surpluses that enabled the development of more densely populated and stratified societies. It provides the basis of subsistence for human populations. Although, the phenomena of soil degradation generated by human activities is a very ancient feature of Europe, its significance for the future humankind has been increased significantly in recent centuries due to the global scale of agricultural activity, which has caused new, unknown in earlier stages of development, dangers (like greenhouse gas (GHG) emissions). The problem – she claims – needs to be answered by suitable remedies, like accepted in the EU new farm management practices in the framework of the PAIS project (Proposal on Agri-Environmental Indicators), financed by Eurostat are decisions and practical measures defining the management of farms. They include input use and production technologies such as crop rotation, soil treatment methods and coverage of soil with vegetation, as well as types and capacities of storage facilities for organic fertilisers. Therefore, they have a direct impact on various soil degradation processes, such as erosion, reduced organic matter content in soil, soil compaction and different types of pollution. The remedy – it is claimed – might be found in sustainable agriculture. And the debate typically focuses on whether farming should be conventional or organic, on an industrial scale or a small scale. However, the issue is rather more complex, as sustainability hinges on many factors. The problems in question, and proposed solutions have been discussed extensively. She focuses her attention on the Common Agricultural Policy (CAP) in Europe as a possible and desired remedy. Since farmers are no longer paid just to produce food, they have to respect environmental, food safety, phytosanitary and animal welfare standards. The latest CAP reforms confirmed this shift towards increasing environmental concerns. As an example of social challenges, which have attracted attention of the European Parliament, might be the request of the European Commission to carry out a pilot project on "Sustainable Agriculture and Soil Conservation through simplified cultivation techniques" (SoCo). The paper of Maria Doula is a good example of natural sciences' contribution to diagnosis and proposing solutions for solving technological civilisation urgent problems.

Joris Hulstijn in his paper *Accountability and Information Systems* deals with a very important question of organizational accountability in an information context. He claims that to be accountable, organizations provide evidence of performance to stakeholders. That means that they respect a certain set of social values (like transparency) they are committed to. Internal control systems, policies and procedures to gather reliable evidence of organizational performance are often implemented by information systems and such applications are designed. The paper considered and explained how it is possible to build the value of accountability into the design of governance structures, business processes and information

systems. It is proposed to make trade-offs concerning core values (in spite of their incompatibility) explicit in a dialogue with stakeholders, by referring to an approach called value-based argumentation. Crucial notions in this respect are risk and trust. Hulstijn argues that increased accountability is expected by new forms of regulatory supervision, such as responsive regulation, in which the company is expected to demonstrate compliance to the regulator. This approach also puts constraints on the auditing or inspection process. He discusses various cases to illustrate the notions in questions like (a) AEO self-assessment case: companies which obtain certification of Authorized Economic Operator receive benefits, in the form of less physical inspections and advance warnings in case of inspections. The application procedure for an AEO certificate involves a self-assessment and respect of self-accepted norms; (b) SBR Programme which deals with language of Standard Business Reporting (SBR) which applicatory follows the idea: "store once, report to many"; (c) Three Lines of Defense Model. It is a governance model of how to organize the risk function of a large organization. The model is based on a military metaphor of consecutive lines of defense, which tries to balance risk and control at different levels of such bodies, and finally, he discusses (d) the Lehman Brothers case. What caused the crisis? And why the sophisticated risk management function has not prevented such a disaster? He shows how in each of these cases, the value of accountability had been (or not) ensured. The purpose of such critical discussions is not to create uncertainty, but rather to challenge assumptions and conventional wisdom, and derive information, which can be used to learn and improve. In the end, this will also improve decision-making.

Nasos Argyriou's *Innovative Approaches to Social Aspects of Climate Change and Water Management* discusses profits of application of a Geographical Information System (GIS) to presentations of climate changes and water management. He develops the history of various ways of positioning of human activity in space and he defines modern systems of remote sensing as consisting of a graphic file linked to an attribute database. GIS facilitates wise use of limited resources by clarifying characteristics and patterns over space. It is especially useful for problem-solving situations. He points that GIS has emerged in the last decades as an essential tool for urban and resource planning and management. It is a tool that uses the power of the computer to pose and answer geographic questions. In the first part of his contribution there is an extended characteristic of hardware and software components of GIS, their applications like Global Positioning System (GPS), and advantages of their geospatial and temporal usage. The second part is devoted to climate change understood as a change in the statistical distribution of weather patterns, when that change lasts for an extended period of time. The problem is discussed in the context of global warming (historical perspective), and

greenhouse effects on Earth and on Europe in particular. The author provides an overview of variety of policies adopted in coping with the problem on the EU level (macro level) and on the EU Member States level or even regional level (micro level), i.e. case studies in Belgium, Cyprus, Greece, Portugal. There are examples of application of GIS system in problems of discrimination, diagnosis and decision making as far as climate change is concerned in the context of Corporate Social Responsibility (CSR).

The final part describes problems of water management as a discipline focused on solving problems to secure water for people, based on a sound scientific understanding of hydrologic and hydraulic processes. This includes protection from excess water and from water shortage, as well as providing sufficient water for a sustainable environment. The author discusses plenitude of problems, which water management have to cope with, like the water footprint of products, floods, flood hazards problem, and flood management strategies, as well as droughts dangers, which affect the other regions of the world. In all those questions – it is claimed – GIS technologies might be applied with success.

The collection of papers is concluded by Kawalec's *Ambivalued Innovation and Interactive Research Design*. It links the presented theoretical background of the Polish science of science research with the arguments elaborated in the contributions to the present volume by elaborating on the inherently 'ambivalued' character of the concept of innovation. On the one hand, innovation admittedly possesses the variable utility value, which reaches its climax in the whole innovation process with its market diffusion. On the other hand, however, it also has – as argued by Kawalec – an inherent and constant cultural value, which contributes to the cultural upheaval. The ambivalued understanding of innovation requires, as succinctly presented in the paper, new policy measures and integrative methodological approaches.

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Achieving Excellence in Project and Program Management in Poland through Creation of a Dedicated Center for Project and Program Management

Introduction

Quidquid agis, prudenter agas et respice finem. Projects must be completed on time, within budget, and with an acceptable level of quality. A thoughtful planning and execution process is the strongest predictor of a successful outcome. A *Wikipedia* definition of a project describes it as a temporary endeavour, a collaborative enterprise, frequently involving research or design, that is carefully planned to achieve a particular aim. Projects can be further defined as temporary [undertakings] rather than permanent social systems that are constituted by teams within or across organizations to accomplish particular tasks under time [and resource] constraints. Poland's transformation into a 21st century economy and a world-class society is evolving predominantly through the conduct of projects, long-term and short-term alike. Additionally, almost every organization, public or private, conducts most of its business activity through projects.

Problems associated with the conduct of major projects are well documented world-wide. As reported by the Project Management Institute (USA) and the International Project Management Association (Europe), over 70% of projects undertaken by major organizations end in failure, typically associated with cost overruns and/or schedule delays. Other typical project management failures include inability to reach stated strategic objectives, lack of adherence to the defined scope of work and the quality standards. These problems could be

minimized with properly designed educational offerings for engineering students and practicing professional engineers at all levels, and if research and development has been efficiently employed to optimize the use of project management tools and best practices currently available. These include, for example, web-based project management systems, resource optimization and management, and customized implementation of project management standards such as Project Management Body of Knowledge (PMBoK), and PRINCE2.

Poland lacks a central intellectual entity serving as an academic center of knowledge creation and dissemination in the discipline of Project Management. Current activities in this domain are confined to graduate level coursework offered at several academic institutions and by a handful of professional organizations. There are also commercially sponsored seminars for industry aimed at promotion of commercially available tools project management activities.

A newly established Center of Excellence in Project and Program Management, through its activities, should compile and disseminate the current project management knowledge, and make effective use of the advanced Information and Communication Technologies (ICT) towards excellence in project performance. The Center should become the focal point for creating and disseminating expert knowledge in project management best practices for government and industry planners concerned with the performance of major projects. Such as Center should be housed at a major academic institution in Poland with an existing critical mass of faculty expertise and other resources facilitating its creation and successful operation.

The mission of the Center, besides serving human and societal needs in general, should focus on work for the benefit of its constituent groups, and provide them with the intellectual resources and know-how for effective project management. Specifically, the Center should:

- create, store, manageand disseminate project and program management knowledge for the member organizations and society at large, and
- operate a forum in which best practices for project management are identified and exchanged for mutual benefit of Center member firms and organizations.

The Center philosophy is based on the belief that the Project and Program Management expertise should serve all projects vital to the Nation and the society at large, and that transfer of knowledge within its constituents and partners is a reciprocal relationship. The Center values the tacit knowledge available among the members of global, regional and local partner organizations and firms. Through its activities, the Center shall compile and document this knowledge for mutual benefit through the interaction with its member organizations.

The mission of the Center will assist its constituent members to:

- provide better project management services to their constituent groups;
- achieve effective project delivery methods at all phases of the project lifecycle;
- utilize efficiently project budgets;
- plan projects efficiently;
- motivate available human resources towards professional excellence;
- grow and develop into efficient learning organizations.

One of the initial domains of activity for the Center should be the transportation infrastructure for Poland. The Center should address the need for research and development related to project management, built environment, site safety, economics, and sustainability. The need stems from the fact that:

- there is a considerable size of construction project activities in Poland, particularly related to the execution of the so called Structural Programs, including the creation of a comprehensive transportation network consisting of modern highways, waterways, railroads and airports;
- for project management efforts to be successful, they need to be researched in the local Polish context;
- Poland's infrastructure requires a holistic approach, encompassing the entire life cycle of the project from early planning stages through design, construction, operation, retrofit, demolition and sustainable disposal.
- encouraging integration in the supply chain of the built environment can lead to improved schedule compliance, cost benefits, efficient use of materials, better response to end user needs, and more sustainable selection of construction materials and systems.

The professional communities involved in project management and the built environment in Poland have a need for a locally based academic forum through which Communities of Practice (CoPs) can research and brainstorm professional utilization of resources and techniques. The creation and activities of such a Center can encompass such a forum, through which a vibrant environment for research and development responing to the real needs of the society and national economy can be activated.

Center's Community Building Activities

A number of community building activities can be undertaken through the Center, including:

1. Conducting case studies through collaboration with Center's institutional members and external stakeholders;
2. Creating a vibrant research environment within the partnering organizations;
3. Raising the professional capabilities of all the Center member organizations' personnel participating in the process.

Working on behalf of its member organizations, the Center will lead the effort to generate and implement best practices for planning and implementing effective measures to ensure project success. The success criteria will be established for the context in which the particular project is conducted. Such best practices are well documented worldwide, but there is a need customize them for the local context of each project.

One of the most effective tools essential for the success of projects is the use of the latest advances in Information and Communication Technologies (ICT) for project management. The Center will secure the collaboration of the world's renowned experts in the field, and their expertise can become the starting point for research and implementation of these tools in Polish projects representing considerable challenges, such as the continuing efforts to update the electrical energy distribution grid to include muitple suppliers and the renewable sources of energy, or the modernization of Poland's transport infrastructure.

ICT tools used for project management create opportunities for effective project collaboration. The holistic understanding of how these technologies best integrate with the other communication media and sources of knowledge is a major challenge. The role of local culture and local business practices in Poland need to be taken into consideration for knowledge creation related to Polish project management knowledge creation and implementation. Technologies such as Product/Building Information Modeling (P/BIM) and web-based project management implementation should be considered among initial priorities for research and education efforts in the Center. Additionally, enhancing project sustainability and work safety through the use of advanced technology will also be considered.

The Center can also assist each member organization in creating its own professional cadre capable to deal with project investigation needs. This cadre will be able to determine the measures of success at the start of the project at hand, and document the lessons learned at the end of the project for future use with subsequent projects in the same organization.

Philosophical Aspects of Project Management

Philosophy explores and tries to explain the fundamental way we think about the surrounding world; this includes how we acquire our knowledge and what we can know. It also considers the basis of the way that we act in the world, including making decisions in it. Thus, philosophy is not some distant abstract activity but one that is undertaken everyday in professional project management practice and academia when we explore our assumptions and methods. Although for many academics this is most evident in discussions of 'methodology,' project management researchers are challenging the notions of practice, its management and improvement to an extent that a serious discussion of the philosophy of this issue is long overdue. We are fundamentally concerned about the way we 'problematize' the world and in doing so theorize and act in inadequately reflective ways.

The discipline of Project Management is a rich source of complex philosophical problems; in particular it is fundamentally 'grounded.' Theory-focoused researchers in this field are being challenged as to whether their thinking bears sufficient relationship to the physical world. This thinking and action are mediated by a rich social and organizational world that defines it, values it and is sustained by it. Project management activities have been undertaken over millennia and indeed can be seen as a characteristic of human existence; making them so connected with our social being that project management is difficult to isolate.

The Center activities are likely to open an extended dialogue, no only with the worldwide community of researchers in Project Management, but embracing participants from the surrounding pure and applied disciplines. The aim is to see the philosophical landscape around the discipline and to initiate the clarification of thinking. The Center may likely include a number of stimulus presentations on an Aristotelian perspective of the environment in which projects are undertaken, Bergsonian view of time, meta-theoretical reflexivity, critical realism, and local translation processes and interpretive flexibility, followed by facilitation of new ideas for Project Management methodologies from which one may hope to develop new research, collaborations and implementations.

A latent interest in philosophy and research in project management is often expressed in discussions that take place outside formal professional venues. The Center is likely to successfully bring together a wide variety of people involved in all aspects of project management by supporting education, research and dissemination. The creation of the Center shall contribute to the growing maturity of the Polish body of knowledge in this domain.

The Research Perspective

The Center adopts a holistic perspective towards project success, part of which includes the following concepts:

- the strategic perspective of the project management process, this should include the entire project context, the project stakeholders (internal and external), and all organizational units and entities related to the project through the project lifecycle;
- the sustainability of project resources and project success;
- the consideration of different perceptions of success among the different parts of the organization, in particular between the operations-oriented divisions on the one hand, and the project-oriented divisions on the other, as well as among all stakeholders of the project, and
- suitable standards for project management based on international standards adopted to the Polish context.

Research to be conducted at the Center will focus on the creation of new knowledge, with priorities to be given to the type of knowledge that can be effectively applied to priority project and program areas in Poland, e.g. modernization of healthcare delivery systems, expansion and management of built infrastructure, environmental protection management, and others.

Example Activity Areas of the Center

The Center will engage in a variety of activities related to the creation, archiving and disseminating knowledge related to effective and efficient project management practices for the benefit of all its constituents. The following is a partial list of likely directions and topics that the Center will pursue:

- effective national and local policies related to the procurement of public projects;
- optimal and effective use of budgetary resources assigned to projects;
- efficient and effective project resource management techniques;
- project management advisory to public, non-governmental (NGO's) and non-profit private organizations engaged in the planning and conduct of large-scale projects in Poland and the region;
- sustainability for the built environment, including energy management and development projects;
- safety for the construction, operation, and maintenance of the built environment;

- strategy planning, portfolio-, program- and project management throughout the organization; process analysis, project communication systems, knowledge management in a variety of project-based organizations;
- communications related to projects, use of communication media, analysis of organizational communication structure, rules, and formats, effective use of semantic web-, web-enabled and mobile web-based systems for project environment;
- knowledge (explicit and implicit) and technology transfer models suitable for Poland-based projects, means to enrich tacit knowledge, social models of tacit knowledge transfer for project management;
- establishment of Communities of Practice (CoP) for project management and channels of communication with world's best practices;
- establishment of optimal solutions for public-private partnerships for the conduct of large-scale projects;
- post-completion evaluation of project results and compilation of lessons learned.

Given its wide array of activities, the Center will be likely to establish itself not only as a 'think-tank' organization focused on methods for Project Management, but also as a 'go-to' entity for the solution of pressing problems related to project procurement, execution and control.

Sponsored Research and Consultancy Services for Specific Projects

The Center should conduct externally sponsored research and consultancy activities for specific projects based on needs expressed by the Center's member organizations. This should be accomplished with the participation of all project stakeholders and partners.

The Center will be well positioned to serve as a central repository of knowledge on completed major projects, allowing for effective knowledge management in relation to project-related expertise and facilitating the dissemination of lessons learned from past project experiences for the benefit of similar new projects under consideration or those in the planning stages.

The Center is likely retain the services of experts who combine local Polish experience with project management expertise from abroad, and can assist with selecting optimal procurement of technical consultancy services. The Center may also participate in the consultant and contractor selection and in negotiation for

major projects undertaken by its constituents, in measuring project performance during implementation, and in compiling and documenting lessons learned within a larger knowledge management scheme.

Involvement and Collaboration with the Center

The Center should be established as a non-profit, academic entity generating objective and unbiased knowledge for its stakeholders. It should adopt the following operational strategies:

- comprehensive, win-win approach in which all concerned member organizations benefit from generated knowledge.
- possible synergies with research and development activities with other-Poland-based and international entities such as:
  - University of Maryland (USA) Center for Excellence in Project Management
  - Stanford University (USA) Collaboratory for Research on Global Projects
  - University of Manchester (UK) Management of Projects Expert Group
  - Bond University (Australia) Centre for Sustainable Healthy Communities
  - National University of Singapore Centre for Project Management and Construction Law
  - Catholic University of Lublin, Chair for Company Management
  - University of Warsaw Environmental Management Program
  - Silesian University of Technology Institute for Management and Administration
  - Cracow University of Technology Institute of Management in Construction and Transport
  - Jagiellonian University Chair of Information Technology Systems
  - Warsaw School of Economics Department of Project Management
  - Gdańsk University of Technology Chair of Operations Management and Engineering
  - Cracow University of Economics Department of Information Technology Applications in Operations Research

    and others.

An integral part of the Center activities should be a program of rotating visiting appointments by world's leading thought leaders and experts in specific technical fields related to project and program management.

Operational Approach

The Center will adopt a partnering approach, forming joint research teams with members of participating organizations; these teams will adopt the required research methodology, where the researchers are likely to become the implementers of research results themselves. The outcome of each research project conducted will be guided by implementation prospects and expected benefits to the stakeholders. This approach will likely result in strengthening the learning qualities in the participating organizations, leading to innovative solutions in their undertaken projects.

The Center, in consultation with its constituents, will be responsible for defining its research objectives, setting the annual research plans, defining scope for each research activity, facilitating and resourcing the research, planning the research schedule, budgets, managing the communications, and assuring the quality of the outcome to meet or exceed the expectations.

The participating organizations will designate its representatives to become active members of the Center's research team responsible for the transfer of research results into the UAE project management practice.

Resources

The creation of the Center will become a project in its own right. St. Luke the Evangelist conveys a clear warning in regard to financial planning of projects:

> For which of you, intending to build a tower, does not sit down first and count the cost, whether he may have enough to finish it; lest perhaps, after he has laid the foundation and is not able to finish, all those seeing begin to mock him, saying, This man began to build and was not able to finish (Luke 14:28–30).

Financial support for the startup operation of the Center should be sought from the National Center for Scientific Research (*Narodowe Centrum Nauki*) and the National Center for Research and Development (*Narodowe Centrum Badań i Rozwoju*), as well as from European Union programs and other resources. It is envisioned that in the steady state operation the Center will support itself from corporate membership subscriptions, continuing education programs, consulting assignments and externally sponsored research funds.

The Center is likely to draw from the human resources among accomplished academics working at major universities and their partner institutions in Poland

and worldwide. As the Center grows in stature and Poland's Project Management professional community grows, the Center will facilitate and sustain the creation of locally based Communities of Practice (CoPs) serving as additional external resource for the conduct of the Center's research.

All Center sponsored projects should be externally supported based on a membership scheme. As outlined above, seed funding is likely to be required for the initial phase of the Center's operation (1–2 years).

Membership Scheme should be developed and offer appropriate levels of sponsorship of the Center's ongoing activities, e.g.

- Senior corporate partner PLN 300,000 annually
- Corporate partner PLN 150,000 annually
- Junior corporate partner PLN 100,000 annually
- Individual partner PLN 50,000 annually

Each level of sponsorship will feature progressive levels of privileges commensurate with the financial and organizational input into the Center.

Leadership

If the Center is to be housed at an academic institution, it should be led by a Center Director reporting to a Chief Research Officer of the institution housing the Center. Qualities to be sought in candidates should combine those of effective project managers and those of thought leaders and opinion makers. A suitable candidate should be selected through an international rather than a national-only search. Competitive qualification criteria should include both academic as well as industrial or government experience in Organizational Leadership and Project Management.

Concluding Remarks

The Center of Excellence in Project and Program Management will be a unique undertaking in Poland. It will serve both the continuing education as well as research purposes in a relatively new academic and professional discipline that is vital to further development of the Polish society and its national economy. The Center will draw on a large body of knowledge and experience worldwide, but it will focus on the creation of a specific arsenal of successful approaches and tools for effective project management most suitable for Poland's societal, governmental and economic conditions.

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The Ecological Challenge as a Call for Another Humanism. An Interdisciplinary Approach in Five Lessons

"The urgent challenge to protect our common home
includes a concern to bring the whole human family together
to seek a sustainable and integral development, for we know that things can change."
Pope Francis, *Laudato si,* 13

Introduction: The Environmental Crisis is an Anthropological Crisis

Our times are profoundly signed by the environmental crisis. The deteriorated relationship between the human society and the natural environment in the industrialized world, is now expanding on the scale of the whole planet Earth. We are more and more conscious that this is not a passing problem. We are not going to solve this with simple techno-scientific interventions,[1] nor only with political and economic measures. Here, we touch a fundamental problem of our technological civilizations, a structural problem of our post-industrial societies, not at all easy to solve and which is now menacing the lifestyle of the richest populations on Earth. We are faced with a problem that concerns not one country but the whole humanity, and with a problem that one lone culture cannot solve on itself.

[1] These lines owe much to the different conversations with my fellow-colleague of University Institute Sophia, prof. dr. Sergio Rondinara. We manage affine courses, Prof. Rondinara on *Philosophy of Technique* and on *Ecology*, while I'm working on the theme of *Sociology of the Technological Society*.

But the environmental crisis is linked more profoundly with a deeper crisis that invests the human person as a whole, it is a kind of anthropological and ethical crisis. The indication here is that there is something wrong about the concept of the human person. An anthropological crisis about a precise conception of the modern man, a man looking for the proper auto-affirmation who nominated himself as the absolute patron of nature and the proper destiny. If we relate arrogantly to nature, we shouldn't be surprised if nature itself rebels, with grave consequences for human society and quality of life.

Pope John Paul II himself in his first encyclical already warned that human beings frequently seem "to see no other meaning in their natural environment than what serves for immediate use and consumption."[2] Subsequently, he would call for a global ecological conversion.[3] At the same time, he noted that little effort had been made to "safeguard the moral conditions for an authentic human ecology."[4]

Perhaps the important moral voice of our world, pope Francis in his Encyclical *Laudato si'* (16) enumerated in a powerful synthesis the main aspects of the actual situation: "(...) the intimate relationship between the poor and the fragility of the planet, the conviction that everything in the world is connected, the critique of new paradigms and forms of power derived from technology, the call to seek other ways of understanding the economy and progress, the value proper to each creature, the human meaning of ecology, the need for forthright and honest debate, the serious responsibility of international and local policy, the throwaway culture and the proposal of a new lifestyle."

A new lifestyle, the pope writes; in other words, among the most important things we need is a transformation of our values and categories. At the center must surely be the concept of nature, not intended as the sphere of the non-human typical of the dominant paradigm today with her sharp contrast between subject and object, but as the totality of the physic world, including the human beings because of the strong reciprocity that bounds us. What we need is a kind of anthropocentrism in solidarity.[5] We are not to be considered as the absolute subject dominating everything and anybody. We are subjects in solidarity feeling to be part of the proper human species and part of the Earth as a home where we are embedded in. This anthropocentrism in solidarity recognizes and actualizes the human prerogatives in front of all living beings, and, at the same time, interprets

[2] Encyclical Letter *Redemptor Hominis* (4 March 1979), 15: AAS 71 (1979), 287.

[3] Cf. Catechesis (17 January 2001), 4: *Insegnamenti* 41/1 (2001), 179.

[4] Encyclical Letter *Centesimus Annus* (1 May 1991), 38: AAS 83 (1991), 841.

[5] The concept was coined by Sergio Rondinara, in Italian the original term is 'un antropocentrismo solidale.'

the proper relationship with the Earth not as a dominion or exploitation, but as responsible custody.

Because of the essential anthropological nature of the present crisis, I preferred to privilege in these following pages an approach of the problem of reciprocity as the emerging theme. What can we learn about the challenges we face in philosophy, theology, economy and politics concerning the concept of reciprocity, social space, the space of inter-subjectivity, the concepts of love, fraternal love, agape, gratuitousness? This inquiry brings us to the heart of the questions underlying also the environmental crises:. The anthropological underlying questioning is constantly the center of our attention in the next pages, as the real question for a human sustainable development.

Lesson 1: Culture and Society Today – Towards an Anthropocentrism of Solidarity

1. A Unique Moment in History?

The human race is currently in a unique moment in its history, the moment facing us is probably without precedent.[6] In the first place what is unfolding is of world proportions. While it is rooted in European culture, the political and economic dominance of the Western world make the influence of this culture felt in every part of the globe. And not only because ideas from this culture are adopted elsewhere; its influence can be seen in the negative reactions in other cultures. This negative response is one of the main sources for fundamentalism in several parts of the world and so, also, for the so-called 'Islamic' terrorism that troubles Europe and North America. It arises in large part as a reaction against the allure of the West, which constitutes a real threat, with its often deliberate promotion of its own individualism, hedonism, liberalism, intellectual methodologies, and its current form of government, namely democracy.

Part of what makes this culture so attractive is that it is experiencing a boom in the acquisition of knowledge, a boom that brings about ever more startling technological advances. The human race has never before known so much about so many

[6] This chapter is the fruit of a collaboration with dr. C. Slipper who tested a version of these reflections in a Conference for Bishops, held in Prague, 2008. We both owe much of the inspiration of these pages to the works of G. M. Zanghí. See G. M. Zanghí (2008). *Occidente, la mia terra. Storia, società, politica alla luce del paradigma trinitario*, Roma: Città Nuova. See also an extensive study on the same theme in B. Callebaut, *De christen als gemeenschapsbouwer*, [in:] B. Callebaut, Mgr. P. Schruers, F. Delmartino, J. Timmermans (1986). *Een derde weg*, Antwerpen: Unistad, pp. 117–161.

things. This too is without precedent and leads directly to another unprecedented phenomenon: the experience of galloping change. All through the long centuries, since human beings first emerged as distinct from other animals, using language, persistently making tools, dominating fire, aware of themselves and able to reflect on themselves and the world they lived in, the changes in human society have been generally slow and, because of that, almost imperceptible. Centuries would pass without a new invention. Now it is quite the opposite. Everything is in flux, and the speed of change is always increasing.[7] Hardly is a new form of technology invented when it is obsolete. It is almost as if humanity had decided to undergo an experiment upon itself with no idea of the possible outcome.

2. A Sense of Profound Anxiety

This panorama is directly linked to a profound anxiety. While the factors already mentioned, for all their good aspects, in themselves lead to stress because they produce uncertainty, underlying them all is something still more challenging. It is European culture's abandonment of Transcendence, its dominant atheism. This leads to an even deeper sense of confusion, of having no anchor, no way of distinguishing what is useful from what is unhelpful or even dangerous. It is not that religion has disappeared. In the apparently deeply secularized country of Britain, the 2001 census showed 76.8% of people identified themselves as having a religion, 71.6% of the population declaring themselves to be Christians. But, as a recent article has shown, what people mean by religious affiliation nowadays is very different from what was meant in past ages.[8] It is definitely not what is intended by the leaders of the various religions, and in particular by the leaders of the Christian religion. Furthermore, and most significantly, it cannot be said that religion dominates government policy, shapes social and ethical attitudes, is

[7] Obviously, a sociologist must be more cautious than an essayist on the signification of concepts such as change. On change in religion the French sociologist and historian É. Poulat wrote: "How can we really understand something in this multiplication of words, events, reforms, novelties, projects, intentions? How determine what is superficial change and changes in depth, movement on your own and seeds of future developments, passing agitating and real transformations, collective enthusiasm and personal discoveries, pious words and efficient ones? (…) change is in our contemporary society a presupposition we cannot contest as was God in Christian Europe once. Paradoxically it's the only constant factor in history. But it seems urgent to me not to remain attached to the categories of Greek philosophy on this subject." See É. Poulat (1982). *Modernistica. Horizons, Physionomies, Débats,* Paris: Nouvelles Éditions Latines, pp. 252–253.

[8] V. Harrison, "On Defining the Religious Person," *Theology*, SPCK, London July/August 2007, p. 241 ff.

accepted as offering a consistent truth or has any real place in the arena of collective culture.[9] The public sphere in many parts of Europe is now largely atheistic, displaying the death of God announced by Nietzsche. Indeed, it frequently seems that the public sphere, and especially the media, is actively hostile to religious practice in general and to belief in God in particular. Even if sociologists generally speak more about the growing indifference towards religion than that real active anti-religion currents have an important impact.

In some ways it is, perhaps, not surprising that there has been an effective abandonment of the Absolute in European culture. What no gods or religions in the past have produced, has been achieved by science and the development of technology. We have medical facilities that prolong life and relieve suffering in ways never possible before; we have abundant food, entertainment on demand, shelter from the elements, labor-saving devices, communications and access to information utterly unknown in the previous ages. While, as we shall see, Christianity played no small part in the development of scientific enquiry, it must justly be said that these things are not the direct fruit of religion, but of science.

With this, the main paradigm for real knowledge has also shifted. It is modeled on the perceived success of science. Any valid understanding of how the universe works must have an experimental basis and be developed according to rationally constructed categories. No longer is tradition seen as a source of real knowledge and so religious authority, whether it finds its legitimacy in the Bible or the Magisterium, is excluded simply because its role is *paradosis*, the handing on of truth from the past. Furthermore, the scientific paradigm, though not actual science itself, in its extreme emphasis upon the discursive reasoning, becomes inimical to the kind of knowledge offered by religious witness, since this generally proposes a narrative, using symbols and imagery, through which understanding is intuitively grasped within a community. Reason is thus taken as the only source of knowledge. And even if other, 'postmodern' currents, reacting against such all-embracing rationalism, accept and even occasionally relish alternative, non-logical forms of knowledge, they have no belief in the existence of fundamental principles upon which a shared understanding is possible. This means the loss of the notion of universal truth, and so the denial of what any of the world's major religious traditions propose.

[9] For a very useful summary on the theories of secularization and the necessary distinctions to be made between religious evolutions in the private and public sphere and the reactions also of the religious corpses on the intermediate level between macro society and the personal sphere, see K. Dobbelaere (2002). *Secularization: an analysis on three levels*, Brussels: Presses Internationales Européennes Peter Lang.

3. The Possibility of a Radically Different Picture

For a sociologist interested in the study of the cultural processes ongoing in our Western world, the debates and evolutions within the religious sphere remain of utmost importance. The picture appears bleak for religion, and specifically for Christianity, which gave rise to the culture that now publicly rejects all religion. Nonetheless, seen from another perspective, a radically different picture emerges. As another French sociologist J. Séguy pointed out: "The crisis in our societies means not only 'destruction of religion,' but reveals also in the same moment an aspect of *production of religion*."[10] What is interesting here is to deepen the idea that this disappearance of God prepares maybe also the way for a new discovery of God and, with that, for a new discovery of what it means to be human. If we follow the reasoning that the negative contains a positive of immense proportions, like a seed contained in the crumbling darkness of compost, where do we go?

Surely, to understand this kind of reasoning, we must first glance back at the past. It is fairly certain that human thought, as a way of interpreting reality, began with myth. This was the use of images and stories to speak about and interpret reality. This primordial way of thinking is extremely powerful, with its own dignity and competence. Nonetheless, it has clear disadvantages, in that it is open to flights of fancy and is tolerant of contradiction, illogicality and confusion. It is sufficient to think of the myths of Greece, which have had such an impact on Western civilization, to illustrate this. But, at the very same time, mythic thought has some tremendous advantages, because symbols can give an immediacy of contact with archetypal intuitions that no other form of human expression provides. Furthermore, the weaving together of archetypes in stories not only touches something very deep within the human soul, it also produces narratives that can be repeated constantly and constantly yield up new meanings. Such mythic thought, fortunately, has never died out and is still with us, not least in the Arts with their use of a story, symbol and ritual.

A key aspect of mythic thought, because it is archetypal, is that it works with the collectivity: myths are the expression of the communal intuitions. In the ancient world individual embellishment (if it did not serve the myth) was thus intolerable, since the thinking subject of myth is the group, the collective, and anybody, such as Socrates in Ancient Greece, who steps outside the group to think as an individual is a threat. There is an inseparable link between how people think, the kind of thought they use, and the subject who thinks.

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[10] J. Séguy (1984). *L'insaisissable mouvement religieux,* [in:] J.-P. Rouleau, J. Zylberberg (eds.), *Les mouvements religieux aujourd'hui*, Québec: Bellarmin, p. 340.

Consequently when from the eighth century to the second century before Christ, during what Karl Jaspers called the Axial Era, in various parts of the world, in conjunction with urbanization, new technologies such as iron working, and the beginnings of a market economy, the figure of the individual distinct from the group began to emerge, this new way of being human, this new form of human subjectivity went hand in hand with new ways of understanding. In Greece it took the form of philosophy. The individual had to abstract himself from the community and its tradition in order to think with a clear mind. What was born was rational thought, the use of logical categories to interpret the world. Truth was what could be demonstrated by logical reasoning. This tremendous advance was mirrored in Israel by the Prophets. Here the emphasis was ethical, a response to the transcendent God who had entered into covenant with a particular people, and while the call was to the whole people, it was also an injunction upon each individual, as came to be consummately expressed by Ezekiel: "When the righteous turns from his righteousness, and commits iniquity, he shall die for it. And when the wicked turns from his wickedness, and does what is lawful and right, he shall live by it" (Ezekiel 33,18–19). The individual was accountable to God. This same period was also when what may be called classical spirituality began to emerge. The sage, from Greece to China, was the one who went aside from society to seek the truth. It is seen clearly in India, for instance, in the various ascetics who sought release, *mukti* or *moksha*, and none more so than in the Buddha finding enlightenment as he sat alone beneath the Bodhi tree.

This was the period when many of the world religions were founded or took on a decisive new form. It was to mark the development of human culture, in the variety of cultures across the world, to the present day.

4. Back to Our Fundamental Narratives?

But there is a crucial moment not long after this particular period of tremendous creativity came to a close. It is the coming of Jesus Christ. I do not say this only as a believer, but as someone looking at the development of human culture. Jesus, and all that originated in him, was an event of undeniable importance. After him nothing was ever the same again.

Jesus came in a specific context. He was a member of a minority race within the Greco-Roman world. He was the source and founder of a new experience of God, subsequently carried by his followers far beyond the territory where he had been born; and as part of that new experience, he transformed the way of being human, brought about a new form of human subjectivity. What he did was based upon what had experienced before; previous developments had, as it were, prepared

the ground for him. Part of this was the value given to the individual. But with Jesus this value was underlined to such an extent that each human person was now accorded infinite worth. This is shown by his care for sinners,[11] his concern that not one be lost,[12] his call to people one by one to enter the kingdom,[13] and his identification with the least ('Whatever you do the least of these my brothers, you do to me,' Matthew 25,40). In this, he intensified the Jewish sense of the individual's accountability to God. But this intensification was not the only radicalization that he brought about. He extended this call to everyone, whether or not they formed part of the religious community; that is, to sinners and Gentiles alike, both categories that were in some sense outside the Chosen People.

But his transformation of human subjectivity did not finish there. The kind of individual he indicated was quite different from the individual that had begun to emerge prior to him. This was no longer the awareness of a subject in his or her aloneness, someone standing over and against the community. It was a subject existing in relationship with others, that is, to use language unavailable at the time, a person in communion. Thus, while each distinct human being has infinite value, he or she exists only in and through relationship with others. There is no separate individual subjectivity, but there are distinct subjects in, what may be called, inter-subjectivity. This is, in fact, a logical consequence of giving infinite value to each human being, since if each and all have value and each and all value one another, each and all must then enter into relationship with one another, a reciprocity in which each accords to the others the infinity of their worth.

Such inter-subjectivity is evident in Jesus' specific commandment, his new commandment: "Love one another as I have loved you" (John 13,34; 15,17). But here is the point to work on: it is not, therefore, just an ethical injunction; it has revelatory power. The new commandment is indicating us what it means to be human. It demands inter-subjectivity in which each person, just like Jesus forsaken on the cross, is in total gift of self to others. This implies a mutual relationship that is at once a complete welcome of the other and a complete being for the other, an effort to discover and remain in the intimacy of the other and an opening of one's personal intimacy to the other.

Jesus' inter-subjectivity, moreover, is rooted in Jesus himself. His aim is to liberate us to be able to live him. He does this, according to his own words, by bringing us into union with him, so that we can be as he is, being as he is, fully and

[11] E.g., Matthew 9,11–13; Mark 3,15–17.

[12] E.g., Matthew18,12–14; Luke 15,4–10.

[13] E.g. the story of the rich young man: Matthew 19, 21; Mark 10,21; Luke 18,22. See also John 10,3.

truly open to one another. This is vital to understanding the kind of subjectivity that Jesus brings about. This is not the common understanding of 'subjectivity.' Let us follow the gospel logic to gain some in-depth insight. In John's gospel it is expressed with the image of the vine and the branches (see John 15): as branches we have life if we are in Jesus, living the pattern he shows us in himself, enabled by him to live with his life, to love as he is love. He gives form to our being: his way of being becomes ours. This means, then, that his way of being a *person* becomes ours. And since his way of being a person is total self-gift and therefore always demands another to whom that gift can be made, our way of being a person comes to its completion only when it is lived out with another. Our personhood, enabled and shaped by Jesus, is fulfilled in mutuality. This means, for an actual understanding of the Christian conception of what it means to be human beings, that we enter fully into what Jesus did for us not when just each one of us is united with Jesus, each of one us person as he is person, but when *together* we are united to Jesus, in the inter-subjectivity of persons.

5. The Collective Experience of the Early Church

The pattern of life that this generates is precisely the pattern we can see in the early Church. Paul, for instance, in encouraging believers to live according to the Body of Christ, emphasizes how each member of the Body exists for the others, and the New Testament's frequent exhortations to live in unity likewise underline the vital role mutual love played among the first community. Mutual love allowed the members of the Church to be one, to be Christ together. As Paul put it: "We, who are many, are one body in Christ, and individually we are members one of another" (Rom. 12,5). This means that the inter-subjectivity of persons is truly lived when together they share in the personal reality of Christ.

Nonetheless, the full implications of this new way of being human were not immediately obvious. Time was needed for a deeper understanding. A fundamental aspect of the growing understanding took place as a result of the gradual development of the doctrine of the Trinity. Clearly, the experience of the Christian community was of a God who was the one God of Israel, but who was also three. This led to the great debates as to how this could be so.

6. A Radical Reorientation?

One decisive point was achieved in the fourth century by the Cappadocian Fathers in what the Orthodox theologian and bishop, John Zizioulas calls a 'radical

reorientation of classical Greek humanism,'[14] which he explains as 'the historic revolution in the history of philosophy' (1995: 47) of identifying the idea of each distinct person in the Trinity with that of *hypostasis*, a word that had previously been synonymous with *ousia*, meaning 'being,' 'existence.' To understand the impact of this we must consider first that Ancient Greek thought (as Indian thought also) gave priority to the 'one' over the 'many,' and so to the nature of things over the particular expressions of that nature: human nature, therefore, is expressed in the multiplicity of human beings.

The Cappadocians, in a sense, reversed this. The hypostasis, that is the person, of God the Father was seen as the source of Godhead, the cause (*aitia*) of the other persons of the Son and the Holy Spirit. Hence, the existence of the one does not precede the many, but on the contrary, the one requires the many in order to exist. In consequence, the person is seen as fundamental, and so unique and irreplaceable. But at the same time, each person never exists alone, but only in a relationship (*schesis*) and can only be conceived, both logically and ontologically, in relation to other persons. In fact, a similar discovery, though with different emphases, was made in the West by Augustine, who saw that what made the persons of the Trinity distinct was their relationship with one another, that is, the very thing that distinguished them was the thing that brought them together.

Each person in God, therefore, is unique and irreplaceable and only exists in a relationship. The kind of divine inter-subjectivity this implies has major consequences when applied to human beings, called to participate in the divine being, and who find the fulfillment of their created nature, made in the image of God, in the uncreated God. God, of course, always remains God by nature, and human beings always remain human beings by nature. The two remain distinct. But human beings can, sharing in God through the work of Christ, being identified with Christ, be *as* God is: that is, as *persons* they can be as God is.

7. The Incomplete Reception

Unfortunately, despite the tremendous impact of such a developing understanding upon Christian culture, and so upon the growth of the culture of the Greco-Roman world and its inheritors, this understanding remained limited. The notion of a person tended towards individualism. Certainly, good things happened. A whole current was set in train in which the value of the person served to emphasize the value of each human being. This of course meant acknowledging all that is human:

[14] *The Doctrine of the Holy Trinity: The Significance of the Cappadocian Contribution*, art. [in:] Christoph Schwöbe (ed.), *Trinitarian Theology Today*, T & T Clark, Edinburgh 1995, pp. 44–45.

the multiplicity of human beings, their materiality, as well as human talents and capacities – an attitude that was also both rooted in and underlined by the incarnation. In time this was to explode, as it were, in the European renaissance.

But Christian culture as it developed, because it had not fully appropriated the novelty that Jesus brought, contained unresolved contradictions. The culture to which came the revelation of the Trinitarian God and human inter-subjectivity in Christ was, despite its cultural preparation, an encumbrance, acting as a kind of filter through which this revelation was understood.

Some aspects of Christian culture favored the sense of the collective. For instance, although mythic thought was by no means the only form of thought among Christians, it carried on. It is true that the event of Jesus also transformed mythic thought, by locating it in real time, in history, and presenting a narrative that in fact summed up all other salvation myths (presenting, as it were, the myth of myths). But the basic witness of Christians, the *kerygma*, was contained in a story, told and retold, and conveyed via symbol and ritual. And this took place in a community that sought to be faithful to its tradition. Hence, the communal dimension was vital. But the content of what was passed on also demanded the assent of the individual. It was not just a transformation of the group, but a call to each human being.

In the context of individualistic classical spirituality this led naturally to monastic, and specifically to eremitic, spirituality, something that enriched Christian life tremendously by exploring some of the depths in the experience of God, but something that was also in continuous tension with the communal aspect of Christian life, since loving God demanded service of other human beings as well. Furthermore, the value seen in the individual did not only imply withdrawal from others. At the very same time, it emphasized actions on behalf of others and so the value of not being on one's own. The individual needed the community in which to serve other individuals. To some extent this tension was resolved in coenobitic monastic communities, but not entirely.

Related to these tensions, Christian culture produced other, connected, points of strain. It emphasized the value of rational thought. There has never been in any part of the Christian body an era when it has not had its thinkers, from the Fathers of the Church to medieval Scholasticism in the West, to the present day. Reason is one way of uncovering truth. Furthermore, when the natural world is seen as having real significance, as was concomitant with giving value to humanity, this necessarily led eventually to another kind of intellectual activity: the rational investigation of material reality. This was the cultural basis for the development of scientific thought. Science was a result of Christian culture. Therefore, the form of

thought that was to become, at least within popular culture but not only, a challenge to Christianity was generated by Christianity's own culture.

Now, even though this way of exploring reality always contained a tendency to challenge some of the mythic ways of thinking present in the Christian community, where these strayed beyond their bounds in appearing to give explanations of physical phenomena (as in the case of Galileo), the clash did not have to become chronic. Reality can be explored by different ways of thought. The clash became chronic only as a result of further shifts within Christian culture. The principle among these was the division of the Churches.

On the continent of Europe, as well as in Britain, in conjunction with other political and cultural factors, Church division led to warfare. Britain had its Civil War in the 16th century and in Europe, between 1618 and 1648 there was the Thirty Years War. One result of both was a degree of disillusionment with religion, which led to a diminishing of devotional life in the following decades. But more important than this, which several revivals subsequently sought to overcome, was a shift in emphasis upon where truth was sought. The Gospel, whether preached on the basis of *sola scriptura* or on the basis of the Magisterium, was not looked upon as a solid basis for knowledge. Something else was sought. An alternative in Christian culture was reason, a particularly potent weapon in the armory of human thought. The person who is often taken as emblematic of the new departure in Christian culture that began to emerge is Descartes, even though this can be disputed. Nonetheless the radical doubt, the recourse to reason, and the individualism of his *cogito ergo sum* can be taken to represent what began to emerge. This new kind of Christian culture eventually developed into the Enlightenment, where reason became the fundamental value, the touchstone of truth. It was the way, to the exclusion of others, for coming to know and understand the world. This has brought us to the current situation, described in the introductory remarks: reason, and specifically scientific reason, is seen as the paradigm for all knowledge, God is left out of public discourse, and the only kind of thinking subject is the individual.

The trouble is that this does not fit reality. Human beings are more than individuals, knowledge is more than scientific rationality, and God is more than my own version of meaning, merely something wonderful tasted in my moments of aloneness. Reality cannot be shoehorned into the cramped canons of our current culture. This leads inevitably to the confusion we experience in today's world. The individual expands more and more as the only real value. We then have confusion in ethical standards, the fragmentation of society, a lifestyle that is fundamentally hedonistic, consumerist, and often lacking in the capacity to take any serious commitment – some of the hallmarks of the current crisis.

8. A New Input: a Spirituality of Coming Together

But perhaps it is precisely here that we can see the positive transformation that is taking place. The crisis caused by the swollen ego of individualism and the reduction of all knowledge to the paradigm of scientific rationalism simply cannot last. Bit by bit we are being forced to acquire a more realistic, a fuller sense of what it is to be human, seeing the individual in relational terms and appreciating the whole span of human knowledge. The emerging culture, if it overcomes the fragmentation consequent upon bloated individualism, will be perforce one of dialogue, of the affirmation of community correctly balanced with the affirmation of the single subject, that is, of the inter-subjectivity of persons. Inspired people think also this is the good time where a new experience of God, crucial for what it means to be a person, will be central. This last is perhaps the most exciting element of what has to emerge.

Despite the experience of the early Church, the normative and most intense experience of God of the past has been that of the individual, in solitude, caught up into the wonder of the Godhead. This was the maximum that could be achieved by a Gospel experience filtered through classical spirituality. This, of course, never loses its value. With the advent of the new light shed upon the Gospel by the spirituality of communion, favored by the Council Vatican II and articulated more or less in many of the intra-ecclesial religious movements born in the Catholic Church in the twentieth century – a phenomenon also present in the other Churches and confessions – however, through the inter-subjectivity understood as we said, in Christ modeled upon the life of the Trinity, another experience becomes possible.

If we try to translate the indications of the gospel texts, what happens is this: I seek to give myself fully to the other in a mutual relationship of love, and so I appreciate, come to know the intimacy of the other. I recollect myself, as it were, I dwell within Jesus dwelling in the other. At the same time, I open up my own intimacy to the other, so that the other can be recollected in it, dwell within Jesus dwelling in me. At that point, the two of us, recollected in an intimacy that is not our own, find that we are in fact not simply in the intimacy of the other human being, but in a shared intimacy belonging to neither of us. We find ourselves in God together, God who is more than just the two of us. We meet in Jesus who promised: "Where two or more are met together in my name, there I am in the midst of them" (Matthew 18,20). Thus, we who meet together in love, each one liberated to be persons through sharing distinctly in Jesus, find that we all share together in Jesus. Jesus, the pattern and substance of our relations, shapes who we are. He is the *locus* of our meeting who is also distinct from us, greater than us; he is the Third among us, the Person in whom we become fully persons.

Thus, it can be said that we are currently in a moment of groundbreaking change. We have no idea how long our Christian culture's current confusion will last, and we cannot be certain of the extent or the details of how it will be purified (which of the practices will change form, which will disappear, for instance).

Lesson 2: The History of the Evolution of the Christian Code

One of the most interesting evolutions of our contemporary world has to do with the need to rethink human inter-subjectivity. Sociologists know very well that it is, so to speak, society itself that organized things in order to promote individualization. An ideologization of this societal process of individualization can obscure in the minds of many people the fundamental need of intersubjectivity. Intersubjectivity has to do with the perception of the relevance of the other, the group, family, and so on for my individual existence. There is a growing perception of the negative side of individualism as a moral attitude, but where are the arguments to overcome this present and very diffuse phenomenon? It is noteworthy that there is a kind of parallelism between the story of the catholic spiritualities and the emergency of individualism as a very important trend in thinking and finally also in moral lifestyle. Spirituality in the last centuries made a parallel course and the accent also in the greatest writers in the field was put on the individual relationship between God and the single person. Is there also something going on in religious thinking nowadays that helps to think and to live intersubjectivity taking new paths? Is there something like intersubjective spirituality and theological thinking about intersubjectivity coming on? There is.

I would like to illustrate this analyzing the revival of the theme of the Trinity in Christian theological thinking in the twentieth century. Specialists say the past hundred years have represented one of the most fruitful periods within Catholic faith in terms of a re-appropriation of its intrinsically Trinitarian aspect. We follow here in great lines the development on the theme made by the Italian theologian Piero Coda, the president of the recently founded University Institute Sophia and an international renowned scholar on this topic.[15]

[15] See P. Coda (2011). *The Twentieth Century's Contribution to Trinitarian Theology*, [in:] B. Leahy, S. O'Connell (eds.), *Having Life in His Name. Living, Thinking and Communicating the Christian Life of Faith*, Dublin: Veritas Publications, pp. 137–148. His most important publication on the topic in Iitalian (2011) is his *Dalla Trinità. L'avvento di Dio tra storia e profezia,* Roma: Città Nuova.

1. Context

This evolution was a kind of surprise, because the nineteenth century concluded with an implicit declaration that the Trinitarian truth of God is of marginal relevancy both in life and in thought. We can see this, for instance, in the Catholic Church in Vatican I and in the Churches of the Reformation we see it in liberal theology. Admittedly, background figures such as Antonio Rosmini in the Catholic world were beginning to think of God and faith in Trinitarian terms taking the 'depths of Christianity' as a starting point. In the churches of the Reformation, the philosophies of Hegel and Schelling clearly drew inspiration from the Trinity.

The tragedies that European history was going through in the twentieth century, changed also the theology. The Trinitarian principle and form of Christian faith began to be explored widely in theology. As Coda points it, what Karl Barth did was decisive. He really turned things upside down. Likewise Pavel Florenskij and Sergei Bulgakov for religious philosophy and Russian Orthodox theology. And for the the Catholic world Coda mentions theologians such as Yves Congar and Henri de Lubac, Ghislain Lafont, Karl Rahner and Hans Urs von Balthasar, while Wolfhart Pannenberg, Jürgen Moltmann and Eberhard Jüngel in the Lutheran evangelical world also indicated their desire to move in this direction.

Christianity in the West is clearly marked by a deep *krísis*. That is the context in which the rediscovery of the Trinitarian principle and form of Christian faith is taking place, according to Coda, who defines it as a precise epochal turning point in European and world history, a moment of agony in the West, 'land of the sunset,' or at least in one particular shaping of the West.[16] And in the rest of the world, Christianity is faced with a multidimensional and pluralistic horizon. began It is really only in recent decades that the Catholic Church is coming to realize both the extent of the challenge as well as the corresponding opportunities arising from this totally new situation for the Church. Was these all stimulating 'the Trinitarian rediscovery,' is the interesting question the Italian scholar tries to answer.

He is affirmative. Coda thesis is that it is within this state of things that we can begin to grasp the importance and relevancy of the twentieth century's Trinitarian *ressourcement:* "we are faced with a decisive *kairós* for the future of the Christian faith that requires it re-present in a coherent and new way its own specific identity, capable of weaving and promoting, on the basis of Christian faith itself, interesting and productive relations with other cultures." And "(...) accordingly, faith in the Triune God (with its co-belonging of love, unity and distinction, freedom and

[16] See G. M. Zanghì (2007). *Notte della cultura europea. Agonia della terra del tramonto?*, Roma: Città Nuova.

communication) in terms both of theology and anthropology, has undoubtedly become the 'test case' of identity and relevancy of the Christian event in the history of our time."

2. Overview of the Renewal in Twentieth Century Theology

Coda sees two tasks for theology working on the trinitarian theme. "Firstly, and above all, that of rigorously thinking through the Trinitarian God in the modern horizon of subjectivity without, however, falling into an indiscriminate monological emphasis, but rather rediscovering the full depth of the personal and perichoretic dynamic of *communion*." Following the results of the studies of authors like Karl Rahner, Jürgen Moltmann or more recently Gilbert Greshake, Coda concludes that out of all of this "has emerged a growing realization of the need and indeed practicability of a true *Trinitarian ontology*."[17]

The second and correlative task is, affirms Coda, "to paraphrase Eberhard Jüngel, what could be defined as the overcoming, on the basis of the paschal event, of the abstract conflict between 'theism' and 'atheism' that marks Western modernity." His conviction is that often the criticism and disaffection of modernity vis-à-vis God in reality is aimed at an objectifying and reductionist representation of God. "Though the critique actually is limited, it does, however, cry out for a new experience of and a new thought concerning the God of Jesus Christ, one that is capable of responding to the most hidden needs within modernity and post-modernity's cultural and speculative travail."

The second stage in the twentieth century renewal in Trinitarian theology in many ways follows, according to Coda,

> what we have just seen, and yet in other ways it parallels it and is like a counterpoint to it throughout the twentieth century. What is ultimately at stake is the question of alterity and identity. The big question around which modernity revolves is, as Barth intuited at the beginning of the last century, that regarding the being God of God and humanity's being created in relation to the event of Jesus.

[17] A key text in this area is undoubtedly Klaus Hemmerle's (1976). *Thesen zu einer trinitarischen Ontologie,* Einsiedeln: Johannes Verlag. See further P. Coda (1984) *Evento pasquale. Trinità e Storia*; P. Coda and L. Žák (eds.), (1998). *Abitando la Trinità. Per un rinnovamento dell'ontologia,* Roma: Città Nuova); M. Krienke, N. Salato (2008). "A proposito di ontologia trinitaria. Il contributo di Antonio Rosmini Serbati ed Edith Stein, per una fondazione in chiave teosofica e fenomenologica della filosofia cristiana," *Rassegna di Teologia* 49, pp. 227–261.

Coda analyzing the evolution of the Trinitarian theology that blossomed in the 1900s writes that when it "loses sight of this issue that definitively wounds human identity, the moral risk is that of remaining a prisoner and imploding in a self-awareness that claims to be Christian but in reality is trapped within a circle of a presumed strong identity but ultimately one that is deaf to the call of otherness."

He specifies two other themes that emerge in recent decades regarding "the Christian understanding of the *Deus Trinitas*. On the one hand, there is the encounter with world religions, an encounter that is new both in its form and demands," he mentions the encounter with the Jewish faith and then with the Islamic religion, "both of whom profess faith in the One and only God." And he mentions also the effort required "with regard to the 'neopagan' criticism of monotheism and the revival of a experiential and subjectively gratifying experience of God."[18]

On the other hand, both at the level of critical perception and existential implications, another theme is emerging, one that has been rather neglected in the Trinitarian theology of the 1900s. "I am referring to an anthropologically meaningful and universally incisive pre-comprehension of the mystery of God who, in an otherness that is demanding, working from within and in the Spirit (cf. GS, 22), directs humanity's unifying and compelling desire." In other words, Coda puts here the question of a correct, penetrating and renewed articulation of the relationship between *De Deo Uno* and *De Deo Trino*.

3. The Task that Lies Ahead for the Relational Thinking about God and man

Very interesting are the final conclusions of Coda in his article in the Dublin publication, summarizing his logical developing of the argument of the space today for an interpretation of the social location of Trinitarian lifestyle here in our postmodern times. The question is, is there still room for an experience of God not only in the most inner life of the single but also in the social space, between modern man? The sociological conception of the important evolution of society synthesizes with the term of functional differentiation a centuries long ongoing process of reducing in the West the space for religion in the public sphere, and placing the religious function aside the other big functions of society but no more above. What is then today the 'place,' the locus of the experience and understanding of the Triune God?

[18] See P. Coda (2004). *Il Logos e il nulla. Trinità religioni mistica,* Roma: Città Nuova.

Coda develops here an interesting intuition and operationalizes it by drawing on a hypothesis that in these years has inspired his research.[19]

> As gift and experience, the locus of Trinitarian revelation is undoubtedly the 'flesh' of Jesus: 'And the Word became flesh and lived among us, and we have seen his glory, the glory as of a Father's only son, full of grace and truth' (Jn 1,14). But what does it mean to encounter in our understanding of the faith the flesh of Jesus in order to 'contemplate' in it God/Abbà in the Spirit?

As the Trinitarian theology of the twentieth century teaches, continues Coda, "it means that we are called to look at God in the flesh of Jesus Christ and, ultimately, in the flesh of him crucified and risen, radiating the Spirit. But as the twentieth century phenomenology has indicated, the flesh is the place of relationship between creatures. It can be said therefore that the notion of encountering the flesh of Jesus in our understanding of faith in God/Abbà refers precisely to this locus – the interpersonal and incarnate relation – as that which, definitively inhabited by the Son in his Spirit (cf. Mt 18,20), offers us access to the life and intelligence of the *Deus Trinitas* in the everydayness of our journey as human beings, shoulder to shoulder with one another."

Coda's proposes than to re-read the history of the Trinitarian and theological experience of the Church from this perspective. The link between spiritual experience, growth in theological understanding and the maturing of anthropological consciousness has always been very close in Christianity's bimillenial journey, he states. And he sees repercussions of this in the multiform expressions of culture (cf. *Dei Verbum*, 8).

By way of example, he takes Augustine of Hippo and his *De Trinitate*.[20] "The crucial point of his itinerary – contemporary scholarship is more or less in agreement now on this – is to be found in the eighth book of his *opus magnum*. This eighth book comes after the Doctor of Charity has outlined the doctrine of faith and explored an understanding of it in a way destined to mark the history of Trinitarian thought after Augustine, namely, the genial re-thinking of the ontological category of relation according to the perspective of revelation. He then proceeds

[19] For brief summaries see my chapter (2007) *L'esperienza e l'intelligenza di Dio Trinità da Sant'Agostino a Chiara Lubich* [in:] P. Coda, *Dio che dice Amore. Lezioni di teologia,* Roma: Città Nuova, pp. 131–164.

[20] See P. Coda (2008). *Sul luogo della Trinità: rileggendo il 'De Trinitate' di Agostino,* Roma: Città Nuova. On the impact of Augustine's Trinitarian theology in the twentieth century see the comprehensive work by P. Sguazzardo (2006). *Sant'Agostino e la teologia trinitaria del XX secolo,* Roma: Città Nuova.

to explore the place from which to contemplate the dazzling light of God who is Trinity."

And Coda synthezises Augustine's finding as follows:

> With amazement and gratitude he finds this place to be the *dilectio mutua* e *erga omnes* of the disciples [mutual love and love in relation to all] – according to the precept of the Lord. This is where the *Deus Caritas* (God Love) lives as the first letter of John indicates (cf. 1 Jn 4:8,16). And Coda comments: Augustine's intuition is one of the most luminous also for Augustine himself as an analysis of the language used to describe it indicates, one that almost totally coincides with what he recounts in the seventh book of the *Confessions* of his first encounter with God ('*cum primum te cognovi,*' [when I first encountered you] VII, 10.16). Augustine recognizes he is like a person who has found not 'what he is searching for' (*quod quaerit*), but rather the place 'where the searching has to be done' (*locus ubi quaerendum est*) (VIII, 10.14).

But the Italian scholar studying Augustine in depth, remarks: "And yet in the remaining seven books he does not follow this way – la *via caritatis*. He explains why in the fifteenth book of the *De Trinitate* – the light was too intense and in order to be able to 'rest' there a little, his intelligence had to be directed to objects that were more familiar."

In describing the intuition there is, however, a passage that is symptomatic, continues Coda. "He tells us that in order to reach high, in God, into the secret of the 'Trinity' enclosed in the experience of love among the one who loves, the one who is loved and the love that flows among them, it is necessary that "*calcata carne*, *ascendamus ad animum*" (*De Trin*., VIII, 10.14). *Calcata carne*, the flesh having been trampled upon."

And here Coda places the most interesting moment of his analysis. For him, "Augustine is not thinking here of the flesh of Christ. But in referring to human flesh (that affected by sin) and the need to flee that 'flesh similar to sin' (cf. Rom 8,3), does he not end up bypassing what the *Lógos*/Son took on in the Incarnation right up to the abyss of the Cross? And once this flesh is abandoned, will it be possible to find again the *Deus Trinitas* between human beings where he came, without forgetting that he now lives risen also *in excelsis* (in the highest)?" Coda defends himself from being accusing the great Augustine. For him,

> (...) each era has its grace and its task, and by this very fact also its conditionings and limits. I simply want to draw attention to the fact that, without taking this flesh into consideration, it is not possible to enter and dwell

> in the place of an experience and understanding of the Trinity, that is the relationship among human beings, in the tangible and dramatic depths of history, freedom, difference and also the depths of sin that Christ made his own in order to redeem it from within.

The history of Trinitarian theology throughout the centuries – Coda is referring here to the Western tradition that he knows more closely – can be read, he believes,

> as a progressive entering of this flesh into the categories of living and thinking. So, for instance, in theology, in the Medieval Ages, Thomas Aquinas, and then too Bonaventure, following Francis of Assisi, take a huge step forward vis-à-vis Augustine and later, Ignatius of Loyola, Teresa of Avila, and John of the Cross. Too little reflection has been given to the fact that in Thomas Aquinas, the extraordinary extension of speculative understanding of the Trinity is radically connected with the affirmation of the humanity of Christ (*humana natura* – he underlines – *pérvenit [in Christo] ad ipsam veritatem divinam*, *In Ioa*, 188) ["human nature reaches (in Christ) to the divine truth itself"] and with the Eucharistic form of his thought that, at the end of his life, passed through a decisive crisis.[21]

4. After Augustine

And after Augustine, how did Christian thinking go forward? Noteworthy is, still according to Coda, Bonaventure's intuition.

> Contemplating Francis' experience at La Verna of being identified with Christ and by Christ in his bodily stigmata, Bonaventure affirms: *nemo intrat recte in Deum nisi per Crucifixum* ["no one enters rightly into God except through the Crucified Christ"]. Teresa of Avila for her part and in her way reaches the point of affirming that at the highpoint of ascetic climbing the mountain of God only the humanity of Christ introduces us into contemplation of the splendor of the Trinity.

[21] A recent thesis has contributed to remedy this lack. See Riccardo Ferri (2007). *Ille homo ipsa divina veritas. Cristo-verità nell'interpretazione di Tommaso d'Aquino: sviluppo e novità rispetto ad Agostino d'Ippona*, Roma: Città Nuova.

Later, for example, with Hegel's 'dialectic of recognition'[22] and with Edith Stein's phenomenology both of empathy and of intersubjectivity, theology, says Coda, "is offered conceptual instruments that clearly have to be assessed but they do allow for an anthropologically-felt focus on the intersubjective locus exhibited in the 'flesh' of Christ. Von Balthasar's comment is also pertinent here that *intersubjectivity, upon which the ethics of the Gospel is based, failed to find an adequate philosophical foundation in the classical period, and even today has yet to become the principal theme of Christian philosophy*."[23]

Coda stresses in his final conclusions what our time is gaining as new insights on the theme of the relationship between the intersubjective space and Christian lifestyle and thinking. 1) There is a new focus on the universal singularity of the Word of God in Christ as well as on the Church as the people of God, and with it a new appreciation of the communion that blossoms from the Christ event as the seed and beginning of the Kingdom in history (cf. *Lumen gentium*, 5); 2) it has been recognized that an individualistic notion of the human being and an objectivistic notion of knowledge need to be overcome in favor of a phenomenological anthropology that is personalist and dialogical, opening to a practical experience of the truth of humanity in its relationship to the transcendent; 3) the tragic experience of the night of God that seemed to reach its culmination in the catastrophe of the Second World War and in what follows it with the intuition that in it is hidden and proposed the face of the Crucified and Forsaken God (see for instance, Teresa of Lisieux, Dietrich Bonhoeffer, Simone Weil, Edith Stein, Chiara Lubich); 4) the announcement of a new era in the history of civilization in which the centripetal force of identification of the diverse civilizations, starting out from their religious matrix and forms, is balanced and re-directed by that centrifugal force of their new encounter and relating with one another.[24]

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[22] See P. Coda (2007). *La percezione della forma. Fenomenologia e cristologia in Hegel*, Roma: Città Nuova.

[23] H. U. von Balthasar (1991). *The Glory of the Lord: A Theological Aesthetics. Vol. V: The Realm of Metaphysics in the Modern Age*, Edinburgh: T&T Clark, p. 23.

[24] See also P. Coda (2010). "The experience and understanding of the faith in God-Trinity from Saint Augustine to Chiara Lubich," *New Humanity Review*, 15, pp. 17–38 [orig (2007): "L'esperienza e l'intelligenza della fede in Dio Trinità. Da Sant'Agostino a Chiara Lubich," P. Coda (ed.), *Dio che dice Amore. Lezioni di teologia*, Roma: Citt. Nuova, pp. 131–164.

Lesson 3: Economy and the Good Life: Love Agape in the Economic Sphere

> Without taking this flesh into consideration, it is not possible to enter and dwell in the place of an experience and understanding of the Trinity, that is the relationship among human beings, in the tangible and dramatic depths of history, freedom, difference *and also the depths of sin that Christ made his own in order to redeem it from within.*
>
> P. Coda

Is it possible to think our world from the perspective of love? We saw elements for a new understanding of the human person in his intersubjectivity in a general cultural and philosophical approach. Love, a social, relational love, so to say, becomes a central question in our changing world, for a human sustainable development. The quality of relational life between men and women is an open question today. But so is the quality of relationship in our professional worlds, what do we have to tell each other about 'social love,' 'economic love,' political 'love,' and more and more now also 'ecological love,' our relationship with our environment? In a second moment we perceived a strong parallel on the level of theological thinking: in theology also there is a kind of paradigmatical swift from thinking God in the relationship between the single person and his or her Creator. The social space as a new ground for the encounter with a relational God! The next step in our inquiry about the possibility of an intersubjective relationship that creates a space for the Gospel logic of fraternal love, leads us to the world of the economy. What have terms as fraternity, reciprocity, gratuitousness, responsibility, love, happiness to do with economics, is the question we like to discuss now.

Our guide here is a fellow colleague from Sophia University Institute and economist, specialist of the history of economic thinking, Luigino Bruni.[25] His conviction is "that the relational crises and the malaise that pervades many economic environments today can be considered a result of the 'famine of gratuitousness' that is afflicting our development model" (2012: 45). And, for the Italian scholar, if an experiment gratuitousness was to be eliminated completely from our ordinary economic affairs, our productive organizations and many of our markets would implode in a single morning. In economic science, so to say, *agape* has been and is still markedly absent. The challenge for civilization today is, according to Bruni, to

[25] See first of all L. Bruni (2012). *The Wound and the Blessing,* New York: Living City, (or. version (2008). *La ferita dell'altro,* Trento: Il Margine). The quotes in this chapter come from this book. Bruni applies here to economics, and this is a great merit, a number of core ideas that circulated in the circle of scholars linked with Chiara Lubich, Pasquale Foresi and G.M. Zanghí, P. Coda and others, theologians, philosophers, sociologists, etc., who from the eighties prepared what in 2008 became the Sophia University Institute in Loppiano (Firenze).

place *agape* again at the center of the life of the polis rather than leave it confined to just the private sphere, where it can play only a residual, minor role. And reasoning on that precise point, he adds that "were a postmodern society to lose the contact with agape in the public sphere, it would quickly lose it in the private sphere as well, since in globalized societies the veil that marks the boundary between public and private areas is tearing apart" (2012: 57–58).

The book he wrote, *The Wound and the Blessing*, is a remarkable plea for nuanced thinking. At the very end of his essay, he summarized his conviction against a mainstream assumption: the market and its logic are polar opposites of the realm of gratuitousness, since they are based on instrumental calculation. In other words, where gratuitousness begins economics ends. Bruno affirms, in rather strong terms, that this is not correct 'either historically, methodologically, or theoretically' (2012: 108). His research in recent years was on the possibility to hold gratuitousness together with the incentives and dynamics of the market and of the company. In this long essay Bruni is obviously analyzing our economic system and the functioning of the markets.

> I wish to stress that this book does not seek to incite opposition to markets or to construct a society without them. (...) I am convinced that a society without markets and contracts cannot be civil; yet a society that seeks to regulate human relations only through markets and contracts is even less so. Much of my argument, he concludes, elaborates a space between the terms *without* and *only* (2012: xviii).

1. The problem: we need markets, but ...

In his multidimensional inquiry about human relationships Bruni states that we need markets, without them we cannot live well, yet neither can we live well reducing all social relationships to markets. In the following pages, I will follow and synthesize some of the main lines of the book as it seemed to me functional to the aim of this contribution. Bruni refers in his reasoning to the Latin term *munus*, carrying between others the sense of 'service or favor,' 'present or gift.' *Munus* is often an obligatory gift, in contrast to *donum*. *Munus* is the root of two words that form a key thread in Bruni's discourse: *communitas*, or community, and *immunitas*, or immunity. Thus a *communitas* is a group bound together in the various forms of social interaction that involve this obligatory and obliging gift exchange; the condition of *immunitas* is to remain outside such a social structure of obligation, service or duty. Adam Smith, more or less the father of modern economic thought, reacted against the feudal, vertical, personal, immediate (or

unmediated), asymmetric relationship of direct dependence or benevolence. For Smith, the market as a mediating 'third,' instead creates a horizontal, impersonal, mediated, symmetric relationship that does not depend upon one individual alone, nut upon multiple competing merchants. In such a social structure, an individual is *im-mune* or exempt from a *com-munal* system of binding obligations that constrain that constrain individual freedom and implicitly and explicitly preserve relationships of power and dependency. This then is the system that has evolved into our present day economies.

Smith in a way reacted against medieval asymmetric relationships, where the many depended on the benevolence of the few. Bruni considers the market as a positive triumph of modernity, in which we can meet and exchange as peers. But the move to *immunitas* in markets, sets a course for the reduction of all public interpersonal interaction to contractual, impersonal, immune relationships. "A market designed to separate people does separate people" (2012: xiii). In a market-centric system in which interpersonal relationships in the market are instrumentalized toward the exchange of goods and services, the real scarce good becomes an authentic human relationship. And here is Bruni's point. In keeping a relational *communitas*, we need not settle for the model of asymmetric, power based social relationships. Bruni proposes that the difference is gratuitousness, or free and open reciprocity. And, attention, this is not an altruistic relationship, he proposes gratuitousness not from altruistic motives, but from reciprocity. A desired return is in his eyes good and natural, but gratuitousness will not attempt to create an asymmetric, dominating relationship in order to extort or subtly induce a response from the other. Instead it will attempt a relationship of trust between peers.

2. The Fundamental Intuition: the Link Between Wound and Blessing

"An image and an insight are the source of this book," writes Bruni. "The image is that of Jacob's struggle with the angel as related in the Book of Genesis, and the corresponding insight is the unbreakable link between 'wound' and 'blessing' in every authentic human relationship" (2012: xvi). He opposes this story in the first lines of his *Introduction* with the story of an ideal city where conflicts have been eliminated because the precondition for conflict, that is, the need to maintain a common ground, a *communitas*, has itself been eliminated. For Bruni this is not a utopian view, he thinks this is very close to the reality taking shape in the cities being envisioned and planned in market societies. These two stories shape his conviction:

> Sooner or later every person has an experience that marks the coming to full maturity: we understand in the depths of body and soul that to experience the blessing which is bound up in a relationship with another, we must accept its wound as well. We come to understand that we cannot enjoy life without going through the dark and dangerous territory of the other, any attempt to escape this agonizing struggle inevitably leads to a joyless human condition.

Here, we have the core conviction of the author. He will illustrate his own conviction with Aristotle, make the contrast with Adam Smith, comment on the role of the Third in relationships between human persons, and the emergence of markets and the State as neutral Thirds in modernity. When he formulates an alternative way of thinking, he finds in the classic tripartite *eros*, *philia* and *agape* the starting point of his plea for gratuitousness in economic life as the missing link.

The result of two centuries of economic science is this message : life together without sacrifice is possible. Bruni says that the result is the deception of our post-modern world, what is now called the paradox of happiness, and the diagnosis is not; let's destroy the markets, but well; if we understand that this crisis of ours is about the failure of a social model of mutual indifference, a global relational crisis, than the way is open to rethink relationship, reciprocity, fraternity as essential categories also for the economics. For Bruni, the aim is to put agape at the center of public and private life, not as a rare element of the only private sphere. And that would be the most intelligent and cultural advanced goals economics and social sciences should have in mind. Against the great *im-munizing* project of modernity Bruni designs the possibility for a *communitas*-oriented approach starting from reciprocity and integrating and not opposing *eros*, *philia* and *agape*, but with agape as the central player. How does he proceed?

3. Aristotle, Smith and the Mediating Third: the Great Immunizing Project

"Studying the broad currents of European philosophical thought regarding the definition of what it means to be human, one reaches an unexpected conclusion: the social aspect, the element of life in community, is not generally considered necessary for humankind. However, this thesis is never presented as such; it is rather a presupposition that is never formulated." This statement of the anthropologist and philosopher Tzvetan Todorov[26] could well resume Bruni's perception of modernity. Interpersonal relationships are essentially a problem, a necessary evil:

[26] T. Todorov (1998). *La vita in commune*, Milan: Pratiche, p. 15.

the other is primarily a wound. Modern humanity does not see the 'blessing' associated with the wound, we try to escape from the other in search of *beata solitudo*.

Bruni studies the birth of this attitude in history and situates it in Renaissance Humanism. This is a kind of rupture with the precedent society: in traditional medieval society the possibility of life in community was closely bound to sacrifice and tragedy. The source of this vision lies in Greek thought, predominantly in Aristotle's Ethics. Aristotle knew the paradox that a 'good life' or a happy life is at once civil and vulnerable. In chapter IX of his *Nicomachean Ethics* he notes that 'the happy man needs friends' (1169b). Bruni comments "this is why no one can be happy alone, and why it is impossible to achieve happiness in solitude and in flight from social life and encountering the other (…) the happy life is ambivalent: the other is my joy and sorrow, my only chance for true happiness, but also the one on whom my unhappiness depends" (2012: 15). Why, because the blessing, depends on others who, however, can hurt me too. If I am to take refuge in solitude and contemplation apart from others, my life cannot fully flourish. This is way the Aristotelian tradition, beyond Aristotle himself, associates the happy life with tragedy. Social life, the *communitas*, carries the mark of suffering within itself. Premodern and ancient thought understood the ambivalent nature of the good life.

The pre-modern world view remained substantially holistic, states Bruni: the community is important, not the individual. "The Absolute absorbed everything; individuality did not emerge. Ancient people did not consider horizontal intersubjectivity between equals. The friend of Aristotle is not really a Thou, but an alter ego. Friendship, *philia* is selective and exclusive: were there many friends the risk of injury, of betrayed reciprocity, would increase" (2012: 7). In the ancient world interpersonal relationships were mediated by an Absolute, by a Third. This Third avoided direct contact between people, symbolized by the community and its representatives. Pain, finitude and sin are all oriented toward this relationship with God, everything makes sense from this vertical perspective. A perspective that, translated into social life, becomes the hierarchical feudal system, comments Bruni. But the entire Middle Ages becomes also a process of the slow emergence of individuality as a category, to the detriment of *communitas*. The big difference in modernity will be that modern humanity has seen the wound rather than the blessing, of the other, a negative anthropology will dominate the scene (see Hobbes *homo homini lupus*).

Two crucial moments emerge according to Bruni, in this epochal process in the social sciences: Thomas Hobbes and Adam Smith. Hobbes with the Leviathan and Smith with the 'Invisible Hand' of the market sought a replacement for the Absolute as the mediator of the I-Thou relationship. Because of the negative perception of the other, they return to the inter-personal relational structure of

pre-modernity, that of I/Mediator/Thou, in which, instead of God, the mediator becomes the Leviathan or the Market – which has as a consequence to impede the perception that the other could set himself alongside me on an equal footing. In Hobbes' politics and in Smith's economics there is no direct intersubjectivity, but rather a mediated and anonymous relationality for the fear of the negative and the suffering that a personal 'you' carries in him- or herself. The State and the Market are new 'thirds,' no longer the Third (God or *communitas*) nor a third that opens and universalizes the I-Thou relationship, only a third that is immune from our relationship and which reciprocally 'immunizes' us, and that guarantees (or promises) a free zone in which to meet each other without being wounded (2012: 8).

Bruni wants to find new paths for reciprocity. Contractual reciprocity in markets became a new form of reciprocity, a radical alternative to that based on a free and reciprocal gift: the gift that brings us together since it requires that we find a common ground that, by definition, belongs to neither of us, whereas the contract makes us immune from each other since what is mine is not yours, and vice-versa. A common ground, especially when a place of relationships among equals, is also a place of conflict and death, a conflict and grief that modernity did not want to accept, renouncing as well to life-giving fruit of that common ground. Modernity wanted to break the inevitability of this union, though without being able to really do it, and by paying a price that in Bruni's eyes is proving too high.

4. Smith's Original Sin and Gratuitousness as the Salt of the Earth

Adam Smith, the father of modern economics theorizes classical liberal economics. Smith wanted to emphasize the independence from 'the benevolence of our fellow citizen' as a possible virtue related by the new form of sociality introduced by the market. This autonomy in the market economy was for Smith an immediately civilizing factor. But a civil society, a civilization based on *immunitas*. The humanistic inspiration of Smith cannot be understood unless one understands his enthusiasm for the market together with an indignation at the suffering and humiliation inflicted by a few feudal masters on the many servants in pre-modern *communitas*. Smith takes recourse in the mediation of the market, because an unmediated relationship is synonymous with an uncivilized, feudal, asymmetric, and vertical relationship. The other harms me because he or she is a powerful person or a master who rules me, one who does not fight with me on equal terms.

"Society may subsist among different men, as among different merchants, from a sense of utility, without any mutual love or affection."[27] So, for Smith, the civil

[27] A. Smith (1984). *Theory of Moral Sentiments,* Indianapolis: Liberty Fund, II.ii.3.4.

society can function and develop without gratuitousness (beneficence, charity), or that a contract can take the place of gift. The gift of oneself and of friendship are important in the private sphere, but in the market and in civil society we can easily do without them; rather, we do well without them precisely because of the burden of pain and injury. But, argues Bruni, as the growing loneliness and misery of our affluent economies are telling us, a society free of gratuitousness is not a habitable place, much less a place of joy. This is especially true in post-modern societies, where the boundary between 'private' and 'public' is disappearing. In our societies, if we do not live gratuitousness in public (work, politics, associations, and so forth), neither will we live it in private, affirms Bruni.

Where is the point? Why is the mediation a problem? "The wound that Smith saw and wanted to avoid by recourse to the mediation of the market is not the wound I receive from friendship and horizontal relationality between peers, but the wound I receive from power asymmetry and from forces objectively present in the field" (2012: 18). And this wound should be avoided:

> But the problem is that if the market becomes the principal means of organizing community life, that is, if it permeates the whole of civil society from health care to schools, from child care to elder care, as is increasingly happening, then entrusting social relationships tot the market contract alone is insufficient and dangerous. Nor could the Leviathan State, which incorporated the same mediated, impersonal logic, heal such a failure in interpersonal relationships.

Against Smith Bruni affirms strongly that interpersonal relationships are not always uncivilized and asymmetric, mediated relationship is not always more civilizing than un unmediated relationality as Smith saw it. That is Smith's (venial) sin according to Bruni (2012: 18). For the Italian economist, we must envision an economic science capable of gratuitousness, beyond a merely contractual and immunizing relationality.

But can reciprocity do the job? Bruni analyzes at this point of his argumentation a series of studies on reciprocity from a theoretical point of view made by economists, and the results are very encouraging. To say only a few points. Bruni affirms that the theory of reciprocity has undergone many developments and the paradigm of rational egoism is coming into serious discussion. New models revealed behavior in which the players tend to respond with more generosity than standard economic theory would predict. Experiments on trust reveal that trust, which is risky and costly, impels the recipient to behave in a worthy manner, greatly reduces opportunism, and markedly encourages growth.

5. Gratuitousness as a Fundamental Value in a truly habitable environment

The thesis of Bruni's book is very clear: he wants to reclaim the value, including the economic value, of a more fully dimensioned relationality, open to the contract but also to the encounter with the other inspired by gift, by its blessing and by its wound; a relationality, therefore, open to gratuitousness. Gratuitousness is for him not the only essential principle of civil economy, but one of the basic and identifying dimensions. He also confesses it is an extremely difficult concept to define, because precisely it is an essential human dimension: we can live a long time without markets and income, but we cannot live without giving and receiving gratuitousness. He uses then an ancient word for gratuitousness: agape. A classic tripartite division of the concept of love articulates it into the relationality of *eros*, *phili*a and *agape*. Lastly, also pope Benedict XVI' *Deus est Caritas* encyclical stressed the thesis of the strong unity of human love: Love is at once one and many, says the pope. Eros, the love of desire, 'exalts.' Friendship love, or *philia*, endures if reciprocated, though it is given more freely than *eros*. *Agape*, instead is a form of love that appeared in history with Christianity. The archetype here is the Crucified. One who gave his life even for those who were not his friends. Bruni adds at this point that at the same time, the gift of *agape* is a sustainable and fully human love if it has the passion and the desire of *eros* and the liberty of *philia*. A multidimensional love alone expresses humanity.

And then he expresses the most original element of his analysis. He puts forward an analogy between the three forms of love and the economic discourse: he sees analogy between eros and the contract, and develops an interesting argumentation of four pages on it, and concludes on the relevance of it (2012: 47). Economics also recognizes the relationality of *philia*, primarily in forms of mutuality. Historical and contemporary cooperative and associational movements are defined around the basic principles of mutuality and friendship. But in contrast with the contract, *philia* is not universal, *philia* is a relationship of choice. The danger is always to close in and exclude non-friends (as happens in the various mafias and, though differently, in clubs and communitarianism).

And *agape*? In economic science, *agape* has been and is still markedly absent, relegated on the one hand, to the private sphere, particularly in familial or spiritual or closely intimate relationships, while on the other hand, in the public sphere the dimension of unconditioned gift, at least in the European tradition, has primarily been entrusted to the State ('Welfare State') and secondarily to the civil society, and in the U.S. in particular, philanthropy has assumed some of the dimension of

agape. But for a full understanding of Christian agape is lacking here the aspect of neighborliness, and 'unconditional reciprocity.'

According to Bruni, a challenge for civilization today is to place *agape* again at the center of the life of the polis rather than leave it confined to just the private sphere, where it can play only a residual, minor role. Were a post-modern society to lose contact with agape in the public sphere, it would quickly lose it in the private sphere as well, since in globalized societies the veil that marks the boundary between public and private sphere is tearing apart. There is no better illustration for Bruni's insight here than the example of the entrepreneur's actions. Bruni writes that at the beginning of an entrepreneurial commitment there can be, and frequently is, a passion driven by *eros*; however, it is only when the entrepreneur begins to build *philia* in his or her company, and is open even to gratuitousness, that the company grows and matures over time in a harmonious and fully human manner. This is analogous to what happens in family life and organizations in civil society (2012: 51). These often originate in passions and desires, but they weather the vicissitudes of life and become truly habitable environments in which people can flourish when erotic love lets itself be contaminated and transcended by *philia* and *agape*.

He distinguishes then four means by which to re-establish (or establish?) *agape* in its crucial role in the civil dynamic. I mention them briefly because they give an insight into a possible strategy for instilling *agape* in the public sphere (2012: 59 ff.). A first way is to use meaningful, specific, and credible experiences to demonstrate that there has existed and presently exists an economy based on *agape* that is at least as relevant as the economies of contract and friendship. The purpose is to give theoretical dignity to *agape* in economics, demonstrating that there is a rationale for establishing civil and economic life on *agape* that is different but just as 'reasonable' as that of contract and of *philia*. Second, it is increasingly urgent to speak out against the *monophysism* of the contract and of the philia in the so-called communitarianism.

A third important challenge is the necessity of an in-depth examination and a new structural ordering of the principle of subsidiarity. Until now that principle has been interpreted in a 'vertical' dimension in the regulatory relationship between the various levels of public administration. Recently, however, its 'horizontal' dimension has been emphasized, that is the relationship between the civil society and the public administration. Bruni proposes to invert the reasoning: let not the contract do what friendship can do; let not friendship do what love can do. The contract remains *potentially a positive and civilizing relationship, but it must always be seen as subsidiary to philia and* agape, and not as a substitute for the other two at a lower price. Where the protection of disadvantaged subjects is at stake, and

structural asymmetries between the parties, the contract can be a valid instrument that serves *philia* and *agape*. Contracts and *philia* are quite welcome, writes Bruni, as long as they increase universal fraternity! Prevailing modern economic theory and practice orders exactly the opposite: let not love do what the market can do. Because love is a scarce resource and thus should not be 'wasted' in contractually based market interactions. But the principle of subsidiarity is based on a different anthropology, in which *agape* is not an economic good that deteriorates with use, but, to the contrary, is a virtue that increases its value with use.

Here we find ourselves at the heart of Bruni's convictions. Bruni expresses now brilliantly what we as colleagues in Sophia University Institute owe to a generation of scholars I mentioned earlier. " (...) every time we resort to a contract when friendship is available, and to friendship when agape is available, we impoverish the value of persons, relationships, and society, and we sell short the value of life in community in a sort of relational dumping" (2012: 60). But therefore, we must learn how to recognize and reward agape, "since it is the true scarce good – virtue in our societies that does not deteriorate." Agape, the virtue *par excellence*, has no inherent incentive, states Bruni, "but I can and must be rewarded" (2012: 61). Agape can only be chosen by intrinsic motivation, by 'internal vocation,' as a response of love. If a society desires to be truly civil, it must 'reward' – not 'pay for' – agape, primarily through recognition, one motivated by gratuitousness must be recognized as a cornerstone of the *civitas*. And Bruni ends this chapter by recording that *agape* is like salt or yeast. If it is missing, everything loses flavor. Civil and economic life is thus exposed to injury; the greater blessing that can be experienced comes at a price.

6. New Stimuli for Civil Society and the Economy: the Forgotten Role of Charisms

Who can encounter the wound of the other, heal it, and receive a blessing for himself and for society (2012: 99 ff.)? History has shown that when charisms are at work the blessing beyond the wound can be seen. A charism, Bruni defines it as 'different eyes,' capable of seeing things that others do not, knows how to see the embrace concealed in combat. The actions of charisms go well beyond the visible confines of religions, and, in fact, are the most secular acts imaginable. Bruni gives some examples of the economic realm from recent times, and speaks about the many men and women who committed themselves to create the trade unions, the founders of savings and loans, rural banks, and cooperatives, which continue to turn problems into resources and opportunities, even today, thanks to the different eyes with which they viewed the world. Human history, including

its economic and social aspects, is in large part the result of these charisms, and the economies influenced by charisms are therefore a co-essential dimension of civil life. For example, without the charisms of the founders of social orders and groups, between the seventeenth and the twentieth centuries, the history of European welfare state would have been quite different. The actions of charisms served as trailblazers and innovators in hospitals, health care, schools, education, and hardship assistance.

The leader with a charism innovates, sees unfulfilled needs, identifies new classes of poor, opens new avenues for solidarity, and drives ahead the frontier of humanity and civilization. And that is what we will now illustrate in the next chapter at the hand of one example also Bruni had constantly in mind elaborating his theoretical developments.

Lesson 4: Charism at the Heart of Economic Life: a Case Study

After Bruni's essay for a greater role of gratuitousness in order to change our environment in the sense of a more human sustainable development, time has come to illustrate a case study where all this seems to become concrete. We remain in the field of economy, and obviously this is only one of the so many cases we could analyze in order to illustrate our views on the central role of agape in our 'social fabric.'

"The charismatic economy is often left in the shadow as if only institutional dimensions were relevant to understanding economic and social life."[28] This formulation reminds one of the sociologist Bryan Wilson, who wondered if charismatic experiences were still possible in contemporary society. He concluded that only feeble charismatic experiences were still available, and only on the periphery rather than in the very heart of the dynamics of society and the sectors of society that matter.[29] In my own sociological study of the case of the so-called "Economy of Communion" (EoC), however, I believe that I have found a charismatic economy in the very heart of economic life. EoC, created through the intervention of a contemporary religious leader, aims not at the margins of society, but at its very heart.[30]

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[28] *The Charismatic Principle in Economic and Civil Life: History, Theory and Good Practice,* (http://www.iu-sophia.org/public/documents/call_for_paper.pdf).

[29] Bryan R. Wilson (1975). *The Noble Savages. The Primitive Origins of Charisma and its Contemporary Survival,* Berkeley: The University of California Press, p. 131.

[30] This contribution was first published in Italian: B. Callebaut (2010). "L'Economia di Comunione: oltre l'alternativa 'santa povertà' o 'santa ricchezza'?," *Nuova Umanità,* XXXII, 192, pp.

The EoC is an initiative of Chiara Lubich (1920–2008), founder of the Focolare Movement. In creating the EoC, she asked people who were competent in business and economics to develop new enterprises in order to increase profits, some of which could be shared with the poor. This proposal was not directed at people on the margins of society, but to central actors in the entire economic process: the entrepreneurs. In doing so, Chiara Lubich proposed that the economic world establish a more direct relationship with the social aspect of life. In this way, the EoC would bring together two major areas of human activity, two fundamental functions of our society, namely, the economic and the social. EoC thus aims to mediate in a new way between two symbolic figures: the entrepreneur and the poor. It would seek to link them in a new alliance, a new relationship of practical solidarity.

This being the case, two questions arise: Is this an economic initiative of a charismatic type? How can this possibility be explored following the logic of sociological inquiry? I decided to try to answer these questions by following the sociological approach practiced by Max Weber in his studies on charismatic leadership.[31] Because Weber's work on charismatic leadership presupposes the presence of concrete needs and innovative proposals, the question then arises: Do the projects of the EoC constitute answers to certain needs, and do they entail true innovations?

1. A Charismatic Leader in Contemporary Society

The very idea of a charismatic economy assumes, at least from a Weberian perspective, that it is a result of a charismatic leader. Chiara Lubich launched the EoC during her visit to Brazil in May 1991.[32] Her life up to that point had clear elements that correspond to Weber's ideal type of a charismatic leader. Few in the Catholic Church or elsewhere would dispute her status as an eminent religious figure of the twentieth century.[33] For Weber, a charismatic leader has followers, people who esteem the leader as possessing an exceptional idea or gift and who become 'disciples' of the message he or she brings. The Focolare Movement that Chiara Lubich originated is today one of the largest in the Catholic world, counting millions of

681–701. The English version was first published as B. Callebaut, "Economy of Communion. A Sociological Inquiry on a contemporary Charismatic Inspiration in economic and Social Life," *Claritas,* I, 1 (March 2012), pp. 71–82. See www.claritas-online.org.

[31] Max Weber (1980). *Wirtschaft und Gesellschaft,* Tübingen: Mohr, pp. 140–142.

[32] The speech that launched the EoC was published in Chiara Lubich (2001). *L'economia di comunione: Storia e profezia*. Roma: Città Nuova, pp. 9–14.

[33] See Maria Chiara De Lorenzo (2009). *Hanno detto di Chiara e dei Focolari*, [in:] Michele Zanzucchi (ed.), *Focolari. La fraternità in movimento.* Roma: Città Nuova, pp. 136–139.

people as adherents to its spirituality. Its committed members include more than 100,000 adults and young people of every race, nation, and social class. The idea behind this foundation is also original. Its spirituality, called a 'spirituality of unity,' is not absolutely original since it is based on central texts of the gospel. Although Lubich cannot be called a pure type of charismatic prophet, neither is what she has inspired be considered a mere expression of current Catholic discourse. In various moments of her life, Lubich has demonstrated a unique charismatic capacity to re-interpret creatively Christian spirituality from the perspective of unity.[34] No other contemporary movement for unity has awakened such a global following at the grassroots level of society.

Lubich is known most of all for her original perspective on unity based on her understanding of Jesus' cry of abandonment on the cross. In this cry she found the secret for renewing relationships between persons, between persons and God, and between persons and creation itself. Her comprehension of what she called 'Jesus forsaken' offers without doubt an original contribution to Christian spirituality.[35] For sociological purposes, it should be noted that this contribution creates linkages that surpass barriers between people that impede universal brotherhood. Notwithstanding the normal difficulties inherent in every social concretization of an ideal concept, the ideal of unity born in the Catholic Church and incarnate in the lifestyle of the Focolare not only inspires and unites Catholics as well as Catholics and other Christians, it also builds unity with persons of other religions and persons without any religious commitment.

Many people consider Chiara Lubich to be a prophet of unity because of the extensive dialogues she established with many religious personalities and currents. But from a sociological point of view, it is also fascinating to see how she was able to promote bonds of fellowship and build bridges between parts of society that typically oppose one another. A sociological study made over several years has convinced me that, in the Weberian way of speaking, Lubich is a religious leader with recognizable characteristics typical of a prophetic charismatic. This is particularly the case if we look at how her Movement develops a myriad of social projects that

[34] J. Shotter (1984). *Social Accountability and selfhood*, Oxford: Blackwell.

[35] For an overview of Chiara Lubich's life and thought see (2007). *Essential Writings: Spirituality Dialogue Culture*. New York: New City Press. For an exegetical reflection see Gérard Rossé (1984). *Il grido di Gesù in croce. Una panoramica esegetica e teologica*. Roma: Città Nuova. For a theological approach see Stefan Tobler (2002). *Jesu Gottverlassenheit als Heilsereignis in der Spiritualität Chiara lubichs. Ein Beitrag zur Űberwindung der Sprachnot in der Soteriologie,* Berlin–New York: Walter de Gruyter; and Florence Gillet (2009). *La scelta di Gesù Abbandonato, nella prospettiva teologica di Chiara Lubich*. Roma: Città Nuova. For a sociological approach see Bennie Callebaut (2010). *Tradition, charisme et prophétie dans le Mouvement international des Focolari. Analyse sociologique*. Paris: Nouvelle Cité.

aim to create bridges between different social worlds in ways that contribute to a broad culture of fellowship. This fact, in turn, suggests another question: Is the launching of the EoC itself a charismatic moment?

2. The Social Context

Chiara Lubich launched the EoC project on May 29, 1991 during a trip to Brazil where the Focolare Movement had been present since 1958. In just over three decades, it has developed rapidly all over this immense country. There were certain expectations concerning possible results of Lubich's first visit in twenty-five years. This was especially true since it may well have been the last for the founder of the Focolare Movement. Therefore, many hoped she would propose something decisive for the future development of the Focolare in Brazil. In particular, it was hoped that the founder would address the problem of social inequality in the context of an economy that had the potential to become one of the most important of the world.

There is a history behind this hope. When the Focolare arrived in Brazil in the late 1950s, those involved were clearly convinced that in order to spread the gospel, they needed to give priority to the situation of social injustice. But they found that it took all their energies to spread their spirituality, with the hope that one day they would have enough people to address this social goal. They also realized that the Church's "preferential option of the poor" did not in itself suggest how they could contribute to the achievement of social justice. At the same time, Brazilian society operated under the political rule of a military regime determined to maintain the social status quo with its deep inequality between rich and poor. In this context, the Church in Brazil evolved and eventually embraced the preferential choice in favor of the poor. This was an option with which the Focolare agreed and supported through a number of specific projects around the country. However, their unique contribution towards realizing this choice remained open.

In the 1960s, the Theology of Liberation and the birth of the Ecclesial Base Communities (CEBs) had enriched the ecclesial panorama and pushed the Brazilian Church forward toward a more engaged presence in the public square. This situation brought reprimands against some of the ecclesial movements of European origin that had come to flourish all over Brazil. The critique was that they privileged middle class people, were not reaching the poor, and therefore did not realize in some way the preferential option in favor of the poor.[36] In the Focolare's case, there were in fact a large number of poor persons in the Movement in Brazil. The

[36] For a synthesis of the situation at the time, see José Comblin (1983). "Os 'movimentos' e pastorale latino-americana," *Revista Eclesiastica Brasileira* 170, pp. 239–267.

middle class members shared in a communion of goods, but it was not enough to meet the needs of the poor within the Movement. So by the time Chiara Lubich visited Brazil in 1991, there was a large consensus that this communion of goods and the social projects they had founded could not solve the social problem of poverty within the Focolare communities, let alone the entire nation. Within this context, it was hoped that during her 1991 visit Lubich would address the problem in a larger and more innovative way.

At the time of her visit to Brazil, Chiara Lubich had reflected on the Berlin Wall being pulled down, and the fall of real socialism in Europe. She also reflected on the conclusions of the recent papal encyclical *Centesimus Annus*, written one hundred years after the first papal social encyclical, *Rerum Novarum*. In the recent encyclical, the pope made clear that any evolution in the economic field had to take into account the freedom of the entrepreneur, that economic creativity demands space for liberty. These reflections were reinforced by her experience of the actual economic dynamics of the city of São Paulo, where she stayed. Although the city was the economic heart of Brazil, Lubich noticed the enormous circle of slums (*baraccopoli* or *favelas*) that seemed to her to be like a 'crown of thorns' around the heart of the city. In her diary for May 15, 1991, Lubich reaffirmed that poverty constituted one of the biggest and most tragic problems on earth. She prayed to God for a new insight on how to act. A few days later, an idea emerged.

3. The Proposal of an 'Economy of Communion in Liberty'

Max Weber had the following conviction about prophets: "An authentic prophet generally proclaims, creates, or brings about new offerings."[37] He continues his analysis by affirming that the root meaning of 'charism' suggests an inspiration for a concrete call to change that the community of believers recognize as original.[38] In the introduction to her formal presentation of the EoC, Chiara Lubich says: "Here, now…is born an idea: God asks our Movement in Brazil that counts some two-hundred thousand people…to create a communion of goods that engages the Movement as a whole."[39]

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[37] In the original text Weber says: "…der genuine Prophet … überhaupt verkündet, schafft, fordert neue Gebote," (1980:141).

[38] *Ibid*. "(…) im ursprünglichen Sinn des Charisma: kraft Offenbarung, orakel, Eingebung oder: Kraft konkretem Gestaltungswillen, der von der Glaubens-, Wehr-, Partei- oder anderer Gemeinschaft um seiner Herkunft willen anerkannt wird."

[39] The Economy of Communion is described in an excerpt from an address by Chiara Lubich during the conferral of an honorary doctorate in Economics at Sacred Heart Catholic University, Piacenza, Italy, 29 January 1999. See C. Lubich, *Essential Writings,* o.c., pp. 274–78.

No authority asked Chiara Lubich to propose the EoC. And while Lubich never said that this was more than an idea, to her it seems to be a call for change that comes directly from God. She never specified that it was an 'inspiration' and she used the more neutral term of 'idea.' But she clearly considered it something to be accomplished because it was according to God's will. Lubich used language such as this in other similar situations. She never 'played' the prophet, even if she realized the gravity of the occasion. But for Weber, the one who offers the idea is not the only important factor in this regard. It is also important that the persons being addressed believe that what is proposed is in line with a charism, part of the broader message already offered by the charismatic figure.

What was then the precise proposal launched by Chiara Lubich? She reasoned that it was not enough to exercise acts of charity, works of mercy, or the 'communion of goods' between individual persons. The key people to whom she directed her speech were entrepreneurs capable of managing profitable companies efficiently. The innovation she proposed was that the profits be put in common.[40] She also proposed that the profits be divided into thirds. One part would go to the enterprise itself, one to the poor, and one would be invested in programs that promote education in support of building a 'culture of communion.' The actual amount of the profits going to each of the three would depend on needs of company and those working in it, the needs of the poor, and the potential of the educational programs being proposed.

What's new about all this? Chiara Lubich makes no appeal to traditional ways of doing business that owners and managers were used to practicing. She did not give a traditional speech about profit sharing within companies, or contributions to charity outside companies. Sociologically speaking, Lubich's proposal was a 'relative, socially-situated innovation.' At the same time, she was speaking from the very heart of Christian tradition. The idea of putting things in common is as old as the first Christian community, as described in the Acts of the Apostles. Looking at the innovative ways of adapting this early communion of goods in the history of Christianity, the original text from Acts "is necessarily always reinterpreted by the mediation of the socio-cultural coordinates of the times, of the place, and of the tradition lived by the group. It is by this particularization, differentiation, and conditioning that the adaption is in fact innovative."[41] It is also true that in her legitimation of the practice of the communion of goods in the Movement, Lubich always called attention to the experience of the first Christians. But now

[40] P. Quartana (1992). "L'economia di comunione nel pensiero di Chiara Lubich," *Nuova Umanità* 80–81, p. 16.

[41] Jean Séguy (1999). *Conflit et utopie, ou réformer l'Ėglise*, Paris: Cerf, p. 129 (own translation).

she applies the communion of goods to a new field, to companies and enterprises. Here is the real innovation.

It is important to point out here that Lubich's proposal not only addresses a social problem (the poor being marginalized from the normal labor circuit), but does so not with an answer made in religious terms (charity or a communion of personal goods) but in economic terms that go straight to the heart of the economy. The answer for Lubich consists in creating new companies that decide from the beginning to share their profits. The answer is an economic one, with the first part of the profits going to the companies themselves to help the business expand and hire new workers. The second part goes to help people in need, giving them the possibility to live a dignified life while looking for work or by offering them work in the business itself. Finally, the third part provides for the cultural support the business needs in order to grow.

This third aspect of the proposal may not be obvious. But if a leader is charismatic, he or she is so because people believe in the message, and this is true also for social movements. The possibility for success is not great without a group that supports an initiative. But once a significant group exists, and here the group supporting the EoC is the whole Focolare Movement, the potential for success is increased. In the case of the Focolare's support for EoC, Lubich understood that it was necessary that the personal and collective lifestyle of this group become a 'culture,' a consistent pattern of human behavior expressing a commonly held conviction. Realizing any level of culture requires cultivation, or education in values, Lubich saw the need to cultivate a culture of giving: "I give, therefore I exist" should become one of the popular slogans of this cultural program as a clear alternative to the reigning slogan in the consumer culture: "I buy, therefore I exist."

On the other hand, it is important to note here that Chiara Lubich does not oppose the free-market system. Indeed, she sees that a viable solution to the problem of poverty that she so urgently wants to remediate demands an economic proposal that produces profits. Her goal is to cultivate successful entrepreneurs in order to achieve the dignity of actors in a new type of economy, and to cultivate a culture of giving that will provide the support such an economy needs. Most social activists look at entrepreneurs with suspicion, as being part of those who exploit rather than as part of those working in favor of the poor.[42] Therefore, the

[42] It is necessary to understand precisely what sociologists mean when they speak of social realities. Usually, they seek to analyze and to understand society as a large set. But here, they are using the term more in the sense used when talking about economics and social policy. So the term has a narrower scope, considers the distribution of wealth in the same way that the economy takes care of the production of wealth.

EoC proposal presents a call to change the way people think about business and social justice – thus the need for education.

4. Catholicism and Economic Theory

How can we situate this proposal in the context of the relationship between modern Catholicism and economics? Émile Poulat, a well-known French sociologist of contemporary Catholicism, identifies three kinds of relationships between modern Catholicism and the economy: struggle without rest (traditionalism), upgrading and fighting (progressivism), and accommodation (modernism). As a matter of fact, none of the three approaches account for the way that EoC integrates respect for existing free market economic logic with solidarity-based evolutionary change.

The fundamental question here is: Down through the centuries, how has the Church been doing in regard to economics? Poulat synthesizes his own research into the reaction of the Church to economic thought in the conviction that it "was always the Achilles heel of the Catholic Church. She [the Church] produced social thought, but never possessed realistic economic thought."[43] The result has been that Catholics active in the economic world have lived in ways that have not been guided by Church doctrine. They have not been preoccupied with theories presented in specific Church social doctrines that do not seem to relate to their life experience. Poulat proposes an explanation considering the period of time from the Middle -Ages until now.[44]

He considers a triple separation. First is the separation between the social teachings of the Catholic *magisterium* and the reality of life lived by Christian people. Second is the separation between economics and religion. It was the same as for science. Economics constituted itself out of the Church and did not ask anyone in

[43] Émile Poulat (1988). "Pensée chrétienne et vie économique," *Les Cahiers de l'Unité*, 16, p. 50.

[44] Poulat explains, using the situation during medieval times as a starting point: "Within the moral battle that placed the Church in opposition with the commercial sphere, the mutual lack of comprehension obscured a mental transformation that was operating: money didn't have the same scope any more. In other times one lent money to the poor; now one lends money to the rich. We are at a crossroads in ways of acting economically. The moralists didn't catch this transition; they missed the train as it left the station, which in the meantime accelerated at a faster and faster pace. Wealth poses all kind of problems connected with modern capitalism, from industrial development to the internationalization of the economy. We can't delude ourselves: integral [in opposite to liberal Catholicism, in the sense Poulat uses the term] Catholicism concentrated on the social aspect where it already had some leverage, because the Church couldn't make any real impact on the economic side of life where liberalism reigned sovereign. Here, her doctrines touched upon one of her most severe limitations." Émile Poulat (1983). *Le catholicisme sous observation. Entretiens avec Guy Lafon*, Paris: Le Centurion, p. 105.

the Church for the principles of their own development. Third is the separation between economic and the social thought. As if there was something like a division of labor: for the entrepreneurs it was the economy, for the workers it was the social aspect of life. This antinomy positioned the Church on the side of the social aspect, and this reinforced the two other separations.[45] There is another significant quotation from Poulat:

> Everything started with the long conflict between holy poverty [the Catholic approach, symbolized by Saint Francis] and holy enrichment [John Calvin and the bourgeoisie of Geneva], where pastors and theologians thought they were working in their own religious fields. When holiness disappeared, there remained two naked forces face to face. The question for Catholic thought remains how to understand what the Church can really do in her own terms for this [purely secular economic] topic (1988: 55).

To this end, the Church in recent decades has invested in a more systematic thinking on economics, the famous letter of the Bishops of the United States on the economy in 1983 being the most famous example.[46] However, this recent effort cannot hide the fact that the Catholic world has had serious and enduring problems in thinking about the economy from its own perspective. Therefore, the initiative of the EoC stimulates the Catholic world to foster new ways of interpreting of the economy based on this vital initiative from within the economic world itself.

The proposal of Chiara Lubich comes from a non-economist, a non-professional who has nothing to do with the economic sector, and who obviously also is a non-entrepreneur. It is even more surprising that she takes an approach to economics not really taken in the social teachings of the Church, as mentioned above. But she does use the economy as her principal leverage for social change. Certainly this is nothing more than an intuition; it is not a scientifically articulated and validated economic position. One might object that this intuition is more of a mystical type than of an economic type. But one can reply that with the vigor of a prophet, she defines what constitutes the very heart of economic acting. Such economic action, she contends, should ultimately be 'love' articulated as concrete 'reciprocity' or 'communion.' Or one could paraphrase Poulat's 'holy sharing' as 'solidarity.' This definition engages the symbolic figure of the modern economic world, the entrepreneur. In so doing, Lubich wants to support enterprises in functioning according to

[45] Émile Poulat, "Pensée chrétienne…," *a.c.*, p. 54.

[46] United States Catholic Bishops (1986). *Economic Justice for All: Pastoral Letter on Catholic Social Teaching and the U.S. Economy,* http://www.usccb.org/upload/economic_justice_for_all.pdf.

the logic of entrepreneurship so as to produce more goods and services. Therefore, it is not surprising that this approach has awakened interest in the academic world, and that she was awarded a doctorate *honoris causa* in economics at Piacenza in 1999.[47] Pope Benedict XVI in his social Encyclical *Caritas in Veritatem* (2009) refers explicitly at no 39 to the kind of experiences the EoC brings about.

5. The Economy of Communion and the Charismatic Practice of Economics

There is another way to illustrate the novelty of the proposal of May 1991. The Weberian approach touches also on the charismatic fulfillment of needs. Jean Séguy, discussing the connection between religious institutes and charismatic economics, affirms that there can be certain elements of charismatic economy in contemporary modernity.[48] Séguy notes that Weber, in his notion of charismatic economy, distinguishes two possible types:

> Those that correspond to the pure type – the ones that consider the fulfilment of needs with an answer that includes only a charismatic way, outside of all rational economies; and the ones that conform less to the pure type but in certain instances are very near to a pure charismatic economy. The latter is the case with a minimally or relatively administered charismatic economy that introduces a certain degree of daily economic rationalization that does not impede or dominate the whole process. He [Weber] stresses the fact that many religious institutes do not have anything more urgent than to produce a surplus – in part by following an ascetic rationality – in order to escape... from accumulation and the need for investment, which means, from the very logic of the capitalistic market (1992: 48).

[47] Beginning in 1998, Chiara Lubich asked scholars in economics to direct their studies so that the Economy of Communion "become a truly scientific discipline, giving dignity to those called to demonstrate the theory in practice, a true 'vocation' for those involved in it in any capacity" (see C. Lubich, *Essential Writings, o.c.,* p. 285). The serious studies generated in response to this call have led to numerous scientific and academic initiatives and publications. See www.edc-online.org, as well as the worldwide archives of the theses related to the Economy of Communion: www.ecodicom.net.

[48] Séguy defined rational economic practice in the sense of the capitalist economy as a rationality of "accumulation, from the investment of capital in the market, of a return on the investment and the profit of modern daily life." For him, the charismatic economy functions with "the gift, the sharing, the ascetic motivations, gratuity, the non-daily exceptional." Jean Séguy (1992). "Instituts religieux et économie charismatique," *Social Compass,* 39, pp. 35–51.

The regular economy of the Focolare Movement is founded partly on the professional labor of the members who live in community, partly on the communion of goods of the whole Movement according to the members' free choices, and partly on Providence. The latter is an important part, estimated a few years ago as half of the Movement's entire economy. Thus, the Focolare economy can be said to be at least partially charismatic, with one part that is foreseeable and another part that is always a surprise. The companies that began to adopt the EoC way of conducting business according to the distribution of profits remain enterprises that obey rational economics and thus submit to the logic of capitalistic markets. But at the same time, out of a charismatic logic, they allow part of their profits to "escape." So here, we are not talking about the logic of a pure type of charismatic routine, but about a rational economy that is charismaticized only in part.

It is difficult to deny the presence of an innovative aspect to the EoC. We are not in the presence of religious people who administer enterprises of an abbey or of a religious institute; we are looking at laypeople who act as entrepreneurs.[49] Considering the three terms of the expression 'Economy of Communion in Liberty' the full title of the EoC project, on the one hand, the company is integrated in a free-market economy, but on the other hand, it receives charismatic inspiration from the Focolare that provides an impulse towards communion. Thus, an enterprise that integrates into the free-market system can be managed according to a charismatic logic of relationality, gift, gratuity, and ascetic motivation, together with a heightened acute sense of the exceptional outside the daily routine of modern economic life.

6. Innovation in the Role of Classical Distribution

The EoC project introduces within the economy a charismatic logic related to distribution. This raises the question whether this charismatic logic is more in line with the authentic logic of human and economic acting than the logic that dominates economics today. An example of this kind of critical questioning can be seen in an observation by the Italian economist Stefano Zamagni, who denounces the paradigm of competition that is invading other spheres of associative life:

[49] Séguy observes that for religious institutes, internal cohesion is a consequence of putting the profits in common. The firms which practice the EoC undergo an analogous evolution. The operation of distributing the profits is perceived as an ethically and religiously valorizing element. Séguy concludes: "It allows the interested people to be free of the feeling of guilt that eventually emerges because of the obligation to produce capital for purposes that are beyond their will, and so to risk the rupture or the weakening of the solidarity *ad intra*" (1992: 47).

> If the rules of social life become competitive, the other becomes my adversary, someone with whom I must fight. And that is the paradox: We know we need each other. You cannot be happy on your own. How can one attain happiness if the rules by which human relations are organized tend to see the other as a rival?[50]

For Zamagni, the EoC reinforces "interpersonal relationships by the concrete demonstration that one can stay within the market and be competitive without undergoing the conditioning that derives from the motivational structure which considers that the only reason to act in the economy is purely for the maximization of profit."[51] But another of Zamagni's observation leads to another point about the EoC worthy of consideration. The desire of the EoC to produce in order to distribute profits also goes against current economic thinking. As Zamagni says,

> Everyone who knows about how the economy functions is aware that at least for the last 150 years the basic idea was this: The market is the place where wealth is produced; and as for what concerns distribution (to counter all kinds of injustice, inequalities, etc.), that is for the State to think about. The State has to determine redistribution with the help of well-known instruments among which taxes come first. This economic model thereby also provides the logic for a dichotomy between market and State. It seems to me that the EoC project represents a provocation to this model and its logic, because it uses the market itself not only for producing wealth, but also to realize objectives of redistribution... of income and wealth.[52]

In Zamagni's view, the EoC represents a kind of innovation for economic theory that clearly stands in contrast to the founding practices of Western liberal-capitalistic society. Above all, as a consequence it gives a whole piece of the economy the responsibility not only to produce wealth but also to distribute wealth.

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[50] Benedetto Gui (2000). "Intervista a Stefano Zamagni," *Economia di Comunione,* 14, p. 10.

[51] *Ibid.,* p. 10.

[52] Stefano Zamagni (2000). *Economia e relazionalità*, [in:] Vito Moramarco and Luigino Bruni (edd.), *l'Economia di Comunione. Verso un agire economico a misura di persona,* Milano: Vita e Pensiero, p. 57.

7. The Poor and the Entrepreneur Perichoretically at the Center

Many times, scholars have difficulty forming perspectives of social movements, and, most of all, in reflecting theoretically on a possible role for the middle class in addressing the conditions of the poor. My study of the EoC and its innovative character, as well as notes I took during a trip to Brazil in 1988, some years before the birth of the EoC, suggest how to address this difficulty. Among the people I met there was the well-known theologian Leonardo Boff, one of the most prolific authors of the Theology of Liberation and a highly regarded participant-observer of the life and projects of the Ecclesial Base Communities (CEBs). At the end of a long conversation at his home in Petropolis, he said that the cause for the relative lack of real impact of the Theology of Liberation and the CEBs on Brazilian society consisted in the fact that they did not engage the middle class. This was a reason that I could accept without difficulty as a sociologist. At that time, I was already aware that a society is more socially balanced when it develops a strong middle class that assures social mobility from the bottom to the top and a good rate of return from its elites. The middle class also assures the development of small- and medium-sized enterprises, which often are a sign of a country's economic health.

I remembered this meeting with Boff when EoC emerged. Without being a specialist in economic and labor sociology, Chiara Lubich's religious 'philosophy' and her evangelical 'instinct' counted on the middle class to be important actors in bringing about the EoC. In this regard, she appealed directly to entrepreneurs. She wanted them to use their own talent – economic entrepreneurship – to serve the poor. A careful reading of Lubich's talks at that time reveals that for her the core question was the situation of the poor. They were the center of her attention as she sought to realize the dream of equality in the evangelical sense, where all are sons and daughters of God. It was for this end that the EoC was. Here we find the very heart of the preferential option for the poor made by the Latin-American Church. But Lubich adds a surprising charismatic innovation to this option: giving a central place to the entrepreneur, and therefore not exclusively to the poor. She seeks to put the dynamism of the entrepreneur at the service of this 'cause' in a way that gives him or her a new social and religious dignity and motivation for doing his or her work.[53] Miles N. Hansen has also commented on this point: "The ideological

[53] It helps them acquire a capital of social prestige. Jean Séguy, discussing the religious institutes, said this about the theme of social capital: "The religious acquire prestige (in religion as well as in modernity) by practicing a poverty that is partially adapted to the modern daily economy; transferring via ascetic conduct the products of the ordinary capitalist market rationality into another market that has its is own logic, the one of the social economy, based on humanitarian and religious motivations." Jean Séguy, "Instituts religieux et économie charismatique," a.c., p. 47.

and religious values – in other times underestimated as irrational, suspected, or estimated only negatively relative to economic growth – could in numerous cases be utilized as fundamental motivations for rational economic action."[54]

The atypical construction whereby Chiara Lubich puts the poor and the entrepreneur both at the center of the EoC project is also significant. This will not surprise those who know about the fundamental way in which Lubich has built bridges, has built reciprocity between diverse people and situations. Lubich's spirituality itself is built on a Trinitarian experience that seeks unity in diversity. During the early Christian era, the Greek concept of *perichoresis* was used in Trinitarian theology. It signifies that "two realities can exist one within the other, without confusing them and maintaining (and even expressing better in a certain way) their proper identity: united without confusion and distinct without being divided."[55] This term, keeping in mind the obvious distinctions that must be made in this kind of comparison, suggests that an important aspect of the EoC's search for a more solidarity-oriented economy is the realization of the religious significance of linking at a deep level the two figures, the poor and the entrepreneurs. This relationship tends toward the perichoretical one.

It is important to note that as far back as 1964 in Recife, Chiara Lubich told leaders of the Focolare in the country at that time that the presence of the Movement in Brazil should serve the poor. The common incapacity of the Brazilian society to bridge the social gap between rich and poor revealed at that time not only the lack of concern for the poor in the daily life of the nation, but also suggested a closed mentality of the rich. Lubich saw a need not only to free the poor but also to free the rich, because – in the Trinitarian view that she held – true liberty is found in real social relationships. With charismatic intuition, the founder of the Focolare saw the difficulty that Boff formulated for me so clearly twenty-four years later.

Conclusion

The EoC project innovates in the sense of the Weberian ideal type of a charismatic economy by identifying a need and addressing it in an innovative way. The need: more social justice, the opportunity for the poor to find a job and an entry into the social life of Brazil (or elsewhere). The innovative way: help businesses successfully complete their usual scope of economic action so as to build profits in order to be able to distribute more. It is clear that here we are facing a novelty in at least

[54] Miles N. Hansen (1963). "The Protestant Ethic as a General Precondition for Economic Development," *Canadian Journal of Economics and Political Science,* 29, p. 473.

[55] Enrique Cambón (2009). *Trinità, modello sociale,* Roma: Città Nuova, p. 31.

three ways: (1) the engagement of the middle class in an active (agapic) social role in the battle for more social justice and equity; (2) the provision of a distributive role for economic production rather than leaving it only to state agencies; (3) the offering of a charismatic role to the world of free enterprise by integrating religious motivations and actions into a more finely-tuned sense of the exceptional social potential of the economic process.

The EoC project innovates in this sense by stimulating an ecclesial reflection on economics itself, not just on certain social aspects of economic life. In this innovation, Lubich adds a fourth pillar to the framework of the Focolare Movement's economy – labor, communion of goods, and Providence. In this way she puts 'holy enrichment' at the service of the poor by practicing a new form of 'holy poverty.' Lubich brings together the middle class and the poor by bringing together Francis and Calvin.

Lesson 5: Jean Monnet in May 1950 and the birth of the EU. Agapic acting in international relations Agape in International Politics: Jean Monnet and the Birth of the EU

Is there something analogous to say about the role of love, fraternal love, gratuitousness, agape in politics? The last decades saw a growing interest of the sociologists to analyze concepts that have affinity with our approach. Following in this a minor sociological tradition where we can cite Simmel, Mauss and obviously Sorokin. But nowadays Senneth, Honneth, Boltanski and others are filling the gap.[56] An international group of researchers[57] spent time to formulate a new sociological category they called following the Weberian approach on social acting *agapic acting*, acting out of love. They spent some ten years on studying the concept and after various seminars and congresses on academic level published for the first time in the most prestigious Italian sociological review '*Sociologia*' their contributions, and recently published finally a book on it.[58] The following case study analyzes a phenomenon in the field of international politics: the birth of modern Europe in May 1950, from this particular point of view, was there at

[56] See M. Colasanto e G. Iorio (2009). "Sette proposizioni sull'homo agapicus. Un progetto di ricerca per le scienze sociali," *Nuova Umanità,* XXXI, 182, pp. 253–278.

[57] See www.social-one.org

[58] For a theoretical approach to the concept see G. Iorio (2011). "L'agire agapico come categoria interpretative per le scienze sociali," *Sociologia,* XLV, 3, pp. 9–15. In the same edition are assembled twelve other contributions. Recently appeared then V. Araújo, S. Cataldi, G. Iorio (edd.), (2015). *L'amore al tempo della globalizzazione. Verso un nuovo concetto sociologico,* Roma: Città Nuova.

the heart of the European construction also something as gratuitousness, agape, fraternal love at stake? After our incursion in economy, these second example illustrates something analogous in politics.

The date of birth of what today is known as the European Union (EU) is May 9, 1950. That day the French Council of Ministers approved the Schuman Plan, in the same hour in which the German Council of Ministers also held its regular weekly meeting and responded affirmatively to the French proposal to establish a Community of Coal and Steel between France and West Germany and, possibly, other countries.

The evening of that day, during a press conference, the French Foreign Minister, Robert Schuman, announced to the world that the initiative actually began the process of unification of Western Europe. It was probably one of the most interesting and relevant human adventures of the whole twentieth century, to give substance to the fact, after centuries of rivalry and war, of the Franco-German reconciliation, and to create a space in the world of peace and economic development that allows today for 27 countries to be the most important economic area in the world, representing 22% of the global economy of the planet, and this with only 7% of the whole world population.[59]

It was not obvious then arriving at this result. In the air they breathed, an atmosphere of crisis reigned: soon would start the Korean War (June 25, 1950) and East-West tensions in Europe had already generated what was then called 'the Cold War.'

Someone saw the difficulties of France to propose, in those months, a policy to solve the 'German question' that would not be only a kind of containment, and therefore defensive, but also positive, i.e. an involvement in a wide-reaching positive project, already the seeds of a future conflict. It must be remembered that in those months the particular political regime of West Germany ended, until then still partly under a regime of 'protection' of the winners of World War II.

How was it then possible that the European project could develop? To explain this process, we present an original analysis that utilizes the concept of *agapic acting* assuming that it will help in understanding the events of those days, revealing aspects previously remaining in the shadow. Although the hypothesis that the construction of Europe, its origin, contained features of *agapic acting*[60] was never

[59] Questo capitolo fu pubblicato in italiano come B. Callebaut (2011). "Presenza di tratti di agire agapico nella fondazione dell'Europa Unita? Un'indagine sociologica sulla figura di Jean Monnet e sul suo agire nel periodo maggio-giugno 1950, *Sociologia,"* XLV, 3, pp. 57–66.

[60] It is clear that we envisage features of agapic acting and that the set of concrete action that led to the birth of Europe, before first of the ECSC (European Coal and Steel Community), then the European Community and finally the European Union, is not understood only from the ideal type

made, I think that asking some new questions about a very well known issue can produce surprising new insights, that, at the very least, is the challenge of this contribution. Such evolution which led to the birth of the European Union can often be caused by the initiative of a few, although there is no denying that it has also depended on a favorable environment for at least a generation,[61] while the whole project was lacking until 1950 a practical starting point. This was finally found with the event on May 9, 1950.

The survey presented here will cover just that founding moment of the European project from the observation and analysis of the actions of a few men, and most of all, one man, the one that all specialists of the history of the European process recognize as the 'inspiring genius' not only of the Schuman Plan, but also of the European Communities tout court, Jean Monnet.[62]

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of agapic acting. There were also, for example, the U.S. strategic reasons to support the European unification. Moreover, the fear of the Soviet Bloc stimulated the search for bonds, a strategy of reconciliation. See G. Courty, G. Devin (2010). *La construction européenne*, Paris: La Découverte, pp. 10–11. There is also a strong argument that F. Duchêne advances that France after Waterloo, and later Germany after Hitler's suicide, had lost all desire to fulfill (alone) the role of a leading country in international affairs, and that Europe could be a way to regain an international audience: "In retrospect, it now appears that Hitler's suicide in the bunker buried the German lust for power as Waterloo did that of the French." See F. Duchêne (1994). *Jean Monnet. The first statesman of Interdependence*, New-York/London: WW Norton & Comp, p. 404. But the idea of this paper is that the analysis cannot be exhausted by considering only strategic or tactical elements of interest, or external factors, the international conjuncture and the national one of France and Germany. There is something deeper that has played a role that will do come to light.

[61] See H. Brugmans (1970). *L'Idée européenne 1920–1970*, Bruges: De Tempel.

[62] In the last chapter of his book, F. Duchêne calls him Mr. Europe and qualifies him as the tutelary genius, the spiritual father: "Becoming the father of the Community involved more than inventing it. If Monnet is the tutelary genius of the European Commission today, this is because he shaped the idea of Europe as no one else even tried to do and Became its spiritual father as well". Duchêne was a direct collaborator of Monnet from 1958 to 1963, but this biography of great value could also take advantage of the distance of time and the author always brings an impressive number of well thought out arguments as proof of the qualifications he uses in the text. See F. Duchêne, *Jean Monnet*..., o.c., p. 400. Duchêne lists five other figures with Monnet who were decisive in his opinion on a political level in the early years of the foundation of a united Europe: Schuman, Adenauer, Beyen, Mollet and Spaak. To me, having studied since the '70s, the history of European construction, this seems a very reasonable list. But most impressive of the thesis of Duchêne is that even Schuman at some point didn't realize that if he had accepted a certain change, everything would go up in smoke. Monnet was able to save only at that moment the possibility of success of the Schuman Plan (1994: 398): "However, it is no slur on Schuman to recognise that without Monnet, the Schuman Plan would never have reached the agenda, let alone, remained there. In particular, Monnet seems to have been decisive over some basic choices when Schuman wavered." (1994: 393). For a very different assessment see M. Joly (2007). *The Myth Jean Monnet*, Paris: CNRS.

Sure, he was not alone to make possible the European Union.[63] Without doubt, however, his role was crucial and concentrating our analysis on his efforts and on those of a few others, makes it possible to get an idea very faithful to what happened in those days.

To conduct the analysis I did not go to seek out new material. I tried to read carefully again several sources already known to see if we could find the elements that characterize a kind of agapic acting, as defined by Colasanto and Iorio. Between them, I present a few in particular, as they appeared to me very important and useful, in the heuristic sense of useful, to understand the social dynamics generative of the European Union.

For Colasanto and Iorio "agapic acting" is a concept that indicates a type of acting that abandons any measuring, translates love into practical action, and through agapic acting is immersed in the present and incurant of the past and the future. It is a primary action abolishing distances, creating social phenomena sui generis that transcend existing social reality, but is rooted in daily life acts, and has the ability to offer new creative energy and affect the quality of human relationships and transform not only interpersonal relationships, but also stimulate the interpenetration of subjects and transform even the macro-social level of society. It is an action that also has a 'price:' the conflict between the life that created it and the forms of a new type it creates. For this is not so much a state of peace, but rather something that is in motion: a becoming, a process.

1. Agape generates a type of acting that tends to abolish distances

This element is primary and Colasanto and Iorio (2009: 266) indicates, following Simmel, that the action agapic abolishes any distance between me and you. Simmel states that does not eliminate the I nor you, but the distance between them, an effect that I would prefer to express with greater caution, saying that agape tends to abolish distances.

With this element we get in some way directly into the heart of the European issue and the story of Monnet, beginning already in those early days of May 1950.

To many it seems that European integration has been, above all, a matter of economic interests.[64] Thus reducing the analysis, however, likely forgetting the dramatic situation of those months and the global context still marked in Europe

[63] See M. Colasanto, G. Iorio (2009). "Sette proposizioni sull'Homo Agapicus," *Nuova Umanità*, n. 182, pp. 252–278.

[64] See the judicious comments of P. Ferrara (2002). *Non di solo €uro. La filosofia politica dell'Unione Europea*, Rome: Città Nuova, pp. 23–39.

and much of the world, by the conflict of the Second World War, that ended just five years ago. The Schuman Plan was conceived in the context of full 'Cold War' and with the Korean War on the horizon, a limited conflict but which testified, however, the existence of a very high international tension. The interest of the United States government consisted in recovering its troops stationed in Germany for use in Korea and they insisted with the Allies (Britain and France), to adapt therefore their policy towards West Germany, a country they occupied in joint liability. German troops, they proposed, could fill the hole provided in the Western defense by the American troops sent to Korea. For the United States, the newly formed German democratic government, was a reliable partner who could take part in the defensive effort of the West to contain the Soviet troops on the front of East Germany. This, however, assumed to give back to West Germany (Federal) full political legitimacy and allow the German army to exist again.

Now, all this was a major difficulty for French diplomacy. In New York, where the foreign ministers of the three nations met in the fall of 1949, the American and British representatives agreed on the idea that it was up to France to make proposals for solutions that could preserve their sensitivity, but that would allow also West Germany to re-enter in the West overall defensive posture.

To Schuman, at that moment, the situation seemed inextricable. Politically, France had the destiny of Germany in her hands, although the first signs already began to appear that this same West Germany, finding a economic dynamism that threatened to overcome rapidly that of France, whose public opinion was rather contrary to concede more benefits.

How could one think in this context about efforts to 'close the gap'? Although public opinion was opposed and the memory of Nazi atrocities still alive, Schuman asked advice from his collaborators and also from leading figure he knew and appreciated such as Jean Monnet. Monnet had his plan in mind, and he proposed something that looked as a real *coup de théâtre,* which had an effect that with Iorio and Colasanto I would define agapic: the 'abolition of the distance' between France and Germany at least for the resources of coal and steel. Sure, others had had similar ideas, but at the right moment, Monnet had the moral authority and capacity to formulate and carry out this idea in practice. Here, we find the first element that Colasanto and Iorio ascribe to agapic acting.

'Abolish the gap' was no abstract slogan for Monnet. He, in more than one moment of his life, had experienced it was possible, even in international relations, to launch proposals that were intended to do this, especially when the distances were rendered obsolete. During World War I, he was able to convince Britain and France to agree to buy together in Argentina products of basic necessity, rather than competing with each other on the same market, since they were already

closely linked by the war effort. But, perhaps more significant still was the episode in May 1940, when Hitler's troops were advancing to Paris and Monnet persuaded Churchill, the British government and the French Prime Minister, Paul Reynaud, to propose, in the most difficult moment of Nazi invasion, a complete merger between the two countries.

Proposing a merger, that of 'abolishing distance' between French and English, is not in itself, sufficient to characterize a type of acting as *agapic*. We must consider the motivations why Monnet put that goal. The reasons for proposing the 'total union' between the two countries, in the case of Monnet, were manifold and the proposal absolutely original, but the effect of the acceptance of the proposal would have had in France in plain disaster important psychological consequences making more effective the defense of the cause of freedom in Europe, which otherwise should have been taken the task of England almost alone. Monnet begins his voluminous autobiography[65] with this story, giving his first chapter a title: "In face of the danger, the total union."[66] The initiative did not succeed because P. Reynaud was outvoted in the French Council of Ministers and the power went to Marshal Pétain who, immediately concluded an armistice with Hitler. Churchill was obliged for a short period to be alone to conduct the war with Hitler. The part of France that was not under the influence of Hitler, experienced during and after the war, great difficulties to be considered and sided with the victors. The 'total union,' conceived by Monnet, probably would have avoided this.

But it was only with the third attempt in his life that Monnet proposed a 'policy' of 'abolition of distance' that became successful: the proposal of 'abolition of distance,' at least from an economic standpoint, between France and Germany in May 1950 constituted the main route through which began the construction of the European Union. But was it really a matter of agapic acting, or, to formulate it more cautiously, *also* of agapic acting?

2. Agape is Expressed in Practical Action

It seems at first sight, very strange to link Monnet to any form of agapic acting. Monnet carefully avoided a moralistic or emotive language and kept away from any discussion of 'religious' type. Yet, reading carefully the pages of his Memoirs

[65] J. Monnet (1976). *Mémoires*, Paris: Fayard.

[66] The event was described extensively in the three biographies taken into account in this work. See J. Monnet, *Mémoires,* o.c., pp. 13–36, in F. Duchêne, *Jean Monnet* ...., o.c., pp. 76–83, and É. Roussel (1996). *Jean Monnet* (*1888–1979*), Paris: Fayard, pp. 218–252.

written around 1975 (1976: 341–353),[67] you can perceive traces of something that normally, in the mystical or spiritual language, is expressed by the word agape.

Some examples, reflecting on his actions, will illustrate this affirmation. Consulting the Memoirs, for the year 1950, we note the strong impression of Monnet that in Europe, just five years after the war, there was again the danger of another war. He wrote: "Germany will again be at stake, even if it will not be the cause." (1976: 342). And, then, a phrase that illuminates the reflection of Monnet: "Germany should stop being a problem; it should instead become a bond." This is perhaps the key phrase, which refers to the process that aims to annihilate distance.

Cancel distances, creating bonds: this certainly was also on other occasions that I do not quote here, the fundamental purpose of Monnet: unite, unite when it appeared necessary, in view of a positive result, such as peace, for example, which was held by Monnet as the supreme good, and also the economic recovery and growth of well-being (material or not), as fruits of a state of peace.

All this was also the result of fatigue, but this never seemed to have deterred Monnet: "You had to start from the difficulty and leaning on it to create a beginning of a general solution," he wrote. If peace today seems a very normal concept, in 1950 it was a very fragile good, constantly threatened!

In order to enlighten his readers about the atmosphere in May 1950, Monnet described in great detail the war psychosis which manifested itself in those months: "This war is already present in the minds of men," he wrote in his diary (1976: 342). "We must change the course of events. And in view of this, we need to change the minds of men. Words do not suffice. Only immediate action, taking on a key point which may change the current situation of stagnation." And, on the next page of his autobiography, he added: "I began to see things more clearly: the action must be brought where the misunderstanding was more tangible, if you would replicate past mistakes" (1976: 344).

We read here without difficulty the firm will of Monnet to defeat the 'spirit of war' and to launch an action capable of changing a situation of threat to the relations between a large number of people: a real action in the way we understand agapic acting! Here, we can illustrate another characteristic of agape: agapic acting pushes to act without measure, without putting limits. Monnet, in this sense, seems fully aware that he cannot measure the efforts that this acting will require him.

[67] It is well known that Monnet was very sparing on his religious feelings. Though educated in the Catholic tradition, only with time and the marriage with Silvia, he found himself familiar with the religious sentiments. He was a Catholic like many men of the Third Republic who preferred to entrust the affairs of religion to the women in the family. Many, therefore, thought that Monnet was a freemason, but he was simply very reserved on this aspect.

3. Take No Heed of the Past and the Future

"Agapic acting" heedless of the past? We should point out here that Monnet and others who decided to engage in the 'European enterprise' were, in some way, not impressed by the weight of centuries of Franco-German antagonism, and especially of the recent past wars (three in particular: 1870, 1914–18, 1940–45). They wanted, in fact, break the vicious circle of fatal recurrent conflicts.

In those months between late 1949 and early 1950 Europe was again in a situation of stagnation, especially in the relations between France and Germany. At the roots of the difficulties of relationship you had, in Monnet's opinion (1976: 334–347), the inferiority complex of French industrialists to those Germans who could produce steel at a price with which France could not compete (1976: 345).[68] In these first months of 1950, the situation appeared to Monnet in these terms: "Already Germany asked to increase its production from 11 million to 14 million tons. France will refuse, but the Americans will insist. In the end we will still make objections, but then succumb. At the same time the French production will come to its fullest and will no more progress or even turn down."[69]

What reasoning did Monnet employ to get out of this stagnation?

> If you approach the problem of sovereignty without a spirit of revenge or domination, if on the contrary winners and losers could agree to exercise together on a joint portion of their wealth, what a solid bond would it not create between them, we would have a large street wide open for new mergers and give the other European peoples a marvelous example (1976: 347).

Monnet was very much decided to leave behind any spirit of revenge, which had dominated relations in the past. In this we note a typical feature of agapic acting: to act regardless of the weight of the past. But by which act in particular, Monnet envisioned to exit from the past, from the doldrums and the spirit of revenge?

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[68] It is worth analyzing in detail the issue and cite more widely Monnet: "Every solution demanded above all that would change the conditions [that led to this impasse in relations]: that is, for the Germans, the humiliation of our control without limits, and for us, French, our fear for a Germany finally out of our control. These two elements could not summarize the whole story of our world at that time, but was enough to block a constructive evolution in Europe" (1976: 345).

[69] Monnet also specified (1976: 346): "Just recall these facts will suffice without the need to describe in great detail the consequences: Germany in expansion, the German dumping on exports, the demand for protection from the French industries; the blocking of free trade, the recreation of the pre-war cartels, perhaps the re-orientation of the German expansion to the East, a prelude to political agreements, and France, which falls again in the old habit of a limited and protected production."

4. The Schuman Plan: a Primary Action Transcending the Existing Social Reality

"What might bound us, France and Germany, together, before it's too late,? How to embed even now a common interest between the two countries? These are the questions that haunted me in those days" (Spring 1950). In other words: how to materialize the will of Monnet to 'close the gap'?

Monnet proposed to put coal and steel under a common sovereignty, that is, to close the gap, to eliminate the distance in a vital sector of the economy, uniting them under one and the same authority. But to what end? In the first lines of the famous speech of May 9 Monnet explained it:

"World peace cannot be preserved without creative efforts in front of the greatness of the dangers that threaten it. The contribution which an organized and dynamic Europe can bring to civilization is indispensable to the maintenance of peaceful relations."[70]

'The proposal is revolutionary' – regardless of the past – emphasized the newspapers the next day, reporting the news. Here, I highlight an aspect that Duchêne put in relief (1994: 401), namely, that Schuman understood at once the proposal of Monnet – historically known as the 'Schuman Plan' – as the means capable to start the Franco-German reconciliation. The ability to reconcile is one of the clearest manifestations of the agapic action. Duchêne also stressed that for Monnet the idea of reconciliation was more largely 'the key to a European strategy' and needed a large positively oriented political environment. Only on this condition Monnet saw possible the realization of his dream: to civilianize international relations.

The man with whom he had to shorten the distance was Konrad Adenauer, President of the Council in Bonn, then West Germany, who now already for some months headed the first German Federal Government. In the morning of May 9, when he was made aware of and had read the proposal, Adenauer did not hesitate to respond immediately. Monnet wrote in his diary (1976: 358) that Adenauer said, "I replied without delay Schuman I wholeheartedly approved his proposal."

Adenauer, in fact – and Monnet commented that he basically agreed with this view – in an interview in March 1950 already stated that "we undoubtedly would have taken a great step forward, if the French and Germans had tried one day to get to the same table, in the same building, to work together and take some joint

[70] The final text of the May 9 is summarized in the five lines that follow: "For the pooling, basic production and the establishment of a new High Authority, which decisions will bind France, Germany and other countries who will join, this proposal will realize the first concrete institutions of a European federation indispensable to the preservation of peace" (1976: 353).

responsibility" (1976: 338). Monnet and Schuman found, therefore, in Adenauer a person animated by similar sentiments, although the chronicles of those months retained the memory of moments of tension between the two governments, caused by the fact that the French seemed to want to claim for themselves the strategic region of the Sarre. Adenauer could not agree to this.

Monnet, commenting the interview of Adenauer, noted the absence in Adenauer of a clear vision of the method to achieve the purpose of reconciliation between their two people. But Adenauer could not suggest the French to be generous: they had to make themselves a good proposal.

Monnet responded in May to the 'generous' proposal Adenauer made in March 1950 with one more element: he indicated where to start, where was the point you really could put great pressure on, because it represented also the very pivot of the difficulty: the steel and coal resources which terrified the French arms industry, but also a convinced European as Adenauer who wanted to avoid any revenge of the Prussian militaristic spirit and, therefore, had decided to destroy this menace once and for all linking West Germany to Atlantic Europe. What will then be known as the ECSC (the European Coal and Steel Community) in fact will represent a social reality *sui generis*, a truly supranational institution to which is delegated part of the national sovereignty, an unseen evolution in the world of international relations until then.

The primary motivation, as already said, was the search for peace between France and Germany. Peace is a strong component and also a typical fruit of agapic acting: be motivated by a desire for peace, in a time when French resentment against Germany was still very much alive, can be considered equivalent to a desire of agape, a desire that led in this case to concrete action.

But did this action transcend the existing reality? The 'reality' concerned the French policy towards West Germany: until a few months before, this reality was above all the question of the Sarre and Ruhr, where the steel and coal industries were concentrated. What would be good to do: return it to Germany in whole or keep it in France? Monnet broke the barrier, took the initiative and he was perfectly understood by Adenauer. This is precisely what Iorio and Colasanto call primary action, i.e. an action with a direct effect, which changes the cards on the table because it creates something new *ex nihilo*.

France renounced to all claims on the Sarre and the German wealth and Germany renounced the competitive benefits of an industry that, in the long run, would have had more growth potential than the French one. That was the prize to pay for 'getting to the table' with France, as equal and transparent partners – now bound by a supranational body and not a bilateral one.

And this was a big innovation on the international scene. The existing social reality was surpassed, thanks to the wish to eliminate all traces of a desire for hegemony of one party over another. According to Monnet, this had always been the polluting element in international relations. Eliminate all temptation of hegemonic acting is in some way a version of agapic acting: agape does not want nor certainly stimulates a master-slave relationship among nations! The action of Monnet with the Schuman Plan was instead able, by giving up all kind of measuring, being oblivious of the past and not having any certainty about outcomes, to abolish distances and to remove the remains of a desire to dominate the other.

Given the aim of gaining peace, it did not make sense to measure how much or what would be forgiven economically (Germany) and politically (France). Monnet, however, was also convinced that both countries, and not only them, at the end would have been much better off. This underlying conviction he had, came from his experience in many years of living in the world of 'international relations'! The feature that most clearly shows the weight of the agapic attitude of Monnet towards Germany was illustrated by the unanimous appreciation he subsequently enjoyed 'over the Rhine,' far more than in France.

5. Social Institutionalization as an Emergent Property of Agapic Acting

Colasanto and Iorio showed that the primary action of agape creates a social reality sui generis, with emergent properties. With the construction proposed by Monnet we are clearly faced with a creation *ex nihilo* in this case of the European Coal and Steel Community (ECSC),[71] a social reality that is truly unique, given that nowhere in the world there was an institution which exercised supranational sovereignty, freely accepted by individual countries.

In the Schuman Plan that entity concerned two countries who wanted to work in a more coordinated way, in view of achieving a greater common good: peace. The renowned German sociologist N. Luhmann uses the concept of 'system of interpenetration' to describe "the social reality created by an act that is the product of two subjects who freely choose to live for each other."[72] Love, say Colasanto and Iorio, is a relation of mutual penetration of the life of Alter and Ego, which is at the basis of an acting and experiencing that creates in each of them change. And they specify: "Love, then, is a primary and irreducible action, because (…) it determines its proper object and creates it as a particular object that before this

[71] The Treaty instituting the ECSC was signed on April 18, 1951.

[72] N. Luhmann (1987). *L'Amore come passione*, Bari: Laterza, p. 234.

love did not exist" (2009: 267). It produces, in other words, a reality *sui generis*, a unity between subjects that by the mutual agapic acting gives life to a generative and specific social reality, that Boltanski would call 'state of peace.' And they note, going a step further than the concept developed by Boltanski, they write: "The agapic acting becomes a relationship" (2009: 268). This has created a social reality with his own emerging properties (Archer),[73] able to develop independently its own characteristics that enrich, some in the sphere of social structures since they essentially depend on components of the material order, but some others more in the cultural sphere.

In the case analyzed here, the project that constitutes a sui generis reality is the ECSC. Can it be considered as an outcome of agapic acting? Clearly the Schuman Plan is a concrete plan that assumes a mutual penetration and changing, "each one when he turns himself to the world of the other is changing himself also" (2009: 267). The fact of living together during the negotiations conducted in a small house in Paris and then, as reported by Monnet, the daily life in Luxembourg, where they established the new institution, shows, with a series of details, the evolution in the minds: from an attitude of the defense of national interests, in the first stage of negotiations before reaching the Treaty, the members of the ECSC evolved and end up becoming the defenders of the common interest of the newborn institution. Life together succeeded in creating a new mentality that Monnet called the 'communitarian mind'!

But do we have here agapic acting? In the writings of Jean Monnet's you see a predominant aspect that leads to hypothesize that the process towards reconciliation between France and Germany in those years had really some features of agapic acting. The reconciliation was not an easy task: Monnet illustrates it (1976: 320), describing the presence of forces opposed to reconciliation in both countries, an opposition before which Schuman, French Minister of Foreign Affairs remained very puzzled. Monnet writes that Schuman knew very well his feelings, he once expressed with great decision: "Peace cannot be founded but on a basis of equality. We missed the peace in 1919 because we have introduced the discrimination and the spirit of superiority. We are committing the same mistakes again" (1976: 336).

The desire for equality and reconciliation is certainly part of an agapic acting. It is a feature not common in the dynamics of international relations where 'self-interest' and the law of the survival of the fittest often predominate. But the basic idea of Monnet goes beyond reconciliation, and assumes a larger horizon. He wished a binding into a larger project, and appeals to some aspects of agapic acting that reconciliation does not consider. Duchêne caught well, I think, these

[73] M. Archer (2006). *La conversazione interiore*, Trento: Erickson, p. 178.

hints of his thinking when he wrote "Monnet had a matured conviction which held the policy together at a deeper level than the rhetoric of European revival which served most politicians. (…) the obligation, already described, to civilianize international relations" (1994: 401).

Another element that records features of agapic acting regards the willingness to take the initiative without waiting for the other, engaging yourself and taking the first risk. Monnet was convinced not only that France had to propose something, but that only she could come forth with an initiative. On the 10th May in London, a meeting of ministers of Foreign Affairs who exercised the political control on West Germany was planned. They had to decide the future of the German steel production and the American and the British had already expressed: "In the present situation the United States and Britain expect a French proposal." Schuman had nothing to propose.

Monnet was convinced, then, that the node was the fear of the Germans[74] and that, at that time, Europe could only come forth as an initiative of France: "Only France can speak and act" (1976: 348). It was France, in fact, that had more to lose in readmitting Germany as an equal partner in international relations.

The agapic acting, then, is social acting, there is not only the one who loves, there's also the beloved one. This aspect is highlighted by looking at the reaction of Adenauer in Bonn in front of the reporters gathered for the announcement of the Schuman Plan acceptance by the Germans: "The proposal of France is a generous initiative towards us. It constitutes a decisive step in the Franco-German relationship. It is not meant to be generic formulas but is made up by concrete suggestions that rest on the equality of rights. (…) The pooling of Sarre production will ensure that a cause of tension between France and Germany will be eliminated" (1976: 360).

Monnet observed afterwards that in front of this complex situation two men [Schuman and Adenauer] had dared,[75] almost alone, to commit the destiny of

[74] "If you could eliminate the fear of German industrial domination, the biggest obstacle to the European Union would be taken away" (1976: 346).

[75] One cannot forget the scene that the biographer Roussel used to close a chapter which he had already given the title "I thanked God…." Roussel, collecting the testimony of Paul Leroy-Beaucourt, wrote: "Konrad Adenauer did not play the comedy. He understood the scope of the French proposal, its providential character for Germany, of course, but also its significance in the history of the Old Continent. The evening at the dinner given in occasion at the French Embassy in Bonn, the Chancellor stressed the importance he gave to the event. The Director-General for Economic and Financial Affairs at the High Commission of the French Republic in Germany, Paul Leroy-Beaulieu described the scene remembering there were two ministers with Adenauer. Jean Monnet approached them. The Chancellor then turns to me and said: 'You can tell mister Monnet that when he offered me his plan, I thanked God.' See É. Roussel, *Jean Monnet (1888–1979)*, o.c., p. 539.

their countries, declaring himself delighted at the thought that institutions were born to consecrate this agreement, based on a meeting of good will. He was aware that if nothing is lasting without men, so nothing is lasting without institutions.

6. Agape and the tragedy inherent in action and experiencing

In the context of 1950 remains relevant Sorokin's quote: "Agape is destined to become a *subversive enemy* and to be persecuted by those who are attached to their own particular world" (2009: 360).

Three were, mainly, the difficulties Monnet experienced with the Schuman plan: the distrust on the part of the political staff and of the French people towards the growing power of the German industry, especially in the case of the steel production. The difficulty also of imagining a reconciliation so fast after the War, given the inferiority complex of both the German and the French; and finally the 'Cold War,' that became, according to Monnet, a real obsession in the minds of governments and the public opinion: "This [cold] war was very present in the minds, you had to fight it with the weapons of imagination. (...) The fear in 1950 generated paralysis and paralysis called for fatality. What was most needed was to recreate a movement" (1976: 344).

In a situation where everyone was on the defensive, one had to touch the spirits with a positive initiative that would move things and men. The complexity of beginning to move the initiative depended also on the presence of the professional diplomats, accustomed for centuries to look at international relations only from the point of view of national interests and unable, therefore, to think of new supranational bodies to which delegate a part of national sovereignty.

Monnet held, as long as he could, the diplomats unaware of his plans, always and everywhere. But as Monnet liked to say, "The density of the resistance is a good measure for the progress in change" (1976: 390). Nothing better illustrates the philosophy of Monnet about the importance of difficulties than the following episode. Monnet after a long meeting, as dawn was already rising and the decision on the location of the ECSC was already taken (temporarily Luxembourg) (1976: 432–434), expressed his feeling to his collaborator Fontaine: "We have a few hours to rest and a few months to succeed. And then ..." – "And then" – continued Fontaine, smiling – "we'll meet great difficulties of which we shall make good use to advance again. I understand you correctly?" – "Just so. You have understood all what you might know about Europe," Monnet concluded (1976: 434).

7. Agape Transcends the Life and Deeds of Those Who Produce it

"At one point, the idea ceases to belong to the men who have invented it" (1976: 559). This phrase is a good synthesis of Monnet's experience. We find an echo to this quote in the concept of agapic acting proposed by Colasanto and Iorio:

> Agape produces a reality that transcends the life that produced it, it creates a reality that is different from the previous one in which both Alter and Ego were immersed, before acting out of love for the sake of the other. (…) Agape leads to the transcendence of everyday reality, because it is not routine, not a typical act, but it's rather characteristic for a subject always ready to discover new horizons, eager to live the new experiences persons he occasionally meets may propose, and he follows them wherever it leads (2009: 269–270).

This feature is quite consistent with the reality of European integration in its first moments. Europe's Coal and Steel Community was still to be invented when it was announced at the famous press conference on May 9, 1950 in the 'Salon de l'Horloge' of the French Ministry of Foreign Affairs, Quai d'Orsay. Very indicative here was the answer of Minister Schuman to the questioning of a reporter who, in front of his vague answers to specific questions, exclaimed: "So, it is a leap into the darkness?" "That's right," he says quietly, "a leap in the darkness."

Monnet also explained in his Memoirs that few understood the truth of this image (1976: 363): for example, during a dinner with senior British officials in London, a few days later, a British official said Monnet to his dismay: "Blessed were our fathers who always knew what to do in all circumstances." There was a whole new situation: the construction of new institutions meant that the Europeans had to enter together in a foreign, unknown land.

What was very clear from the beginning, however was that the ECSC was the first and so far only experience of a transfer of sovereignty to a supranational level, limited but undeniable and unique, as neither the League of Nations in Geneva in 1920, neither the UN nor any other international body, until today managed to reach that level.

8. Agape Breaks the Law

"Since the time of the League of Nations, [Jean Monnet] no longer believes in the good will or in sharing memories of the past sufferings. No progress can come if you do not call into question the concept of national sovereignty. In the history of

Europe, this represents a revolution," wrote Roussel, another of his biographers (1996: 511). Monnet, in 1950, had firmly established this conviction that broke with centuries of established rules.

This element is not easily interpretable, but is very close to what Colasanto and Iorio write down as typical of agapic acting: "Agape breaks the law" (2009: 270). In their view the law, by its nature, needs continuous specifications, interpretations and mediations, because it is an answer to always changing demands. Love, however, as a foundational action, does not generate disputes but authority by action. Freeing itself from all formalism, intentionality of judgment of the other, free from any possibility of dispute. Agape has a rule that is internalized, valid since it was based on the intentionality of love, without prescribing anything to the other. It does not seek the limelight, has not performed in search of recognition by the public or the people, freeing individuals from the anxiety that the other reciprocates what he gives. Agape, in fact, is rooted in minimal gestures, seemingly insignificant acts.

Monnet, we have already said, wanted to destroy the law of the jungle that governs international relations. He spoke repeatedly of the dynamics of fear that paralyzes, provoking an attitude of defense. For example, he often expressed his belief in the capacities of Western Europe, contrary to what was becoming a popular view in Britain that Continental Europe in 1950 would not have resisted the Soviet Union, unlike England, attached to the United States. Monnet however believed first of all in the virtues of a positive project and the strong dynamics that it could generate.

When he spoke of the negotiations of 1950–51 meant to establish the Treaty of ECSC, describing his method of work, he stressed the fact that he always repeated the same speech, and wished to be transparent about the reasons of his speech and action. In his method there was also a big focus on the work environment. He liked it structured in small groups where you could establish mutual trust and sharing of life.

In the relationship with Adenauer, we can perhaps better understand this aspect of the personality of Jean Monnet. From the beginning the two agreed that whatever technical difficulties would appear, it should not provoke an ultimate obstacle to the process, what was at stake for them was the political agreement: peace in Europe was a milestone in the face which no obstacle could ever have enough weight. And this became true as long as Monnet, Schuman and Adenauer were in charge.

9. Agape is Rooted in Everyday Life, its Favorite Environment

This sixth point highlighted by Colasanto and Iorio (2009: 270) at first sight seems of little use to the analysis of the case of Jean Monnet. According to Iorio and Colasanto,

> Daily life, in the sense of Gouldner, contains in itself the idea that society is the product of small collective realities, it produces social change starting from the subject, rejecting the idea that the transformation is exclusively due to the leaders. The heroic culture, in fact, is based on the evidence of its value and the refusal to recognize the dignity of others. (…) Instead agape, rooted in everyday life, free from the anxiety to have to prove the evidence of your heroism and, therefore, free of the despair while waiting for others to do the same (…). The act of love, Kierkegaard notes, does not depend on the love of others, the inner self does not demand a reward.

Monnet, already seen in his lifetime by some as one of the most important figures of his time, had actually in his own story many elements typical of a 'culture of everyday life, not a heroic one:' he was deeply sensitive to the dignity of each one even those who did not think like him. For example, he did not break down by the lack of response of the British, though, in his view, they were necessary to European unity, nor waited rewards and public recognition.

As Monnet explained in the Memoirs (1976: 273), at the age of 55, at the end of World War II, he had the opportunity to start a political career. He said he had not hesitated and chosen firmly to remain where he felt he would be more himself:

> If the competition was vivid in the vicinity of power, there was almost nothing like that in the area where I wanted to act, that of the preparation of the future, a job by definition not under the spotlights. Not being a competitor, I knew I could count on the support of politicians. In addition, if it takes a long time to come to power, it takes little to explain, to those who are there, the way to overcome the difficulties that arise: it is a language they gladly understand in moments of crises. In that instant, where good ideas are lacking, they gratefully accept yours, on condition that you leave them the paternity. Since as they take the risks, they need also the honors. In my work, forget the honors. I have no taste for the shadow, whatever they say about me, but if I can at the price of hiding me better achieve things and obtain results, then I choose the shade.

He also told in length, how in living closely with the other negotiators, and, then, as already mentioned, with the first team of ECSC, came to life the so-called 'communitarian spirit' (1976: 451).[76]

10. The Agape as the Third, via the Construction of Human Institutions

Colasanto and Iorio formulate, with caution, the idea of the existence of a human type definable as *homo agapicus*, acting in an agapic way at least in interpersonal relationships. But at a broader, macro level, is there something observable as agapic acting, between countries, continents?

In our case, that of a personality like Monnet who was able to locate the point on which to turn a static geo-political situation, a quasi static depression and one crystallized into a very difficult relationship, such as the one between France and Germany, the answer would be yes. Somehow pulling a thread of this mess, he managed to instill an element of movement that pushed Europe towards greater unity, showing in his work "a strong assumption of responsibility for the common good" (2009: 273).

Can we deduce from these elements that we can find in the action of Monnet and his companions elements of agapic acting at the institutional level, at the level of European institutions, i.e., action at the dimension of a continent, in view of the common good?

In the pages of the Memoirs of Monnet there are a series of reflections on the dynamics that were set in motion when the proposal ('generous' proposal, Adenauer said) (1976: 360) came on the table in May 1950. Maybe no one else formulated Monnet's merits than president ennedy in his message, addressed at the beginning of 1963 to Monnet, who was in New York to receive 'The Freedom Award' (1976: 555):

> Dear Sir Monnet, over the centuries, emperors, kings, dictators have tried to impose on Europe its unity with the help of force. For better and for worse, they have failed. But under your inspiration Europe in less than twenty years, has made more progress towards unity than it had done in a thousand

[76] Monnet told, for example, they had put together at the beginning of the ECSC jobs in Luxembourg, two experts of the transport by railways, a French and a German, in the same office: Hutter and Klaer. The result was they mutually confessed all tariff tricks they had used against the other to distort the loyal concurrence between their respective railways. Together, in the closest collaboration, they passed a few months to untie the knots that strengthened mutual discrimination between their countries.

> years. You and those who work with you have built with mortar and stones of reason, that is with the economic and political interests. You transform Europe with the sole power of a creative idea."

This agapic acting in favor of the other or, better yet, in favor of a greater common good, rarely was declined in the secular speeches of Jean Monnet's in moral terms. With Adenauer in May 1950, however, for once he was very explicit in this sense: "We want to establish relations between France and Germany on a completely new base and transform the means that divided them, the war industries, in a common benefit that will also be of a benefit to Europe." Monnet felt very sure about the positive effects of this dynamic, as he shows when he declared publicly: "Europe then will gain again the eminent role it had in the world before its divisions brought her in the present situation. Her unity will not result in damage of her diversity, to the contrary. This diversity, which is her wealth, will be of benefit to civilization, will affect the evolution of actual powerful nations as America itself. The French proposal is, therefore, in its inspiration, essentially political. It has an aspect, so to speak, of a moral order. It wants, basically, achieve a very simple goal."

In his official reply, Adenauer wrote with the same solemn tone: "As you see, this initiative in its highest aspect, belongs to the realm of morality" (1976: 365–366). Monnet in his extensive and well documented book illustrated the experience of two world wars and other conflicts and because of the positive actions undertaken by him during these wars he could affirm with authority: "The aggression not only divides people into two camps, it divides also the efforts of each part because fear fosters selfishness" (1976: 396).

But it is in the comment on the importance of European institutions that we can best illustrate the presence of Monnet's agapic acting as Colasanto and Iorio understand it. Monnet insisted in those pages on the idea of 'equal dignity' as a translation, I would say, of his humanistic philosophy. It is not difficult here to see another aspect of agape in Monnet's approach to politics. Speaking at the first meeting of the Parliament, that had the task to control the ECSC and prefigured the current European Parliament, he said:

> (…) Europe will live the same process that built our states, i.e., establishing among nations a new form of relations similar to those established among the citizens of any democratic country – equality embedded in common institutions. Monnet quoted, then, at the end of his speech to the Assembly: The union of Europe cannot be based solely on goodwill. Rules are necessary. The tragic events we have experienced and are still present have made us perhaps wiser. But men go, others will take our place. What we leave them,

> will not be our experience, which will disappear with us, we can leave to them our institutions. The life of institutions is of longer duration than that of men and institutions may well, if they are well built, accumulate and transmit the wisdom of many generations (1976: 449).

Conclusion

Monnet was not a man without flaws, a hero without blemish, a man with only agape. However, he has been known as a generous man and capable of obtaining, in action, results seldom seen and obtained in European history. He succeeded to build the European institutions that create a space of peace and, therefore, of trust, so favorable for the economic and social development, showing the multiplier effect so typical of an agapic acting. His actions so obviously inspired by the value of the equal dignity of men and between nations, have been known to be a driving force that pushed him to take the initiative, to act without measuring, rooted in the everyday, heedless of the past and able to face adversity and trials, so to create a social reality sui generis that became a source of new energies that initiated on a wide-ranging scale, that is, an entire continent, a process that still is in progress: Europe.

If the construction of Europe cannot be regarded as a pure fruit of agapic acting, one cannot deny that, in its origins, there have been some fundamental features of agapic acting at work fermenting the whole process, and their effects still continue to vivify the social and institutional dynamics of this continent.

General Conclusions after Five Lessons

Our times are profoundly signed by the environmental crisis. The deteriorated relationship between the human society and the natural environment in the industrialized world, is now expanding on the scale of the whole planet Earth. Here, we touch a fundamental problem of our technological civilizations, a structural problem of our post-industrial societies, not at all easy to solve. We are faced with a problem that concerns not one country but the whole humanity, and with a problem that a single culture cannot solve on itself. We started our lessons with the environmental crisis as starting point, but the choice made from the beginning was to concentrate on the deeper level of the phenomenon. The conviction that animates these lessons was that the environmental crisis is linked more profoundly with a deeper crisis that invests the human person as a whole; we are confronted with a kind of anthropological and ethical crisis. There is something wrong about

the concept of the human person. We are in the middle of an anthropological crisis about the precise conception of the modern man, a man looking for the proper auto-affirmation who nominated himself as the absolute patron of nature and the proper destiny.

One of the most decisive factors in this crisis is that it touches the whole planet. The human race is currently in a unique moment in its history, the moment facing us is probably without precedent. While the crisis is rooted in European culture, the political and economic dominance of the Western world make the influence of this culture felt in every part of the globe. And not only because ideas from this culture are adopted elsewhere; its influence can be seen in the negative reactions in other cultures. This negative response is one of the main sources for fundamentalism in several parts of the world and so, also, for the so-called 'Islamic' terrorism that troubles Europe and North America. It arises in large part as a reaction against the allure of the West, which constitutes a real threat, with its often deliberate promotion of its own individualism, hedonism, liberalism, intellectual methodologies, and its current form of government, namely democracy.

The first lesson is centered upon the relation between the crisis and religion. For a sociologist interested in the study of the cultural processes ongoing in our Western world, the debates and evolutions within the religious sphere remain of utmost importance. The picture appears bleak for religion, and specifically for Christianity, which gave rise to the culture that now publicly rejects all religion. Nonetheless, seen from another perspective, a radically different picture emerges. As another French sociologist J. Séguy pointed out: "The crisis in our societies means not only 'destruction of religion,' but reveals also in the same moment an aspect of *production of religion*."[77] What is interesting here is to deepen the idea that this disappearance of God maybe prepares also the way for a new discovery of God, in addition for a new discovery of what it means to be human. If we follow the reasoning that the negative contains a positive of immense proportions, like a seed contained in the crumbling darkness of compost, where do we go?

The second lesson is about the new elements that come forth in recent theological research. Von Balthasar, one of the leading theologians of past century stated that "intersubjectivity, upon which the ethics of the Gospel is based, failed to find an adequate philosophical foundation in the classical period, and even today has yet to become the principal theme of Christian philosophy." P. Coda, one of the leading figures in contemporary theologians and specialized in Trinitarian theology, stresses in a contribution about the new possibilities for a Christian rethinking

[77] J. Séguy, (1984). *L'insaisissable mouvement religieux,* [in:] J.-P. Rouleau, J. Zylberberg (eds.), *Les mouvements religieux aujourd'hui*, Québec: Bellarmin, p. 340.

of social relationships, synthesized and briefly commented that what our time is gaining as new insights is very promising. He thinks we are in the presence of a new era in the history of civilization in which the centripetal force of identification of the diverse civilizations, starting out from their religious matrix and forms, is balanced and re-directed by that centrifugal force of their new encounter and relating with one another.[78]

The third lesson starts from these premises. Is it possible to think of our world from the perspective of love? We saw elements for a new understanding of the human person in his intersubjectivity in a general cultural and philosophical approach. A social, relational love becomes a central question in our changing world, for a human sustainable development. The quality of relational life between men and women is an open question today. But so is the quality of relationship in our professional worlds, what do we have to tell each other about 'social love,' 'economic love,' political 'love,' and more and more now also about 'ecological love,' our relationship with our environment? In a second moment we perceived a strong parallel on the level of theological thinking: in theology also there is a kind of paradigmatical swift from thinking God in the relationship between the single person and his or her Creator. The social space as a new ground for the encounter with a relational God! The next step in our inquiry about the possibility of an intersubjective relationship that creates a space for the Gospel logic of fraternal love, leads us to the world of the economy. Is this only about the hard battle for the survival of the fittest? What have terms as Has fraternity, reciprocity, gratuitousness, responsibility, love, happiness something to do with economic life in the day-to-day situation, is the question we discussed in the third lesson.

The lesson is a large presentation and comment on a book a young Italian economist, L. Bruni, wrote: *The Wound and the Blessing*. It presents a remarkable plea for nuanced thinking. At the very end of his essay, he summarized his conviction strongly in contrast with the Mainstream assumption: the market and its logic are polar opposites of the realm of gratuitousness, since they are based on instrumental calculation. In other words, where gratuitousness begins economics ends. Bruno affirms instead, in rather strong terms, that this is not correct 'either historically, methodologically, or theoretically' (2012: 108). His research in recent years was on the possibility to hold gratuitousness together with the incentives and dynamics of the market and of the company.

[78] See also P. Coda (2010). "The experience and understanding of the faith in God-Trinity from Saint Augustine to Chiara Lubich," *New Humanity Review*, 15, pp. 17–38 [orig: (2007). "L'esperienza e l'intelligenza della fede in Dio Trinità. Da Sant'Agostino a Chiara Lubich," P. Coda (ed.), *Dio che dice Amore. Lezioni di teologia*, Romà: Citt. Nuova, pp. 131–164.

According to Bruni, a challenge for civilization today is to place *agape* again at the center of the life of the polis rather than leave it confined to just the private sphere, where it can play only a residual, minor role. Where a post-modern society looses contact with agape in the public sphere, it would quickly lose it in the private sphere as well, since in globalized societies the veil that marks the boundary between public and private sphere is tearing apart.

Bruni expresses brilliantly what we, as colleagues in Sophia University Institute owe to a generation of scholars that helped us to found this university. "(…) every time we resort to a contract when friendship is available, and to friendship when agape is available, we impoverish the value of persons, relationships, and society, and we sell short the value of life in community in a sort of relational dumping." Therefore we must learn how to recognize and reward agape, "since it is the true scarce good – virtue in our societies that does not deteriorate." Agape, the virtue *par excellence*, has no inherent incentive, states Bruni, "but I can and must be rewarded" (2012: 61).

Regarding the fourth lesson, after Bruni's plea for a greater role of gratuitousness in order to change our environment in the sense of a more human sustainable development, time has come to illustrate a case study where all this seems to become concrete. We remain in the field of economy, and obviously this is only one of the so many cases we could analyze in order to illustrate our views on the central role of agape in our 'social fabric.' The lesson is about the role of charismas in our world and in particular about a project called 'Economy of Communion' the lesson analyzes in depth.

"The charismatic economy is often left in the shadow as if only institutional dimensions were relevant to understanding economic and social life." This formulation reminds one of the skepticism renowned sociologists had, wondering if charismatic experiences were still possible in contemporary society. They often concluded that only feeble charismatic experiences were still available, and only on the periphery rather than in the very heart of the dynamics of society and the sectors of society that matter. In my own sociological study of the case of the so-called "Economy of Communion" (EoC), I believe that I have found a charismatic economy in the very heart of economic life. The EoC created through the intervention of a contemporary religious leader, aims not at the margins of society, but at its very heart.[79]

[79] This contribution was first published in Italian: B. Callebaut (2010). "L'Economia di Comunione: oltre l'alternativa 'santa povertà' o 'santa richezza'?," *Nuova Umanità*, XXXII, 192, pp. 681–701. An English version was first published as B. Callebaut (2012). "Economy of Communion. A Sociological

The EoC project innovates in the sense of the Weberian ideal type of a charismatic economy by identifying a need and addressing it in an innovative way. The need: more social justice, the opportunity for the poor to find a job and an entry into the social life of Brazil or anywhere else. The innovative way: helps businesses successfully complete their usual scope of economic action so as to build profits in order to be able to distribute more. It is clear that here we are facing a novelty in at least three ways: (1) the engagement of the middle class in an active (agapic) social role in the battle for more social justice and equity; (2) the provision of a distributive role for economic production rather than leaving it only to state agencies; (3) the offering of a charismatic role to the world of free enterprise by integrating religious motivations and actions into a more finely-tuned sense of the exceptional social potential of the economic process.

The fifth and last lesson enlarges the horizon: international Politics. Is there something analogous to say about the role of love, fraternal love, gratuitousness, agape in the public sphere, in politics, international politics? During the last decades, a growing interest of the sociologists to analyze concepts that have affinity with our approach. Following in this a minor sociological tradition where we can cite Simmel, Mauss and obviously Sorokin. But nowadays Senneth, Honneth, Boltanski and others are filling the gap.[80] With an international group of researchers[81] I spent time to formulate a new sociological category we called following the Weberian approach on social acting *agapic acting*, acting out of love. We spent about ten years on studying the concept and after various seminars and congresses on academic level published for the first time in the most prestigious Italian sociological review *Sociologia* our contributions, and recently published finally the book with our contributions.[82] The lesson presents the case study I analyzed the phenomenon of the birth of modern Europe in May 1950, from this particular point of view: was there at the heart of the European construction also something as gratuitousness, agape, fraternal love at stake?

Five lessons. How to conclude? There are no final conclusions. History is till now an open end-story. But the final lesson, conclusion, could maybe be this one:

Inquiry on a contemporary Charismatic Inspiration in economic and Social Life," *Claritas,* I, 1 (March), pp. 71–82. See www.claritas-online.org.

[80] See M. Colasanto e G. Iorio (2009). "Sette proposizioni sull'homo agapicus. Un progetto di ricerca per le scienze sociali," *Nuova Umanità,* XXXI, 182, pp. 253–278.

[81] See www.social-one.org

[82] For a theoretical approach to the concept see G. Iorio (2011). "L'agire agapico come categoria interpretative per le scienze sociali," *Sociologia,* XLV, 3, pp. 9–15. In the same edition are assembled twelve other contributions. Recently appeared then V. Araújo, S. Cataldi, G. Iorio (edd.), (2015). *L'amore al tempo della globalizzazione. Verso un nuovo concetto sociologico,* Roma: Città Nuova.

love, agape, is probably at the heart of the solution of the crisis of modern man. The problem still remains, in the past these types of conclusions could well fit in a book on spiritual lifestyle. However, I hope I have provided some first proof that it should also become the heart of the academic research on the anthropological question of our times.

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Value Sensitive Design and Responsible Innovation*

1. Introduction

The Netherlands has learned interesting lessons about ethics and innovation in the first decade of the 21st century. A first instructive case was the attempt to introduce smart electricity meters nation-wide. In order to make the electricity grids more efficient and meet the EU CO_2 reduction targets by 2020, every household in the Netherlands would have to be transformed into an intelligent node in the electricity network. Each household could thus provide detailed information about electricity consumption and help electricity companies to predict peaks and learn how to "shave off" the peaks in consumption patterns. After some years of R&D, a plan to equip every Dutch household with a smart meter was proposed to parliament. In the meantime, however, opposition to the proposal by privacy groups had gradually increased over the years (Al Abdulkarim 2011). The meter was now seen as a 'spying device' and a threat to the personal sphere of life, because it could take snapshots of electricity consumption every 7 seconds, store data in a database of the electricity companies for data mining, and provide the most wonderful information about what was going on inside the homes of Dutch citizens. With some effort it could even help to tell which movie someone had been

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watching on a given night. By the time the proposal was brought to the upper house of the Dutch parliament for approval, public concern about the privacy aspects was very prominent and the upper house rejected the plan on data protection grounds. The European Commission, being devoted to the development of smart electricity grids in its member states, feared that the Dutch reaction to this type of innovation would set an example for other countries and would jeopardize the EU wide adoption of sustainable and energy saving solutions in a EU market for electricity (Al Abdulkarim 2009).

Another story – not very different from that of the smart meter – is the introduction of a nation-wide electronic patient record system in the Netherlands. After 10 years of R&D and preparations, lobbying, stakeholder consultation and debates – and last but not least an estimated investment of 300 million euros – the proposal was rejected by the upper house in parliament on the basis of privacy and security considerations (Tange 2008; Van Twist 2010).

Clearly, these innovations in the electricity system and health care system could have helped the Netherlands to achieve cost reduction, greater efficiency, sustainability goals, and in the case of the electronic Patient Record System, higher levels of patient safety. In both cases, however, privacy considerations were not sufficiently incorporated in the plans so as to make them acceptable. If the engineers had taken privacy more seriously right from the start and if they had made greater efforts to incorporate and express the value of privacy into the architecture at all levels of the system, transparently and demonstrably, then these problems would probably not have arisen.

The important lesson to learn from these cases is that values and moral considerations (i.e. privacy considerations) should have been taken into account as "non-functional requirements" at a very early stage of the development of the system, alongside the functional requirements, e.g. storage capacity, speed, bandwidth, compliance with technical standards and protocols. A real innovative design for an Electronic Patient Record System or a truly smart electricity meter, would thus have anticipated or pre-empted moral concerns and accommodated them into its design, reconciling efficiency, privacy, sustainability and safety. Value-focused thinking at the early stages of development at least might have helped engineers to do a better job in this respect. There is a range of fine grained design features that could have been considered and that could have been presented as choices for consumers. A smart meter is not a given, it is to a large extent what we design and make it to be. Respect for privacy can be built-in (Garcia & Jacobs 2011; Jawurek, Johns, Kerschbaum 2011). There are several objections against this suggestion. The first is that of moralism, another is that of relativism. Should values be built-in at all and, if so, which values should be 'built-in' and with which justification? There

seems such a great variety of values. Empirical research even seems to indicate that there is no coherent and stable set of European values, let alone global values (see for a discussion of European values Von Schomberg in this volume). Both objections I think can be addressed satisfactorily. No technology is ever value neutral (Van den Hoven 2012b). It is always possible that a particular technology, application or service, favours or accommodates a particular conception of the good life, at the expense of another, whether this was intended or not. There is therefore virtue in making particular values at play explicit, and evaluate how their implementation works out in practice and adjust our thinking accordingly. If we were overly impressed in the field of technology by objections of moralism and relativism, and, as a result, would abstain from working with values in an explicit and reflective way, we would run the risk that commercial forces, routine, bad intentions would reign free and impose technology with values that were not discussed and reflected upon by relevant parties.

Two European cases can serve as a contrast with the two aforementioned Dutch failures in innovation. They show that early and serious attention to moral considerations in design and R&D may not only have good moral outcomes, but may also lead to good economic outcomes. Consider the case of the so-called 'privacy enhancing technologies.' The emphasis on data protection and the protection of the personal sphere of life is reflected in demanding EU data protection laws and regulation. The rest of the world has always considered the preoccupation with privacy as a typically European political issue. As a result of the sustained and systematic attention to data protection and privacy, Europe has become an important cradle of new products and services in the field of Privacy by Design or Privacy Enhancing Technologies. Now, the Big Data society is on our doorstep and many computer users – also outside Europe – are starting to appreciate products and services that can accommodate user preferences and values concerning privacy, security and identity. Europe has a competitive advantage and is turning out to be an important commercial player in this branch of the IT industry.

A second case concerns Germany's success in the development of sustainability technology. Germany is one of the leading countries in the world in sustainability technology. During the 20th century, in the sixties and seventies, the world felt sorry for West Germany. Members of the Green Party chained themselves to every new chemical plant and seemingly frustrated economic growth by means of their disruptive protests. The conflict between economic growth and sustainability was a genuine value conflict that divided the political landscape and led to tensions in society. But in hindsight the conflict between different value orientations seems to have stimulated innovation instead of having stifled it. The conflict and political tension formed the occasion and trigger for Germany to try to have the cake and

eat it. The environmental technology that they felt the need to develop in the past has laid the foundation for commercial successes in the future.

2. Innovation and Moral Overload

Innovation can thus take the shape of (engineering) design solutions to situations of moral overload (Van den Hoven, et al. 2012a). One is morally overloaded when one is burdened by conflicting obligations or conflicting values, which cannot be realized at the same time. But as we saw above, conflicts of privacy and national security seem amenable to resolution by design and innovation in the form of privacy enhancing technologies. Conflicts between economic growth and sustainability were resolved by sustainability technology. Some think of these solutions as mere "technical fixes" and not as real solutions to moral problems. I do not take a stance on this issue here. I just want to point out that in such cases it seems to me that we have an obligation to bring about the required change by design or innovation (Van den Hoven, et al. 2012a).

(I) If a contingent state of the world at time t1 does not allow us to satisfy two or more of our moral values or moral obligations at the same time, but we can bring about change by innovation in the world at t1 that allows us to satisfy them all together at a later time t2, then we have a moral obligation at t1 to innovate. I consider this an important part of what responsibility implies in the context of innovation. It construes innovation as a second order moral obligation: the obligation to bring about a change in the world that allows us to make more of our first order moral obligations (e.g. for security and privacy, for economic growth and sustainability, safety and security) than we could have done without the innovation (see Owen et al. in this volume for a discussion of how these dilemmas can be the subject of discursive strategies of reflection and deliberation). Normally, the principle that 'ought' implies 'can' holds, but a noteworthy feature of this second-order obligation to innovate is that it does not imply 'can.' This means that we may be under the obligation to come up with an innovation that solves our problem, although success is not guaranteed.

It may seem fairly obvious to claim that we have a higher order moral obligation to innovate when it leads to moral progress, but it requires a considerable shift in our thinking about innovation. We need to learn to think of ethical considerations and moral values in terms of requirements in design and research and development at an early stage. Value discourse should therefore not be left on an abstract level, but needs to be operationalized or 'functionally decomposed,' as is often done with high level and abstract requirements in engineering and design work.

The process of functional decomposition leads eventually to a level of detail that points to quite specific design features of the system. This requires engineers to be value focused in their thinking and capable of articulating the values at play with different stakeholders (Pommeranz 2012b).

3. Values and Design

The above examples show that articulation and transparency concerning values are important to innovation processes. These allow us to detect dubious value commitments and allow us to design for shared public value commitments (see also von Schomberg, this volume). The history of technology is full of examples where values have been obfuscated or tacitly lodged in designs or products. They range from 'racist overpasses,' which were designed to be so low as to prevent buses from poor black neighbourhoods being routed to the beaches of the white middle class near New York (Winner 1980), to misleading biases in search engines, flaws in models of financial software serious enough to "kill Wall Street," and deceptive maps in the user interfaces of Geographical Information Systems (Van den Hoven 2007).

Technical systems and innovative technology are the solidification of thousands of design decisions. Some of them were consciously taken after painstakingly precise discussion among designers and engineers with good intentions. Some, however, were inserted negligently or malevolently to serve the interests of the designer, or those commissioning him or her. What they have in common is that they may affect the lives of future users or entire societies. In the 21st century, we will have to help ourselves to the tools, methodologies, institutions and procedures (see Owen et al. in this volume for specific suggestions) to discuss them explicitly and see to it that our world of technology and innovation is the best possible expression of our shared and public values.

The idea of making social and moral values central to the design and development of new technology originated at Stanford in the 1970s, where it was a central subject of study in Computer Science. It has now been adopted by many research groups and is often referred to as Value-Sensitive Design (VSD). Various groups in the world are now working on this theme. Batya Friedman (Friedman 1997, 2002, 2004) was one of the first to formulate this idea of VSD, others have followed with similar approaches, e.g. 'Values in Design' at University of California (Bowker, Gregory) at Irvine and NYU (Nissenbaum 2001) and 'Values for Design' (Van den Hoven 2007). These approaches share the following features:

First, there is the claim that values can be expressed and embedded in technology. Values and moral considerations can, through their incorporation in

technology, shape the space of action of future users, i.e. they can affect the set of affordances and constraints of users. A road from A to B allows one to drive to B, but not to C. Large concrete walls without doors make it necessary to take a detour. Architects and town planners have known this for quite some time. An ancient example not very different from the low hanging overpasses of the early 20th century is the so-called "Door of Humility" in the Church of the Nativity in Bethlehem. The door is exceptionally low and whoever wants to enter needs to bow his or her head, hence its name. The historical reason has been quite a different one from that of reminding people of the virtue of humility. The door was made intentionally low at the time of construction so as to make it impossible for mounted horsemen to enter the church on horseback in raiding attacks. If values can be imparted to technology and shape the space of actions of human beings, then we need to learn to incorporate and express shared values in the things we design and make.

Secondly, there is the claim that conscious and explicit thinking about the values that are imparted to our inventions is morally significant. Churchill famously observed: "first we shape our dwellings and then our dwellings start to shape us." Technology and innovation are formidable shapers of human lives and society. It is therefore very important to think about what we are doing to ourselves and to each other by means of technology. Contemporary moral philosophers have started to become aware of this and want their ideas to have an impact in the real world of technology, policy, and economics. Modern applied ethics attempts to make a difference by informing the way we design things. A good example of this design trend in ethics can be found in the recent work of Cass Sunstein entitled *Nudge*, which construes the task of applied ethicists and public policy as one of 'choice architecture' (Sunnstein and Thaler 2010; Van den Hoven, forthcoming). Think for example of the person who arranges the food in your university lunch room. By placing the deep fried stuff almost beyond reach and the healthy fruit and veggies in front, the consumer is invited (not forced) to go for the healthy stuff (the nudge). Speed bumps and the 'fly' in men's urinals are other examples of persuasion and nudging by technology.

A third feature of the value-design approach is that moral considerations need to be articulated early on in the process, at the moment of the design and development when value considerations can still make a difference. This sounds easier that it in fact is. This desideratum runs into the Collingridge dilemma, that states that early in the process of development of a technology, the degrees of freedom for design are significant, but information that could inform design is scarce, while later on, in the development of the technology, as information starts to become available, the degrees of freedom in design have diminished. The world of technology is

a world of probabilities, ignorance and uncertainty. Ethics and the law have had problems with the associated epistemic insecurity of our own making. Still, ethics will have to rise to the occasion in order to be relevant to a man-made world of complex adaptive systems, chaotic phenomena, and emergence. One way to deal with this is to be honest and explicit about what can be known about what we have created. We cannot be held responsible for not knowing what is by its very nature epistemically inaccessible. We can, however, be held responsible for not thinking about the limits of what is epistemically accessible and for obfuscating what we know about our epistemic limits. Sometimes we have to act and choose under conditions of uncertainty or ignorance and take responsibility for what we do relative to what we know, and be held responsible relative to what we knew and what we could have known.

4. Responsible Innovation

Every country and every company in the world wants to be innovative. Innovation is encouraged, subsidized and praised. Innovation is also extensively studied. Studies in innovation economics, management, psychology are booming at nearly every university. Thousands of scholars in the last two decades have turned into "innovation experts." They study the legal, fiscal and cultural and socio-economic conditions which are conducive to innovation, they describe best practices and make recommendations on how to be innovative. There is a panoply of definitions of innovation available (Baregheh et al. 2009). I define innovation as follows:

(II) Innovation is an activity or process which may lead to previously unknown designs either pertaining to the physical world (e.g. designs of buildings and infrastructure), the conceptual world (e.g. conceptual frameworks, mathematics, logic, theory, software), the institutional world (social and legal institutions, procedures and organization) or combinations of these, which – when implemented – expand the set of relevant feasible options for action, either physical or cognitive. Innovation processes are well studied in the literature of the Sociology of Science and Technology and the literature on management of innovation and R&D. They can extend in time over generations, can be spread across the globe, may be either haphazard and serendipitous or carefully and meticulously planned, they may involve one person or several thousands of persons, and involve complex interactions between people, artefacts, propositional contents, in the context of rules, institutions, and organizations (see Bessant 2013).

Innovations in this sense typically concern technical artefacts or technical systems – but as the definition above indicates they are not limited to the material

domain – that allow us to do things we could not do before, or allow us to think about things we had not thought about before, or it allows us to do familiar things in new ways, e.g. do them better, faster, cheaper, etc.

Now we can turn to the qualifier "responsible" in the expression "responsible innovation." "Responsibility" is a philosophical notion that has become prominent in the last century in ethical theory and in moral discourse. There are various ways to explicate the term and there are many different paradigms, theories, accounts and connotations (see Grinbaum and Groves 2013). Some argue that "responsibility" has become a central organizing concept in moral and social discourse. Others argue that its centrality is undeserved. In the world of work and the professions we speak of "professional responsibility" (or role responsibility), and in the world of international criminal and humanitarian law we speak of "the responsibility to protect." Responsibility is predicated primarily of persons and only derivatively of their actions i.e. the subject and the object (see Stahl et al. 2013). Strictly speaking, the paradigm case of responsibility is 'the responsibility of a person for his or her actions – in light of his or her intentions – and their effects in the world.' We say, for example, that 'John is responsible for breaking the vase.' Alternatively we can say that it was 'John's responsibility to prevent the breaking of the vase,' or that it was 'his responsibility to put it in a safe place.' We can also speak of "a responsible person." More recently, however, the qualification "responsible" has become attached to impersonal events and processes. We can thus also talk about "a responsible way of proceeding," "a responsible investment," "a responsible procedure," or an "irresponsible bonus structure." Similarly, with respect to technology, applied science and engineering, we now have come to talk about "Responsible Innovation."

The use of "responsible" in the expression "responsible innovation" resembles the use of "lazy" in the expression "a lazy chair": strictly speaking the chair is not lazy. The word "lazy" in this expression refers to chairs that invite and accommodate people who can be said to be lazy, who feel lazy, are lazy, or behave as if they were lazy. Analogously, it is not the innovation itself that is responsible. "Responsible innovation" is a truncated and indirect way of referring to contexts in which people who are the appropriate subjects of responsibility claims either feel responsible, or can be held or can be made responsible. "Responsible innovation" can thus be used to refer, in the realm of innovation, to whatever invites, accommodates, stimulates, enhances, fosters, implies or incentivizes responsible action.

If some innovative organization or process would be praised in virtue of its being "responsible" this would imply among other things that those who initiated it and were involved in it must have been accommodated as moral and responsible agents, i.e. they must have been enabled:

(A) to obtain – as much as possible – the relevant knowledge on (i) the consequences of the outcomes of their actions and on (ii) the range of options open to them and

(B) to evaluate both outcomes and options effectively in terms of relevant moral values (including, but not limited to well-being, justice, equality, privacy, autonomy, safety, security, sustainability, accountability, democracy and efficiency), (see Owen et al. and Grinbaum and Groves 2013 for further discussion of consequentialism and the status of knowledge and the problems of this in the context of innovation as an uncertain, collective and future-oriented activity).

In the light of (I) and (II) above I suggest that another implication of the notion of Responsible Innovation is the capability of relevant moral agents

(C) to use these considerations (A and B) as requirements for design and development of new technology, products and services leading to moral improvement. In section 1, we concluded that there could be a higher order moral obligation to innovate. On the basis of this characterization of innovation and the implications (A), (B) and (C) we may characterize Responsible Innovation in summary as follows:

(III) Responsible Innovation is an activity or process which may give rise to previously unknown designs pertaining either to the physical world (e.g. designs of buildings and infrastructure), the conceptual world (e.g. conceptual frameworks, mathematics, logic, theory, software), the institutional world (social and legal institutions, procedures, and organization) or combinations of these, which – when implemented – "expand the set of relevant feasible options regarding solving a set of moral problems." I thus suggest a core conception of responsible innovation which refers to, among other things, a transition to a new situation, and which has as its defining characteristic that it allows us to meet more obligations and honour more duties than before. A simple demonstration goes as follows. Let us consider how innovation could bring moral progress by solving a moral dilemma. The one who solves a moral dilemma, has overcome the problem of choosing between two obligations and thus escapes from a situation where one is bound to fail, because one of the two obligations cannot be met. A solution by innovation means, in this context, that one is able to discharge both obligations. Responsible innovation aims at changing the world in such a way that the pursuit of one horn of the dilemma is no longer necessarily at the expense of grabbing the other. Responsible innovation aims at grabbing the bull by both horns. Responsible innovation should, therefore, be distinguished from mere innovation or the adding of mere new functionality. Responsible innovation is the endeavour of attempting to add morally relevant functionality which allows us to do more good than before.

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Design for Values

Chapter 1: Design for Values: four challenges

1.1. Introduction

We live in a thoroughly technological world. Technologies mediate how we live, write, make friends, what we eat and how we care for others. Technologies have contributed to human well-being but also to the destruction of traditional ways of living, animal life and beautiful biotopes. Some believe that technology has made it possible for the first time in history to destruct human life entirely, be it through the atomic bomb or global warming (e.g Jonas 1984). In any way, technology is a main factor today both in the creation and in the destruction of values like wellbeing, friendship, justice, sustainability, safety and ecology.

Technology is basically a human product. It is the result of conscious and intentional human activities. This is not to say that we can entirely control or predict technological development or how it will affect human life and the creation or destruction of value. Nevertheless, the development and use of technology are processes in which we can make choices, and one way in which we can make these choices is with an eye for the values that are created or destructed through technologies. It is this way of dealing with technology on which I will be focusing here.

One of the central activities in the development of technology is engineering design, the process in which certain desiderata for a technological product, including relevant values, are translated into a blueprint for that product. It is true that many other engineering activities also contribute to technological development like research & development (R&D), testing, certification, production, maintenance, repair, and decommissioning. It is also true that many activities by non-engineers

shape technologies and the creation or destruction of value, like use, appropriation, operation and regulation. Nevertheless, my focus will be on engineering design and how value considerations can be taken into account in the design process. I have mainly two reasons for this focus. One is that design seems to be the single most important activity in the shaping of technology. Of course, as said, other activities are important as well and in specific cases they may even be more crucial than design; nevertheless, the design process seems me in many cases the most relevant spot to start. The second reason is that the design process seems to be an appropriate place to incorporate value considerations with respect to technology. This might require some explanation.

A very general characterization of design – one broader than engineering design, also including for example institutional design, educational design or policy design – would first of all draw attention to the fact that design is aimed at changing the world in which we live. In this respect, design has the opposite direction of fit as science. Whereas science aims at making our ideas (theories, descriptions) fit the world, design aims at making the world fit our ideas (values, prescriptions). Design is thus not a descriptive but a prescriptive activity. It always aims at an intervention in the world, at changing the world in a particular way. This very general description of design as a prescriptive, normative activity, immediately makes clear why design is an appropriate place to incorporate value considerations in the shaping of technology. Design is an activity that is more or less by definition driven by values. Making values bear on the design process is in a sense nothing more than recognizing the nature of design.

Another reason why design is a proper place to incorporate value considerations in the shaping of technology is that design is a deliberative activity. In general, we can speak of design when the actual doing or making of things is preceded by a phase in which we think our or plan what to do (cf. Forty 1986; Ferguson 1992). This thinking out or planning can result in a blueprint for the thing to be produced (as usually in engineering design) but can also be a rough mental idea that is still rather open-ended. This thinking out or planning makes design, at least in part, a reflective activity: an activity in which we reflect on what to do and/or how to do it best. This reflective nature of design makes it an appropriate place for incorporating value considerations.

1.2. Design for values

The idea of incorporating values in design is not new. It might be argued that the practice of incorporating values in the design of technology is as old as technology itself or at least as old as engineering design as a specific activity in the development

of technology. In recent decades, a number of authors have argued for, and developed approaches for what might be called Design for Values.

I use the term Design for Values here for a number of approaches which come under different headings like Value Sensitive Design (VSD), Values at Play, and Value Conscious Design (Friedman 1996; Feng 2000; Brey 2001; Van de Poel 2001; Friedman and Kahn 2003; Cockton 2004; Tatum 2004; Van den Hoven 2005; Cummings 2006; Friedman, Kahn, and Borning 2006; Albrechtslund 2007; Johnstone 2007; Flanagan, Howe, and Nissenbaum 2008; Oosterlaken 2009; Van de Poel 2009; Manders-Huits 2011). The general thrust of these approaches is the integration of values of ethical importance in a systematic way within engineering design. Design for Values has been particularly articulated in the domain of information systems and software. However, the idea is more generally applicable; it applies to all kinds of engineering design and, in fact, also to many kinds of non-engineering design like architectural design, policy design or institutional design.

Design for Values is related to a number of other approaches in engineering and technological development. One family of approaches is Technology Assessment (TA) (Grunwald 2009). Traditional TA aims at predicting the social consequences of technological development. Some more recent approaches to TA, such as Constructive Technology Assessment (CTA), Interactive Technology Assessment (ITA) and Real-Time Technology Assessment, aim at anticipating potential consequences of technology and feeding these back into the design and development process (Grin and Hoppe 1995; Rip, Misa, and Schot 1995; Grin and van der Graaf 1996; Schot and Rip 1997; Reuzel et al. 2001; Guston and Sarewitz 2002). The thrust of such TA approaches is the same as Design for Values. There are, however, differences in emphasis. TA approaches focus more on (anticipated) consequences rather than on values. The approaches are moreover more procedural and sociological in nature, focus less on moral issues and are less philosophically informed.

A second family of approaches is those that are critical of current technological development and that propose alternative approaches to technological development or engineering design. Some of these approaches are activist in nature. Such approaches can be found in the philosophy of technology (Winner 1986; Feenberg 1995; Sclove 1995) but also in the literature on design (Papanek 1984; Whiteley 1993; Papanek 1995). Sometimes authors merely criticize current technological development without offering an alternative or only stating alternatives in very general and abstract terms. Others have proposed more concrete alternative approaches under such names as socially responsible design, ethical design, design for the real world, design for society, feminist design, inclusive design, universal design and design for sustainability (Papanek 1984; Whiteley 1993; Feng 2000; Birkeland 2002; Keates and Clarkson 2003; Nieusma 2004; Tatum 2004; Ehrenfeld

2008). In many cases these alternative approaches rather quickly moves to practical guidelines, tools and methods without considering the values at stake in any depth or addressing issues with respect to value conflict.

A third family of related approaches is based on ideas of concurrent engineering and 'design for X' (DFX) that have been articulated in the engineering literature. Concurrent engineering is an approach to engineering in which downstream considerations, such as production, use, and maintenance are integrated into upstream decisions in engineering design and development. In DFX approaches, X can stand for a certain virtue or value or for a life phase. Table 1 lists a number of DFX_{virtue} and $DFX_{lifephase}$ approaches that are distinguished in a recent overview article by Holt and Barnes (2010). Design for Values certainly fits in the general pattern of DFX_{virtue} approaches. Most of the current DFX_{virtue} approaches, however, focus on instrumental rather than substantive values (see also section 1.3). Moreover, the concurrent engineering and DFX literature does not discuss the more foundational issues with respect to integrating values in design on which I will be focusing.

Table 1. DFX approaches (Holt and Barnes 2010)

DFX_{virtue}	$DFX_{lifephase}$
Design for environment	Design for manufacture and assembly
Design for quality	Design for end-of-life
Design for maintainability	Design for disassembly
Design for reliability	Design for recycling
Design for cost	Design for supply chain
Affective design	
Inclusive design	

What sets Design for Values apart from related approaches and the more traditional practice of incorporating values in design is that it pays *explicit* attention to values in design, and that it tries to make the incorporation of values into design more *systematic*. While it may be argued that design is always driven by certain values, this does not mean that every design process answers to the standards of Design for Values. While what these standards exactly are is open to debate, they seem to include at least 1) the explication of the values that are to drive the design process, 2) a systematic attempt to incorporate or embody these values into the product designed and 3) some kind of verification to check whether the designed system indeed incorporates or embodies these values.

These three requirements are indeed reflected in the 'methodology' for embodying values in technology that has recently been proposed by Flanagan, Howe and Nissenbaum (2008). This methodology consists of three steps:

1. *Discovery*. This activity will result in a list of values that are relevant for the design project.
2. *Translation*. Translation is "the activity of embodying or expressing (...) values in system design" (Flanagan, Howe, and Nissenbaum 2008: 338).
3. *Verification*. This is assessing, e.g. trough simulation, tests or user questionnaires, whether the design indeed has implemented the values that were aimed at.

In addition to these three activities, proponents of Design for Values have argued that Design for Values involves different kinds of (disciplinary) knowledge and different modes of investigation. Friedman and Kahn (2003), for example, distinguish three kinds of investigations: empirical, conceptual and technical. Empirical investigations "involve social scientific research on the understanding, contexts, and experiences of the people affected by technological designs" (Friedman and Kahn 2003: 1187). It is not hard to see why this is relevant: people's experiences, contexts and understanding are certainly important when it comes to appreciating precisely what values are at stake and how these values are affected by different designs. Conceptual investigations aim at clarifying the values at stake, and at making trade-offs between the various values. Technical investigations "involve analyzing current technical mechanisms and designs to assess how well they support particular values, and, conversely, identifying values, and then identifying and/or developing technical mechanisms and designs that can support those values" (Friedman and Kahn 2003: 1187). The second part of this assertion is especially interesting and relevant because it provides the opportunity to develop new technical options that more adequately meet the values of ethical importance than do current options.

This brief overview suffices for identifying four challenges that seem crucial for the success of Design for Values, both practically and theoretically. These four challenges are:

(1) How to determine what values to include in an engineering design project?
(2) How to make these values bear on the design process?
(3) How to make choices and tradeoffs between conflicting values?
(4) How to verify whether the designed system embodies the intended values?

The first, second and fourth challenge correspond to the steps or activities indentified by Flanagan, Howe and Nissenbaum (2008: 338). I have added the third challenge because it seems to me that value conflict is endemic to engineering design.

At first glance, each of the challenges may seem practical in nature, but closer inspection shows that each of them is related to one or more underlying philosophical problems. My main aim is to philosophically clarify these challenges and to show ways for dealing with them or even avoiding them. My aim is not to develop a clear-cut methodology for engineers, but I would hope that my philosophical investigations contribute to a reflective awareness among engineers of the mentioned challenges and of ways of dealing with them, so that they can better deal with them. Let me then briefly summarize what I see as the main philosophical issues that are raised by the four mentioned challenges:

(1) The question about what values to include in an engineering design project is partly a question about how to identify relevant values given a certain design project. Just identifying values is not enough, however: designers also need to answer the *normative* question what values are worth pursuing in design. This normative question in turns raises a number of more foundational and metaphysical questions about values. Is value subjective or objective? Should we distinguish between and instrumental values? Can we somehow distinguish 'mere' values from 'real' values?

(2) It might be argued that making values bear on design requires bridging the gap between the world of ideas and the material world, or bridging the gap between philosophy (and other humanities and social sciences) and technology. Here the philosophical issue seems to be: Can these gaps be bridged at all?

(3) Making tradeoffs between values, or design criteria, is a common procedure in engineering design. I will argue, however, that engineers here tend to neglect what philosophers have called the incommensurability of values (Raz 1986; Chang 1997). Two or more values are incommensurable if they cannot be measured on the same scale. Incommensurability may arise from the fact that it is impossible or at least inappropriate to cancel out loss in one value domain by benefit another domain (For how much money are you willing to betray your friend?). Value incommensurability raises fundamental philosophical questions about choices under value conflict in design and the rationality of such choices.

(4) Verification of values in design is not just a practical challenge; it also raises the more fundamental philosophical question: can technology embody values?

In the remainder of this chapter I will focus on the first two challenges. In section 1.3 I will propose a conceptualization of value that is helpful in dealing with the first challenge. In section 1.4, I will make a start with discussing the second challenge. The third challenge is discussed in Van de Poel (2009).

1.3. What values to include in design?

The first challenge is what values to include in the design process. Several authors who are critical of current technological developments have suggested that technological design is mainly driven by instrumental values like efficiency and functionality or by technological enthusiasm and has unjustly neglected broader human, ecological and democratic values (e.g Winner 1986; Feenberg 1995; Sclove 1995). Similarly authors on Design for Values have suggested that whereas in the past design was driven by functional values now a broader range of human values needs to be included (Friedman 1996; Friedman and Kahn 2003; Friedman, Kahn, and Borning 2006; Flanagan, Howe, and Nissenbaum 2008).

Below, I will first discuss possible sources of value in a design project. Identifying these sources is helpful, but does not answer the normative question what values to include in design. I will therefore, next, turn to the question what values are and if we can somehow distinguish 'real' values from 'mere' values. Eventually, I will do a proposal for conceptualizing value that emphasizes the relation between value and reasons for action.

1.3.1. Sources of value in design

In general, one can distinguish between four sources of value in a specific design project. One is the design project itself and more specifically its design brief, in which the goal of the project is further described and constraints and requirements may be given. Projects may be explicitly formulated to serve certain values, but even if this is not the case the design brief will often implicitly contain certain values.

A second source is the values of users and other stakeholders (e.g Holbrook 1999; Boztepe 2007). These also play a central role in the approach proposed by Friedman and her colleagues (Friedman and Kahn 2003; Friedman, Kahn, and Borning 2006), which calls for empirical investigations to identify what users and stakeholders consider relevant values for the design of a technology. Users and stakeholders may have different values than articulated in the design brief and different values than each other.

A third source is the values of the designers and the engineering profession. Empirical studies of design suggest that when designers design a product they try to put, at least implicitly, specific value into a product which they hope will be realized in practice (Akrich 1992; Latour 1992; Akrich 1995; Henderson 2006; Verbeek 2008; Van de Poel 2009). Not only individual designers may be driven by certain values, but also engineering as a profession is committed to certain values such as human well-being, health and safety (Davis 1998). Also sustainability is

increasingly mentioned as common value in engineering codes of ethics. The first canon of the code of ethics of the American Society for Civil Engineers, for example, reads: "Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties" (ASCE 2010).

A fourth source of values is the general social values expressed in for example technical codes and standards or in relevant laws. Technical codes are legal requirements that are enforced by a governmental body to protect safety, health and other relevant values. Technical standards are usually recommendations rather than legal requirements that are written by engineering experts in standardization committees. Codes and standards have two main functions (Hunter 1997). The first is standardization and the promotion of compatibility. This results in, for example, the design drawings being understandable and clear for others and spare parts being compatible. A second aim of codes and standards is guaranteeing a certain quality or protecting public values. In addition to such technical codes and standards and regulation, general social values may also be based on values that surface in relevant social discussions and debate, even if they have not yet been laid down in regulation.

These four sources are helpful in distinguishing relevant values in a concrete design project. They may also be instrumental in avoiding overlooking certain relevant values. However, they do not provide an answer to the question: What values should be included in the design of this technology? This is a *normative* question that cannot be answered by simply citing possible sources of value in a design project. Answering this question seems to require a normative theory or point of view. One way to approach this issue may be to maintain that whatever is of value is normatively worth striving for. After all, statements about value are not statements about what individuals prefer but about what they think is worth striving for. Value statements dot not express an individual taste or preference but are claims about what is valuable in general.

1.3.2. What are values?

Let us for the moment accept that values are more or less by definition things that are worth striving for. Does this solve the first challenge? Not entirely. We still cannot take what users or designers mention as values at face value. After all, they may be mistaken or they may strategically present their own preferences or self-interests as values. What seems required, if we pursue this line of reasoning, seems to be a normative notion of what a value is so that we can distinguish 'mere' values from 'real' values.

At this point, one might want to turn to what philosophers have said about the notion of value. Three main philosophical doctrines can be distinguished here. Subjectivists believe that human desires, or more generally psychological states, constitute the source of value.[1] Objectivists believe that values reside in the world outside us.[2] Rationalists see human rationality as the ultimate source of value.[3] Subjectivism does justice to the connection between values and human desires and interests. It runs, however, the risk of confusing value with preference. Not everything that is actually desired or preferred by people is valuable. Objectivism does justice to the fact that statements about value are not statements about preferences but rather about how the world is or ought to be from a normative point of view. Objectivism, however, seems somewhat mysterious and it may well lead to authoritative claims on the basis of intuitions that are in practice hard to distinguish from subjective claims (cf. Anderson 1993: 119–123). Rationalism can be seen as an in-between position. It restores the connection between human desires and values, which is lost in objectivism but strives to avoid confusing value with preference by claiming that things are valuable not just because people prefer them but because rational beings have sufficient practical reason to pursue them. Nevertheless, rationalism may make it difficult to express the fact that part of the reason for valuing an object may lie in the object itself.

Do we need to solve the tension between subjectivism, objectivism and rationalism, or to take a position in this general philosophical debate about values to deal with the challenge of *normatively* identifying the relevant values in a design project? I doubt it. Of course certain theoretical philosophical commitments are unavoidable, but these commitments need not decide the metaphysical debate about the notion of value. It might be better to look for notions of values or distinctions between values that make sense more or less independent of one's exact metaphysical position.

One possible relevant distinction here that is often made by philosophers is that between instrumental and intrinsic value. Basically, the idea is that intrinsic value is that what is worthwhile for its own sake while instrumental value is valuable because of its contribution to something else, which is either intrinsically

[1] This position is often associated with Hume. Also emotivism may be associated with this position (Stevenson 1944; Mackie1977). Subjectivists' assumptions are also often found in modern decision theory, although the mathematical apparatus developed in decision theory does not necessarily presuppose a subjective metaphysics of value.

[2] The best known representative is maybe Moore (e.g Moore 1903), but one may also think of philosophers like Ross (1930), Dancy (1993) or Zimmerman (2001).

[3] Rationalism is usually associated with Kant. Contemporary rationalist accounts of value are, for example, offered by Korsgaard (1996) and Anderson (1993).

valuable or a means to something that is valuable, *et cetera*. Flanagan, Howe and Nissenbaum have, for example, proposed to incorporate in design "not only instrumental values such as functional efficiency, safety, reliability and ease of use, but also substantial social, moral and political values … In technologically advanced, liberal democracies, this set of value may include liberty, justice, enlightenment, privacy, security, friendship, comfort, trust, autonomy and sustenance" (Flanagan, Howe, and Nissenbaum 2008: 322).

Although the distinction between instrumental and intrinsic value may seem straightforward, it is not. Various philosophers have pointed out a number of terminological and substantive issues with respect to the distinction (for a discussion, see Zimmerman 2004). One issue is that the notion of intrinsic value is ambiguous. The notion is usually understood to refer to objects or states of affairs that are valuable in themselves. Intrinsic value is then value of a non-derivate kind. Intrinsic value may, however, also refer to things that are valuable due to their intrinsic natural, i.e. descriptive, properties. As Christine Korsgaard reminds us, things that are valuable due to their intrinsic properties are unconditionally good (Korsgaard 1983). Their goodness does not depend on relationships to other objects or with people; otherwise value could not be said to be intrinsic to the object. However, according to Korsgaard, some things may be good in a non-derivate sense, even if they are not unconditionally good. An example is human happiness in a Kantian respect. According to Kant, human happiness is non-derivate goodness. Happiness is good in itself, and not because it is a means to another end or contributes to another value. Nevertheless, according to Kant, happiness is only conditionally good; it is only good insofar as it corresponds to good will, i.e. respect for the moral law. To avoid the ambiguity to which Korsgaard refers, I will use the notion of 'final value' for non-derivate value and the notion of 'intrinsic value' to describe value that only depends on the non-relational properties of an object or state-of-affairs.

The notion of instrumental value is also more complex than it seems. It might refer to things that are useful for achieving some end, whether that end is valuable or not. Frankena (1973: 66) refers to such instrumental values as utility values. He proposes the notion of extrinsic value to refer to "things that are good because they are a means to what is good" (Frankena 1973: 66). However, the term 'extrinsic value' is confusing for two distinct reasons. First the term is sometimes used as the opposite of intrinsic value rather than as the opposite of final value.[4] Second, values can be derivate in other ways as being a means to an end (see e.g.

[4] Frankena does not distinguish between intrinsic and final value, which might explain why he proposes to use the term 'extrinsic value' for 'derivate value.'

Zimmerman 2004).[5] Things can, for example, also be valuable because they *enable* a good life, just as privacy or health enable people to live a valuable life or to *contribute* to a good life as do the virtues in an Aristotelian account of the good life. I will therefore use the notion of *instrumental value* for the value of being a means to achieving a good end, i.e. another positive value.

Given these terminological distinctions, I would propose that Design for Values aims at incorporating final values in design.[6] This is not to imply that instrumental, contributory or enabling values are unimportant to design, but rather to suggest that their value is somehow derivate: these values are pursued for the sake of final values, and they are justified as target in design as far they actually contribute to the realization of final values.

How do we recognize final values? One possibility may be to attempt to draw up a list of all conceivable final values. Frankena, for example, has proposed a list of as much as seventeen final values on the basis of the philosophical literature on value (Frankena 1973: 87–88).[7] Although such lists may be useful for practical purposes, they are philosophically not very satisfying for at least two reasons. One issue is whether such a list can be complete. Values like the value of nature, biodiversity and sustainability are, for example, completely absent on Frankena's list. Second, one would like to have a criterion for what to put on the list and what not, rather than an authoritative list, even if such a list is based on what some of the best philosophers in the history of philosophy have said. I think that this criterion can be found in the relation between (final) values and reasons for action that has recently been articulated by several philosophers.

1.3.3. The relation between values and reasons

Both values and reasons belong to the normative domain; they belong, however, to different parts of the normative domain. Values are evaluative; they are relevant for how we evaluate certain things or state of affairs. Reasons belong to the deontic part, they relate to what to do, believe and aim for. Reasons are considerations that count in favor for doing, believing or aiming for something. Reasons are to be

[5] The point is not that the instrumental value may be insufficient to cause the end but that extrinsic values may contribute to intrinsic values in non-causal ways. They may, for example, be an indication of the achievement of an intrinsic value or they may be conceptually part of the intrinsic value (e.g. health and the good life).

[6] An alternative proposal would be to focus on intrinsic (final) value. That seems to me, however, to prejudice in favor of an objective metaphysics of value.

[7] Frankena uses the term intrinsic value, but he appears to refer to what I have called final values.

distinguished from 'oughts' or obligations, which also belong to the deontic part. If one has reason to do something one is usually not obliged to do it (although different authors sometimes use somewhat different terminology here). Often there are both reasons for and reasons against doing something and an 'ought' is then believed to result from the totality of relevant reasons, although the totality of reasons can also be inconclusive or can merely allow to do something without there being an obligation to do it.

There is no agreement in the philosophical literature on how values and reasons are related. One category of theories, often called 'consequentialism,' holds that we have reason to do what has or brings about value, that we should increase the amount of value in the world or even should maximize it. Such theories thus believe that values precede reasons: they are what give us reasons. One need, however, not be a consequentialist in the above sense, to maintain that values are metaphysically prior to reasons. Joseph Raz, for example, holds that values give us reasons to engage with those values in appropriate ways (Raz 1999). What appropriate is may, however, depend on the value (and the situation): some values are to be promoted or maximized (as consequentialists hold), others are to be admired, cherished or enjoyed.

Other theories hold that reasons are metaphysically prior to values. Elisabeth Anderson, for example, defends what she calls an expressive theory of rational choice (Anderson 1993). According to her statements like 'x is good' or 'x is valuable' can be reduced to 'it is rational to adopt a certain favorable attitude towards x.' The reasons we have to adopt certain attitudes to certain things or state of affairs ground the value of those state of affairs or things. A somewhat different account is offered by Scanlon, who argues that "being good, or valuable, is not a property that itself provides a reason to respond to a thing in a certain way. Rather, to be good or valuable is to have other properties that constitute a reason" (Scanlon 1998: 97). Scanlon's account is known as the buck-passing account of values.

I will not take a position in the theoretical debate about the exact relation between reasons and values. It is, however, worth noting that all positions briefly mentioned seem to suppose a certain correspondence between values and reasons of the following kind:

> (V) If x is valuable (in a certain respect) or is a value one has reasons (of a certain kind) for a positive response (a pro-attitude or a pro-behaviour) towards x

This statement is intended to be neutral with respect to the question whether values ground reasons or reasons ground values or that neither can be reduced

to the other. As Dancy (2005) notes, whatever position one takes in this debate something like (V) seems to be true. The notion of positive response in (V) is meant to capture a range of pro-attitudes and pro-behaviors like desiring, promoting, increasing, maximizing, caring for, admiring, protecting, respecting, enjoying, loving, *et cetera*. As suggested above, what positive response is adequate depends on the kind of reasons or values and the context.

It should also be noted that (V) does not imply any a priori commitment to subjectivism, objectivism or rationalism. Although (V) does probably not fit well with extreme varieties of subjectivism, which for example take everything that is desired as valuable, it is seems to cohere with more mild forms of subjectivism, which for example are based on a notion like 'informed desires.' (V) also does not imply an a priori commitment to intrinsic or final values.

Of course the association of value with reason in (V) does as such not provide a clear-cut or fail-proof criterion or procedure to distinguish 'real' values from 'mere' values. One can still disagree whether a contested value corresponds to reasons for actions or not. Reasons may be as contestable as values. Nevertheless, I think that (V) has the virtue of creating room for reasoning, deliberating and discussing about values (and reasons), and does so without necessarily invoking metaphysical arguments about the nature of values. In a sense, the question then becomes what counts as enough reason or argument for something to be a 'real' value independent from the question what exactly the source of such value is. Sure, this is a normative question itself and one that requires making value judgment and may lead to disagreement. But I think one cannot reasonably expect otherwise. Proposing an allegedly objective litmus test to distinguish 'real' values from 'mere' values would, at least in my view, testify of a fundamental misunderstanding of what values, and reasons, are.

In a more practical sense, (V) implies that in an individual design process designers should not just identify values by looking at the design brief, the values of users, themselves and other stakeholders or relevant social value, but that should also engage in deliberation, individually and socially, about such values to decide what values are indeed worth striving for in the design process, because they are 'real' values, and which ones not.

1.4. How to make values bear on the design process?

Identifying values and deliberating on what values to include in design is only a first step. The next challenge is to make these values bear on the design process. Doing so requires translating abstract and general values into tangible technical constructions that embody these values. This translation is made in the design

process and implies a translation from the world of ideas and ideals into the world of objects and physics. I will first discuss two possible arguments why this translation is (philosophically) problematic, i.e. the existence of two cultures for understanding the world between which an unbridgeable gap exists, and the idea that technical artifacts have a dual nature: they are both social and physical objects. I will argue that although the difficulties in translating ideas into tangible objects should not be ignored, they do not pose an unbridgeable gap. In fact, designers already make such translations in design processes.

1.4.1. The two cultures

According to Flanagan, Howe and Nissenbaum (2008), a main reason why it is so difficult to integrate values into design is the epistemological challenge of engaging in rather distinct areas of knowledge with their own methodologies. As they write: "Achieving technical design that soundly incorporates values requires not only competence in technical arts and sciences, but also a reflective understanding of the relevant values and how these values function in the lives of people and possibly groups affected by the systems in question"(Flanagan, Howe, and Nissenbaum 2008: 324). As they go on to stress, investigations of values usually take place in the humanities or social sciences rather than in natural science, which is more familiar to engineers.

In more general terms, the challenge of incorporating values in design can be conceived as an attempt to bridge the gap between the natural and human sciences as described by C.P. Snow in his famous essay about the *Two Cultures* (Snow 1959). Incorporating values in design means that we try to make a translation from the world of ideas and ideals to which values belong to the world of materiality and inevitable natural processes to which technology seems to belong. Doing so requires combining two distinct ways of looking at the world, as exemplified in Snow's two cultures. This may explain why it has often proved so hard in practice to broaden the range of values incorporated in engineering and scientific decisions and why many engineers and scientists tend to feel uncomfortable when they are asked to deliberate about more general human and social values. We might even wonder whether it is even conceptually possible to bridge the gap between the two cultures.

Although there is certainly some truth in the above characterization, the focus on the two cultures may overemphasize the problem because it largely neglects what engineers actually do. It assumes that engineers are basically applied scientists who investigate the natural world. But contrary to science, the primary aim of engineering and technology is not to understand or describe the world but rather to change it. Of course, changing the world may require understanding,

but that understanding is not necessarily or exclusively scientific understanding. The steam engine was developed before the theory of thermodynamics and was in fact a major motivation for its development. More generally, knowledge generation in engineering may be similar to natural science, but it is not always or necessarily so (Vincenti 1990; Kroes and Bakker 1992). When engineers try to better understand the wishes of their clients to formulate design requirements, they may be operating more like social scientists or even the humanities than as natural scientists. When they make choices between different design options they may draw on insights from economics and decision theory. When they develop systematic catalogues of technical parts they may use insights from applied ontology. Moreover, design is social activity that involves deliberation and negotiation between different parties (Bucciarelli 1994). Successful design requires not only the mobilization of engineering knowledge, it also requires organizing and keeping on board customers, investors, managers, companies and so on. To express this feature of design, some authors have used the phrase 'heterogeneous engineering' (Bijker, Hughes, and Pinch 1987; Law and Callon 1988; Bijker and Law 1992). Engineering is a heterogeneous activity that draws on heterogeneous sources of knowledge and heterogeneous modes of investigation.

The heterogeneous nature of design does not mean that engineers always feel comfortable employing modes of investigation that do not belong to, what they see as, hard-core engineering. Nor does it mean that they always have the necessary skills or that they are willing and able to cooperate with others. Sørenson, for example, points out that while engineering is social in nature the use of knowledge from the social sciences, or the incorporation of social scientists in engineering projects seems still rare (Sørensen 2009). One should not ignore therefore the practical difficulties of combining different modes of investigation in engineering design. Still, as witnessed by Sørensen's recognition of design as social activity and Goldberg phrase missing *basics*, there is no reason to think that there is any unbridgeable gap between the different modes of investigation that are required by Design for Values.

The conclusion therefore seems warranted that the modes of investigation and inquiry in engineering are richer than in natural science. There is no reason to think that the modes of investigation that are required by Design for Values, especially the empirical and conceptual mode, are necessarily or deeply alien to engineering.

1.4.2. The dual nature of technical artifacts

There may, however, be another version of the argument that the gap between the world of ideas and values, on the one hand, and the material world, on the

other hand, is unbridgeable. This version emphasizes not the heterogeneity of modes of inquiry that is required for this transition but rather the problematic character of the transition itself. It is indeed a philosophically intriguing question how a transition is made from ideas, goals and values which are all part of the intentional world to material technical artifacts which are part of physical world. It is also true that philosophers usually use different conceptual frameworks to understand both worlds.

As authors like Kroes and Meijers have stressed, technical artifacts have a dual nature in the sense that they belong both to the physical world, as material constructions, and to the intentional world as they serve a function and are connected to human goals and, I would add, values (Kroes and Meijers 2006; Kroes 2010). The design process seems to be the place where these two worlds meet and were goals and values are translated into tangible artifacts. Although it is an interesting philosophical puzzle how this exactly is done (and is possible) I do not think that including value considerations in the desiderata for new artifacts really adds to this challenge. Moreover, engineers seem able to make the transition somehow although philosophers might want to understand more deeply and exactly how.[8] Although this is an interesting philosophical puzzle, it is not the one I will be focusing on. My approach is a little bit more mundane. I will look at the design process, and its different stages or constituting activities, as the locus where the translation is made between values and tangible technical constructions and try to identify some major loci in the design process where values are relevant.

1.4.3. The design process

Engineering design is the process by which certain functions are translated into a blueprint for an artifact, system, or service that can fulfil these said functions. In design methodology, the engineering design process is usually depicted as a systematic process in which use is made of technical and scientific knowledge, but in which creativity and decision-making also play major roles. Design methodologies usually divide the design process in different stages between which iterations are possible (Hubka 1982; Eekels and Roozenburg 1991; Roozenburg and Cross 1991; Ullman 1997; Pahl et al. 2007; Cross 2008).[9] Although the exact

[8] For some interesting discussions and suggestions see (Kroes 2006; Vermaas and Houkes 2006; de Ridder 2007).

[9] Not all design methods and methodologies conceptualize the design process as a linear process. Most methods and methodologies contain possibilities for iteration. Moreover, especially design models from architecture stress that the design problem cannot be formulated completely independent from possible solutions (Roozenburg and Cross 1991: 188).

stages are different from design methodology to design methodology, many of them contain a number of basic activities like analysis (of the design problem), synthesis (of possible design solutions), evaluation (of the possible solutions in the light of the problem) and choice (of one design solution). Additional steps that are often mentioned include simulation, embodiment design and prototype testing. Simulation refers to making predictions about how possible design solutions (concept designs) will behave; a step that might involve calculation, modelling, testing, trying out, *et cetera*. Embodiment design is the phase that follows after one design solution has been chosen and has to be further detailed, finally resulting in design drawings and technical specification on basis of which the design can be built or produced. Prototype testing refers to the testing of prototypes of the system, possibly resulting in new insights and reiterations of the design process. Figure 1 depicts the basic stages of the design process.[10]

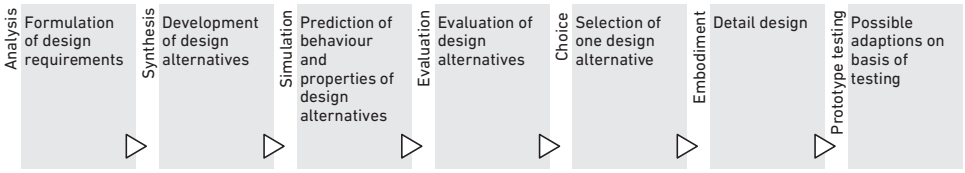


Figure 1. Phases of the design process

Empirical studies have shown that in practice, many designers do not follow the staged approach that is prescribed in many design methods (e.g Stauffer, Ullman, and Dietterich 1987; Ullman, Stauffer, and Dietterich 1987; Stauffer and Ullman 1988; Visser 1990; Henderson 1991; Bucciarelli 1994; Visser 2009). Two common deviations are worth highlighting here. The first one is that especially experienced designers dot not follow the phases that are mentioned in prescriptive methods sequentially or iteratively, but rather in parallel. Designers may switch quickly between, for example, synthesis and evaluation; they may work at different levels of abstraction at the same time and they even skip some design stages entirely. Even if designers follow a more or less structured approach, they often opportunistically deviate from that approach during the design process.

The second deviation is that many designers follow a single concept strategy rather than developing a range of alternatives and then choosing the most promising alternative on the basis of evaluation. Designers often quickly move to a possible solution, which may be based on their experience or existing products. They will then try to further develop and improve that solution till it meets the

[10] The Figure is largely based on (Eekels and Roozenburg 1991).

design requirements. When it turns out to be impossible to meet the requirements, they may abandon their original solution concept and try a new one. The single concept strategy is related to a strategy that is also regularly observed in design: satsificing (cf. Ball, Evans, and Dennis 1994). Satsificing means that designers define thresholds for the design requirements that should be minimally met and if they find a design that is likely to meet those thresholds, they select it and stop looking for alternatives.

There is no agreement in the literature on design methodology whether these deviations lead to poorer designs than if a systematic approach is followed more thoroughly.[11] Opportunistic approaches obviously have some disadvantages (cf. Günther and Ehrlenspiel 1999; Pahl, Badke-Schaub, and Frankenberger 1999). Requirements may be overlooked, for example resulting in poor design or in large costs (in terms of time and/or money) for adopting the design in a later phase when the importance of a requirement becomes apparent. Focusing on one solution may result in overlooking clearly better options or in investing much in working out a solution that later turns out to be unsatisfactory. However, a systematic design approach might be costly too; developing and simulating a range of concepts designs usually cost a lot of effort and will not always lead to a better solution; choosing from a range of alternatives may be particularly difficult because often there is not one best solution but a range of more or less acceptable alternatives.

Apart from such more pragmatic considerations, it has been suggested that the systematic approach is flawed because it neglects the ill-structured or ill-defined nature of design problems. Cross gives the following characteristics of ill-defined problems (Cross 2008: 13–14):[12]

1. There is no definite formulation of the problem;
2. Any problem formulation may embody inconsistencies;
3. Formulations of the problem are solution-dependent;
4. Proposing solutions is a means to understand the problem;
5. There is no definitive solution to the problem.

[11] It has also been suggested that it might depend on such considerations as the type of designer and type of design process or product designed what approach is most fruitful. For example, experienced designers may more fruitfully follow an opportunistic approach while, it is suggested, novice designers are better advised to proceed initially more systematically. It has also been suggested that the systematic approach is more appropriate for innovative design, whereas in redesign or incremental design once can, for example, quicker proceed to a possible design concept without the need for developing variations.

[12] Other somewhat different characterizations are offered by (Simon 1977) and (Rittel and Webber 1984).

According to Cross, the traditional way in which designers tackle the ill-defined character of design problems is by trying "to move fairly quickly to a potential solution, or a set of potential solutions, and to use that as a means of further defining and understanding the problem"(Cross 2008: 14). This suggests that the single concept strategy might be an effective way to deal with the ill-structured character of design problems, especially the third and fourth characteristic mentioned by Cross.[13] Also the observation that designers tend to work on different design stages and on different levels of abstraction at the same time (or quickly switch between them) might be explained by the ill-structured nature of design problems, which makes it impossible, for example, to formulate all the design requirements without envisioning possible solutions.

The upshot of the discussion above is that actual design processes are more complex and more opportunistic than Figure 1 suggests. Nevertheless, the design activities that are mentioned in the figure – like analysis, synthesis, evaluation and choice – are relevant activities of designers. Even if these activities are not strictly separated in actual design, design processes can usually be reconstructed in terms of these activities (cf. e.g. Hykin and Laming 1975). For example, even if designers follow a single concept strategy they will evaluate their design, for example by comparing it with the design requirements they formulated or by comparing it to an existing product or the product of a competitor, and they will make a choice whether their design is good enough or need to be further improved or to be abandoned for another idea.

The design activities mentioned in Figure 1 are therefore appropriate as starting point for answering the basic question with which we started this section: how can we make values bear on design? It might be argued that in all seven design activities values are somehow relevant but it seems that three activities stand out in importance and relevance for integrating value considerations:

- Analysis, in particular the formulation of design requirements which may be based on values
- Evaluation which proceeds on the basis of the design requirements, but may also possibly involve a broader range of evaluation criteria, both of which may be based on values

[13] Some descriptive models in architecture take this explicitly into account. According to Roozenburg and Cross such models have the following general characteristics: "[I]t has essentially a spiral structure; it recognizes the importance of pre-structures, presuppositions or protomodels as the origin of solution concepts, it emphasizes a conjecture-analysis cycle in which the designer, and the other participants, refine their understanding of both the solution and the problem in parallel; and it assumes design problems, by definition, to be ill-defined problems" (Roozenburg and Cross 1991: 188).

- Choice which might require the relative weighing of different evaluations based on different (underlying) values and hence the dealing with value conflict

The other design activities (synthesis, simulation, embodiment design, prototype testing) are less overtly value-laden. Synthesis will often be driven by the design requirements, so that if the latter properly reflect the relevant values, the main value issues with respect to synthesis might also be covered. Simulation might also be considered a less value-driven activity, although simulation models might reflect some value assumptions or they may be more or less appropriate to reliably deliver the data that are needed for evaluations with respect to certain values. Embodiment design is important because the devil is often in the detail, but in as far as it is driven by the design requirements the major value issues may arise in formulating those requirements rather than in the embodiment design itself. Prototype testing is, as activity, somewhat comparable to simulation, as it is also aimed at acquiring information about the behaviour of the designed object. Prototype testing may be particularly relevant for verifying whether the designed system indeed embodies the desired values. In particular, it may involve different types of users or stakeholders, for which the values have a somewhat different meaning or for whom somewhat different conditions apply in order for a value to be realised.

Chapter 2: Translating values into design requirements

2.1. Introduction

As we have seen in chapter 1, values may bear on different phases or stages of the design process. In this chapter, I will consider how they may be relevant in the analysis stage, and more specifically in the formulation of design requirements. Although design methods often relegate the formulation of design requirements to the first phase of the design process, in practice design requirements are often added and reformulated during the entire design process. The reason for this is that design is usually as much a process of problem formulation as it is a process of problem solving.

In this chapter, I will focus on how general and abstract values can be translated into more tangible design requirements that can directly guide the design process. I start this enquiry with an example that highlights how the value of animal welfare was translated into design requirements for chicken husbandry systems such as

battery cages. This example will highlight some of the general characteristics of the translation of values into requirements in design.

After discussing the example, I will introduce the notion of *values hierarchy*, i.e. a hierarchical structure of values, general norms and more specific design requirements. A values hierarchy is a coherence structure that is held together by two relations. *Specification* is the relation by which higher level elements are translated into lower level elements in the hierarchy. Pursuit *for the sake of* is the relation by which we can connect lower level elements, like design requirements with higher level elements, such as more general norms and values.

After discussing the specification and the *for the sake of* relation, I will critically discuss some desirable attributes of design requirements that have been proposed in the engineering literature. In this, and in the final section on the role of design requirements in the design process, I argue that design requirements should not be seen as determinative for the final design chosen. Rather they are kind of heuristic guides that help to develop possible solutions. Evaluation of these options and the choice between them is a topic that I will take up in the following chapters.

2.2. The design of chicken husbandry systems as an example[14]

Currently, battery cages are the most common system in the industrial countries for the housing of laying hens. The system makes it possible to produce eggs in an economically efficient and factory-like way. The system, however, has also been heavily criticised for its neglect of animal welfare by reducing chickens to production machines (e.g. Harrison 1964). A main concern in the design of battery cages – and a main reason for the introduction of the battery cage – is economic efficiency. This value has, in the course of time, been translated into more specific design requirements in terms of egg production per animal, feed conversion (the ratio between the weight of the food fed to the chickens and the weight of the eggs), egg weight and the mortality of chickens, all of which can be measured in tests. Other relevant design requirements relate to egg quality, manure removal and drying, and the cost price and lifetime of systems.

Important moral values in the design of battery cages include environmental sustainability (battery cages cause environmental emissions, especially ammoniac), wellbeing of farmers (labour circumstances and profitability of the systems) and animal health and welfare. These values have in the course of time been translated into design requirements for battery cages and for alternative chicken husbandry

[14] A more extensive discussion with further references can be found in (Van de Poel 1998).

systems, sometimes through government regulation. Here, I will focus on how the value of animal welfare was translated into more specific design requirements.

Translating animal welfare into design requirements first of all required more insight into the notion of animal welfare and factors that might enlarge or jeopardize animal welfare. The engineers and technicians involved in the design of battery cages lacked such insight. The scientific discipline that came to play a key role in making the notion of animal welfare more tangible was ethology. Ethology is a branch of biology that studies the behaviour of animals in their natural environment. This 'natural' behaviour gave ethologists a kind of reference point with respect to which they can claim to discern 'abnormality' in the behaviour of, for example, chickens in battery cages. Deviant or absent behaviour can then be interpreted as possible failure of the animal to adapt itself to the new environment. This led to the notion that chicken have certain 'ethological needs' that should be respected. So, ethology as a science provided a normative standard by which to judge the suffering of animals. Of course, this did not mean that all ethologists agreed on the level of animal welfare in battery cages or on possible measures that might be taken. However, ethology offered instruments and concepts with which the general and abstract value of animal welfare could be translated into a set of more concrete norms for chicken husbandry systems. The main norms that have been articulated in the course of time are (e.g Kuit, Ehlhardt, and Blokhuis 1989):

1. Chicken should have enough living space. As the Brambell Committee, installed by the English government and including the ethologist William Thorpe expressed it in the sixties: "An animal should at least have sufficient freedom of movement to be able, without difficulty, to turn around, groom itself, get up, lie down and stretch its limbs"(cited in Harrison 1993: 120).
2. Chicken should be able to lay their eggs in laying nests;
3. Chicken should have the freedom to 'scratch' and to take 'dustbaths,' which implied that litter' should be present in the husbandry systems;
4. Chicken should be able to rest on perches.

These norms have in the course of time been translated by governments into more concrete requirements, which have often been adopted as design requirements in the design of chicken husbandry systems. I focus here on the EU legislation. In the 1980s, EU rules with respect to battery cages for laying hens were laid down in Directive 88/116/EEC. This directive stipulated the minimum requirements for laying batteries coming into use after 1 January 1988. The requirements were: at least 450 cm^2 floor area per hen, 10 cm feeding trough per bird, 40 cm height over at least 65% of the area and a floor-slope of maximally 14%. These requirements were a further specification of the first general norm above (enough living space),

but did not address the other norms. Addressing these other norms was in fact impossible in conventional battery cages and required the development of alternative systems. Main alternative systems that have been developed in the course of time are enriched battery cages and aviaries. Enriched battery cages are cages with special areas for perches, laying nests and litter. Aviaries are characterised by the presence of several levels on which the chickens can drink, eat and rest.

In 1999, new EU legislation was adopted implying a de facto phase-out of the traditional battery cage by 2012; no new traditional battery cages may be brought into service after 1 January 2003 (EU Council Directive 1999/74/EC). The new directive also contained requirements for enriched cages and for other alternative systems. For enriched battery cages the main requirements are (EU Council Directive 1999/74/EC, article 6.1):

> (a) at least 750 cm^2 of cage area per hen, 600 cm^2 of which shall be usable; the height of the cage other than that above the usable area shall be at least 20 cm at every point and no cage shall have a total area that is less than 2000 cm^2;
> (b) a nest;
> (c) litter such that pecking and scratching are possible;
> (d) appropriate perches allowing at least 15 cm per hen.

For other alternative systems like the aviary, the main requirements are:

1. The stocking density must not exceed nine laying hens per m^2 usable area (i.e. about 1100 cm^2 per hen);
2. At least one nest for every seven hens. If group nests are used, there must be at least 1 m^2 of nest space for a maximum of 120 hens;
3. At least 250 cm^2 of littered area per hen, the litter occupying at least one third of the ground surface;
4. Adequate perches, without sharp edges and providing at least 15 cm per hen.

This example shows how the general value of animal welfare was translated into more concrete design requirements. It is striking that this translation largely took place outside the design process or other engineering practices. Partly, this is the result of certain particularities of this example. Animal welfare was, and still is, a value that is rather alien to engineering and engineers lacked expertise to specify this value. Moreover, there was little market demand for alternative systems. Still, the example highlights a number of aspects that are more generally illustrative for the translation of values in design requirements.

First, the translation especially of new values into design requirements may be a long-lasting and cumbersome process. This also applies to values that are initially

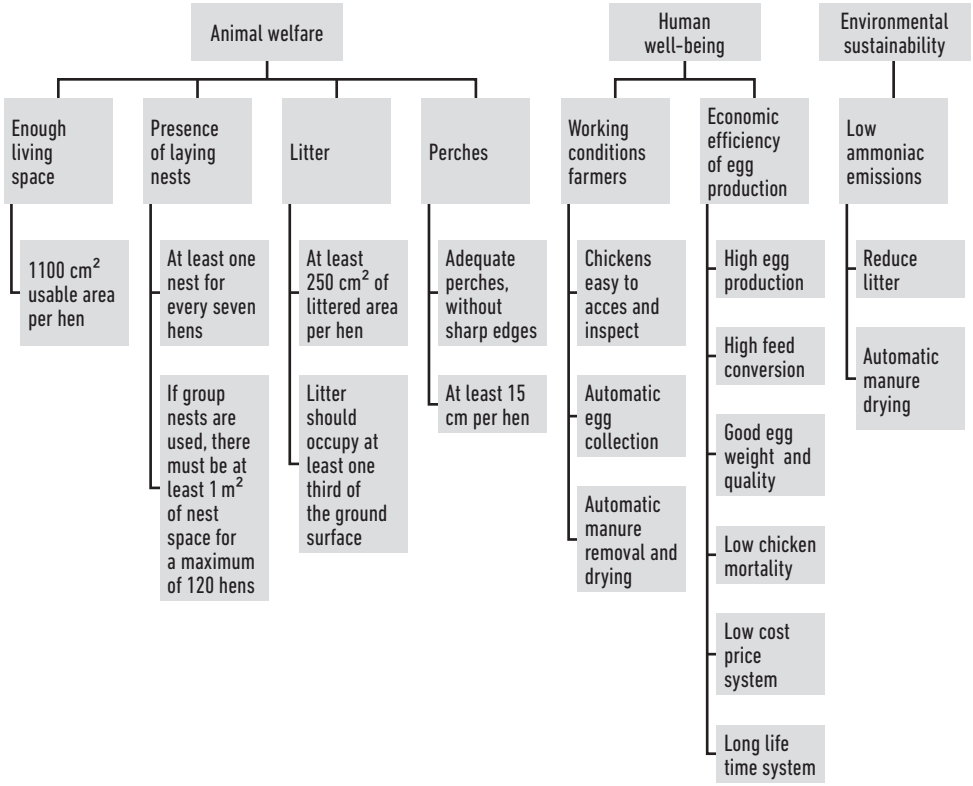
less alien to engineering than animal welfare. A nice illustration is Vincenti's description of how the broad notion of flying qualities for aircraft was translated into more specific requirements (Vincenti 1990: chapter 3). As he argues, flying qualities were initially ill-defined, contained subjective elements and were related to different, but related needs of aircraft designers and pilots. It took a mere twenty five years and much effort to translate ill-defined flying qualities into more or less well-defined design requirements.

Second, translation may require specific expertise, sometimes from outside engineering. In this case, ethology provided this expertise. In cases of environmental values, environmental science or ecology may be relevant. For values like privacy and trust, philosophical analysis may help to better understand these values and translate them into more concrete norms. Even values like safety and usability, which are more familiar to engineering, may require specialized expertise, as witnessed by the emergence of such disciplines as safety science, safety engineering and ergonomics.

Third, translation will often partly take place outside specific design processes. The chicken husbandry example is extreme in this respect; often the final translation from more general norms into specific design requirements will take place within the design process. Nevertheless, also in such cases engineers will often rely on specifications that are more generally available. Apart from legislation, a main source of such specifications are technical codes and standards, which are usually drawn up by engineers in standardization committees and which lay down requirements or guidelines for dealing with general values and considerations like safety and compatibility.

Fourth, the translation of values into design requirements is value laden. It can be done in different ways. Sometimes different (sub)disciplines offer different ways of specifying a value. Sometimes specification is made dependent on what is feasible with current technology or on trade-offs with other relevant values. The reason why Directive 88/116/EEC only addressed one of the four more general ethological norms was that it was deemed economically undesirable to formulate requirements that would de facto forbid the commonly used battery cage. From a philosophical point of view, a main question is when certain specifications are adequate or at least tenable.

Fifth, the translation of values into design requirements is context-dependent. Although animal welfare is a general value, its specification is different in the context of design of chicken husbandry systems than for example in the context of toxicity tests or medical experiments. EU Council Directive 1999/74/EC contained as much as three different specifications of requirements for chicken husbandry systems applying to three different types (layouts) of such systems.



Sixth, the example illustrates that values and design requirements have a hierarchical structure. In this case, the general value of animal welfare was first translated into a range of norms for holding chicken by ethologists, next a translation was made of these norms into very specific requirements by governments. In the next section, I will be exploring this hierarchical nature of values and design requirements in more detail and introduce the notion of a values hierarchy. Figure 1. A partial values hierarchy for the design of aviaries, a specific type of chicken husbandry systems. The design requirements for animal welfare are based on EU Council Directive 1999/74/EC.

2.3. Values hierarchies

As we saw in the animal welfare example, values and requirements are of a hierarchical nature. Design requirements, as it were, constitute the most concrete layer

of a hierarchy of values, norms and design requirements that can be identified or defined for a design project.[15] Figure 1 gives an example of a values hierarchy.

Whereas the upper layer of a values hierarchy consists of values, and the most concrete layer of design requirements, value hierarchies will usually, as in the example in Figure 1, contain an intermediate layer of norms. I use the notion 'norm' here for all kinds of prescriptions for, and restrictions on action. One kind of norms that are especially important in design are end-norms. An end-norm is a norm referring to an end to be achieved or strived for (cf. Richardson 1997: 50). The end can be a state-of-affairs but also a capability ('being able to play the piano') or even an activity ('to sing an opera'). End-norms are particularly important in design because design is aimed at the creation of technical artefacts or at least at blueprints for them. End-norms in design then may refer to properties, attributes or capabilities that the designed artefact should possess. Such end-norms may include what sometimes are called *objectives* (strivings like "maximize safety" or "minimize costs" without a specific target), *goals* (that specify a target like "this car should have a maximum speed op 150 km/hour") and *constraints* (that set boundary or minimum conditions). Whereas values are evaluative, norms are deontic. In fact design requirements are also deontic end-norms, because they guide design action. However, they are more specific than norms at the intermediate level. Therefore, it is usually worthwhile to distinguish a layer of more general norms in a values hierarchy (see Figure 2).

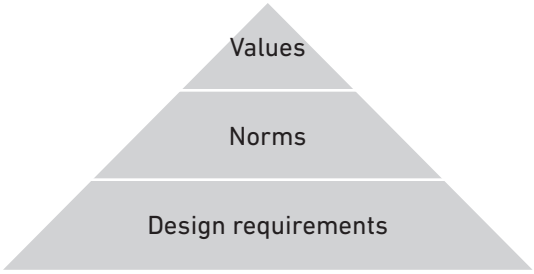


Figure 2. The three basic layers of a value hierarchy. Note that each of the layers may itself be hierarchically layered

[15] In the literature, such hierarchies have been called objectives hierarchies, objectives networks or objectives trees (e.g. Keeney 1992: chapter 3; Keeney and Raiffa 1993: chapter 2; Cross 2008: chapter 6). What I call a values hierarchy below resembles what (Keeney and Raiffa 1993) call an objectives hierarchy and what (Cross 2008) calls an objectives tree. Keeney (1992) distinguishes between fundamental objectives hierarchies and (means-end) objectives networks. My values hierarchies come closest to the latter but allow a larger heterogeneity of relations between the elements.

Figure 2 suggests that the formulation of design requirements is based on certain values. Although that is basically what I am claiming here, a range of clarifications is in place to make clear what this claim entails in my view and what not. First, it should be noted that the relation between the different layers of a values hierarchy in not deductive. Elements at the lower levels cannot be logically deduced from higher level elements. One reason for this is that the lower levels are more concrete or specific and that formulating them requires taking into account the specific context or design project for which the values hierarchy is constructed. The point is, however, not just that we should take into account contextual information, the point is also that there is usually a certain degree of 'latitude' or 'discretion' in translating higher-level elements in lower-level elements. Such translations are sometimes called *specifications*, a term I will also use.[16] Specification involves (value) judgment and usually more than one specification is possible. This is not to deny that we can formulate criteria for when a certain specification is adequate or tenable (I will be doing so in the next section), but these criteria will usually not narrow down the range of possible specifications to one specification that is the only one allowable.

Second, values hierarchies can be constructed top-down as well as bottom-up. In the latter case, one starts with more specific design requirements and looks for more general norms and values on which these requirements may be based or to which they may contribute. Often constructing a values hierarchy will require working in both directions. We have already seen that working top-down requires specification, but what is involved in constructing a values hierarchy bottom-up? One suggestion is that the elements higher in the hierarchy give an answer to the question *why* we aim for or adhere to certain elements lower in the hierarchy (Cross 2008: 81). This suggests that the higher-level elements have a motivating and justifying role with respect to lower-level elements. I will take up this suggestion by saying that the lower level elements are done *for the sake of* the higher-level elements.

The *for the sake of* relation is antisymmetrical (Richardson 1997: 54–57). If A is done for the sake of B, B is not done for the sake of A (unless A = B). It can easily be seen that values hierarchies are antisymmetrical in this sense. Chickens should have enough living space *for the sake of* animal welfare, but it is nonsensical to say that animal welfare is a value *for the sake of* chickens having enough living space.[17]

[16] Cf. Richardson (1997). In the engineering literature, specification is also used in a number of different meanings which I do not intend to imply here.

[17] Note that it does make sense, however, to say that animal welfare is a value (partly) *because* chickens should have enough living space. This suggests two things. First, that the relation *for the*

The reason for the antisymmetry of *for the sake of* is that the elements higher in the values hierarchy are more general and abstract than the lower elements. While you can do something specific for the sake of something more general; the opposite seems impossible.

The antisymmetry of the *for the sake of* relation suggests that the elements at the highest level of the values hierarchies are to be done for their own sake. The most obvious candidates for the highest level in the values hierarchy are therefore the so-called final values, which are defined as values that are strived for for their own sake (cf. chapter 1).

A number of things can be done for the sake of something else. The relation of A being done *for the sake of* B can therefore be seen as the placeholder for a number of more specific relations. One possibility is that A is a means to B. Another possibility is that A is a subordinate goal or end, the achievement of which contributes to (the achievement of) B. A third possibility is that A enables the achievement of B, without itself contributing to that achievement. If A takes away an obstacle to B, A may be done for the sake of B. If both A and B are values and B is a final value, A may be either an instrumental value, a contributory value or an enabling value. Health for example is a contributory value to human well-being. Health is not a mere means to well-being (as money may be) but rather it is conceptually part of well-being; it is sub-value (or sub-end).[18] If B is a value and A is a norm that prescribes a positive response to A, then A is done for the sake of B is in line with the more general relation between values and reasons for actions (norms) that I suggested in the previous chapters:

> (V) If x is valuable (in a certain respect) or is a value one has reasons (of a certain kind) for a positive response (a pro-attitude or a pro-behaviour) towards x

The *for the sake of* relation is normative. It can neither be reduced to a means-end or causal relation nor to a purely conceptual relation. The best way to capture the normativity of this relation is, I think, to say, that the higher elements provide *reasons* for the lower level elements. (Note that this is consistent with V). The notion of reasons refers here both to a motivational and to a justificatory element.

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sake of is not exhausted by its justificatory part that may be expressed by *because* and second, that the justificatory relation that is expressed by *because* may be bidirectional, as I indeed will suggest below.

[18] This does not rule out the possibility that health may also be a final value that is sought for its own sake. As Aristotle noted some things may be sought for their own sake as well as for the sake of something else.

I will focus here on the justificatory element. The normativity of the *for the sake of* relation suggests that the higher levels elements justify, or give (moral) authority to, the lower level elements. However, since, as argued earlier, lower levels cannot be deduced from higher levels, justification at a higher level is not automatically transferred to the lower levels. The degree of justification, or normative support, which is transferred from higher to lower levels depends on the plausibility or adequacy of the specifications made.

Since the *for the sake of* relation is antisymmetrical, it might appear to follow that normative support can only flow from the top to the bottom of the values hierarchies. Quite some philosophers seem indeed committed to such an assumption. The antisymmetry of *for the sake of* relation does, however, not necessarily imply the antisymmetry of normative support. The reason for this is that the *for the sake of* relation has an intentional direction which is absent in normative support. This can maybe best be seen by again considering the relation between values and norms as suggested by (V). As stressed in previous chapters, (V) is intentionally so formulated that it does not prejudice between two positions, i.e. either 1) values are more fundamental than norms and thus values justify norms or 2) norms are more fundamental and justify values. If we would maintain that justification can only flow top-down in a values hierarchy, we would be obliged to choose the first position. But can we avoid this choice while maintaining that norms can be adopted for the sake of values as Figure 2 implies?[19] Consider the norm 'you shall not kill' and the value of 'human life.'[20] It seems to me to make sense to say that you shall not kill for the sake of (respecting) the value of human life. It would be odd, however, to say that human life is valuable for the sake of not killing. Since the *for the sake of* relation is normative in the sense discussed earlier, it follows that the value of human life lends normative support to the norm 'you shall not kill.' It does not follow, however, that the norm therefore cannot be self-supporting or that it cannot lend normative support to the value of human life. In this specific example, I think it does both. 'You shall not kill' can, for example, be considered an evident or self-supporting norm on basis of Kant's categorical imperative or the Golden Rule.[21] Moreover, it seems to me to make sense to say that the value of human life, even if it is considered a final value and justified in itself, is additionally (and maybe redundantly) normatively supported by the plausibility of a set of

[19] I say 'can be' because Figure 2 does not commit me to the position that all norms are adopted for the sake of value; some may be based on other reasons.

[20] Frankena (1973: 87–88) mentions 'life, consciousness, and activity' as one of the final values. (He uses the term 'intrinsic value').

[21] There is no contradiction in stating that a norm is followed for its own sake and, in the meantime, for the sake of a value (cf. note 18).

norms that tell us to respect human life, like the norm 'you shall not kill.'[22] Norms and values can thus mutually support each other normatively, without suggesting a certain priority relation. Normative support can be bidirectional, even if *for the sake of* relation is antisymmetrical.

If support can be bidirectional, we no longer need to think of the final values at the top level in the values hierarchy as the source for all justification or normative support. Rather support can flow in different directions and from different sources. It should be noted, however, that nothing I have said rules out the possibility that some elements in a values hierarchy, like final values or norms, are worthwhile in themselves or are 'self-evident' without requiring justification or support by other elements. Moreover, the upper elements in a values hierarchy are often better supported by normative elements outside the values hierarchy than elements at the lower levels. The reason for this is that elements at the higher levels are more general and abstract and can therefore lend support from a large number of other cases and situations, while the elements lower in the hierarchy are context-specific and cannot lend direct support from normative elements in other contexts. That safety is an important value in engineering design is hardly controversial, in part because safety has turned out to be an important normative consideration in many concrete engineering projects. A specification of safety that is specific for a particular design project is much more likely to be controversial than the value of safety itself.

2.4. Specification

I will now further explore the relation or activity of *specification* by which values are translated into design requirements. Although specification proceeds top-down in a values hierarchy, what I am going to say about when a certain specification of a value into design requirements is adequate or at least tenable can also be applied as a critical assessment for values hierarchies that are constructed bottom-up. It might then be used to assess whether the design requirements sufficiently cover the value on which they are based and may potentially lead to new design requirements or the reformulation of existing design requirements (or the reformulation of the value).

The specification of values is to be distinguished from an activity that is somewhat related but different in scope and aim: the conceptualization of values.

[22] It should be noted that in the picture I am here sketching we need not think of final values as justified in themselves but only as sought for their own sake. Something can be valuable for its own sake without being self-justifying (cf. Korsgaard 1983).

Conceptualization of value is the providing of a definition, analysis or description of a value that clarifies its meaning and often its applicability. Ethologists, for example, conceptualized animal welfare as the fulfilment of certain ethological needs that animals like chicken have in 'natural' circumstances. Usually different conceptualizations of a value are possible. The value of individual human freedom may, for example, be conceptualized as 'the absence of external constraints on individual actions' or as 'the ability to make one's own choices in life.'[23] The second conceptualization strikes me as more adequate because it seems better to capture why we consider 'individual human freedom' a value. Most people do not strive for a life without any external constraints. They have friends and family; make commitments and promises, all of which usually introduce additional constraints, without necessarily feeling like a loss of freedom. What seems more important or essential to freedom is the ability to make such choices yourself, without being forced or manipulated to make a choice. As this example suggests, some conceptualizations may be more adequate than others. An important criterion for the adequacy of a conceptualisation, as suggested by this example, is whether the conceptualisation does justice to, or at least coheres with, the reasons we have to consider the value valuable in the first place. In many cases different conceptualizations of a value meeting this criterion may be possible.

Conceptualization is largely a philosophical activity that does often not require detailed knowledge of the domain in which the value is applied.[24] This is so because conceptualization does not add content to the value but merely tries to clarify what is already contained in the value. Specification, on the other hand, adds content and this content is context or domain specific. Specification therefore requires context- or domain-specific knowledge. For example, it might be known that – on the basis of experience and engineering analysis – the main safety risk of

[23] The example here may be a bit simplistic, but it is merely intended to show that values can be conceptualized in different ways and that not all conceptualizations are equally adequate or tenable.

[24] It is worth noting that the general conceptualization of animal welfare by ethologists in term of the fulfillment of certain ethological needs that animals like chicken have in 'natural' circumstances does require very limited domain-specific knowledge. The conceptualization does not require any detailed knowledge of what these needs or what natural circumstances would be, only that these can be somehow identified. Philosophers might indeed criticize this conceptualization of animal welfare on a number of grounds. They may, for example, doubt whether there exists such a thing as 'natural' circumstances and, even if such circumstances would have existed, they may question why these circumstances would provide a normative yardstick. (How convincing would it be to argue that killing or rape is part of human welfare or wellbeing because in 'natural' circumstances humans felt a need for them? Of course, animals are not humans). In fact, other conceptualizations of animal welfare are possible, for example, in terms of how animals 'feel,' which might be measured for example in terms of stress.

a certain type of technical installation is that it explodes. In that case, safety may be specified into the norm 'minimize the probability of the installation exploding.' In other cases, a technical installation may be very unlikely to explode but toxic substances may possibly escape from it. Safety may then be specified as 'minimize the probability and amount of toxic releases from the installation' or 'try to replace the toxic substance with a functionally equivalent non-toxic substance.' As these examples illustrate the adequacy (or least tenability) of a specification is usually highly context-specific. What is an adequate specification of the value of safety for the first type of installation is not an adequate specification for the second type of installation and vice versa.

Although specifying values requires more than philosophical analysis, a philosophical analysis of the activity of specification may be helpful to judge the adequacy, or tenability, of certain specifications that are made in engineering design. For the current purpose, specification may be defined as the translation of a general value into one or more specific design requirements. This translation may be broken down in two steps:[25]

1. The translation of a general *value* into one or more general *norms*
2. The translation of these *general* norms into more *specific* design requirements

The first translation implies a transition from the evaluative to the deontic (or prescriptive) domain. Values are relevant for evaluating the worth or goodness of certain options or objects. However, they do not directly imply certain prescriptions or restrictions for action. Norms, on the other hand, are deontic because they articulate certain prescriptions or restrictions for action.

For the transition from the evaluative to the deontic domain that is required in the first translation, the relation between values and reasons expressed in (V) is relevant. Here, we are interested in the case that 'x' is a value and (V) tells us that 'x' then corresponds with certain reasons that express a positive response to 'x.' In the design process, these may often be reasons to increase or even maximize 'x' if 'x' is a positive value like safety. However, increasing or maximizing a value may not always be a proper response; for some values it may be more appropriate the cherish them, to admire them, to protect them or to respect them. Moreover, although in context of design the proper response to a value may often be to take it into account in the design process and to try to embody it in the design, this is certainly not always the only or even the most appropriate response. Values like freedom and democracy might be appropriately translated into design requirements for

[25] In practice, the translation may be made in one step, but even then it may be analyzed as involving these two steps.

a product designed (cf. Sclove 1995), but they may also be translated into requirements for the design *process* rather than the product designed. My focus is here on the translation of values into design requirements, but a proper response to values in design may be broader than this specific focus.

Two criteria might be formulated for the adequacy or tenability of a certain translation of a value into general norms. The first is that the norm should count as an appropriate response to the value. The second is that the norm, or set of norms, is sufficient to properly respond to or engage with the value. The first criterion tries to avoid inappropriate responses to a value, the second tries to avoid that one response is selectively chosen which in isolation does not do justice to the value. Applying both criteria requires a judgment that is context-specific. In the context of a beautiful sunset, a proper response to the value of aesthetic beauty is to enjoy it; in the context of architectural design a proper response might be to respect the value of aesthetic beauty and to try to embody it in the design. In the first context, bothering about how the sunset can be made more beautiful would be an odd and inappropriate response, while in the second context admiring the beauty of the building would be odd as long as it has not been designed and built.

The second step in specification is the translation of general norms into more specific design requirements. The requirement can be more specific with respect to a) scope of applicability of the norm, b) the goals or aims strived for and c) actions or means to achieve these aims (cf. Richardson 1997: 73). An example is the specification of the general norm 'maximise the operational safety of a chemical plant' into the following design requirement: 'minimize the probability of fatal accidents (specification of the goal) when the chemical plant is operated appropriately (specification of the scope) by adding redundant safety valves (specification of the means).' In this case, the design requirement specifies the general norm in three dimensions, but specification may also be restricted to one or two dimensions.

A specification substantively qualifies the initial norm by adding information 'describing what the action or end is or where, when, why, how, by what means, by whom, or to whom the action is to be done or the end is to be pursued' (Richardson 1997: 73). Obviously, different pieces of information may be added so that a general norm can be specified in a large multiplicity of ways. Not all specifications are adequate or tenable, however. In general, one would want to require that actions – or in our case: designs – that count as satsificing the specific design requirements also count as satsificing the general norm (cf. Richardson 1997: 72–73). In the above example 'maximising operational safety' is specified as 'minimizing the probability of fatal accidents.' This specification is adequate if in all cases in which the probability of fatal accidents is minimized operational safety is maximised. Now arguably operational safety encompasses not only avoiding or at least minimizing

fatal accidents but also avoiding or minimizing accidents in which people get hurt but do not die. This does not make the specification necessarily inadequate, however. Maybe, it is known on the basis of statistical evidence for example that in this type of installation there is a strict correlation between the probability of fatal accidents and the probability of accidents only leading to injuries, so that minimizing the one implies minimizing the other. In that case, the specification may still be adequate. In other situations, it may be inadequate and it might be necessary to add a design requirement related to minimizing non-fatal accidents.

We can now also see why the specification of animal welfare in EU Council Directive 88/116/EEC may strike us as inadequate (see Figure 3). It translates only one of the more general norms for animal welfare into specific design requirements and neglects the others. Therefore meeting the formulated design requirements hardly seems to amount to a sufficient response to the value of animal welfare in the design of chicken husbandry systems.

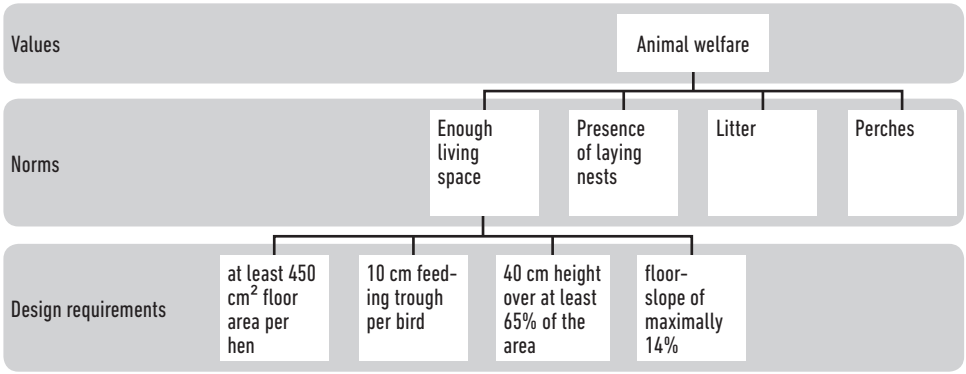

Figure 3. The specification of animal welfare in EU Council Directive 88/116/EEC

2.5. Design requirements

I will now look at the lowest level of a values hierarchy, design requirements. Design requirements are end-norms that specify certain properties, attributes or capabilities that the designed artefact should posses. But how specific should design requirements be? Should they, for example, refer to physical properties of artefacts, as in the case of the requirements for chicken husbandry systems discussed, or rather to functional properties? In this section, I will consider a number of requirements for the formulation of (design) requirements that have been proposed in the engineering literature (Sailor 1990; Grady 1993; Magrab 1997; Bray 2002; Young 2003; Hull, Jackson, and Dick 2005; Pahl et al. 2007; Buede 2009). Sometimes these requirements for requirements are incorporated in the

definition that authors offer for a design requirement, in other cases they are presented as attributes that requirements should have. Buede (2009: 172), for example, mentions the following attributes that individual requirements should have: unambiguous, understandable, correct, concise, traced, traceable, design independent and verifiable. In addition, he mentions the following attributes that are required for the set of requirements: unique, complete, consistent, comparable, modifiable, attainable and organized. Many of the proposed attributes are not very controversial, and some are rather straightforward. I will therefore focus here on the ones that seem to me most relevant or controversial.

Below, I will discuss in more detail three proposed requirements for individual requirements and three proposed requirements for the set of requirements. The attributes of individual requirements that I will discuss are 1) that requirements should be confined to what is required, 2) that requirements should be design or solution independent and 3) that requirements should be verifiable. The attributes of the set of requirements that I will discuss are that 1) the requirements should be non-redundant, 2) that the set of requirements should be complete and 3) that the set of requirements should be free from conflict.

Required

Several authors maintain that design requirements should be restricted to required or essential requirements (Grady 1993; Young 2003; Buede 2009). Authors who defend this perspective usually also believe that only non-negotiable requirements should be included because only these are really required (e.g Young 2003: 55) and that requirements should always be defined as constraints or goals, fixing a minimum or desired value, rather than as objectives, which are typically formulated in terms of "as much as possible" or "minimize …" (e.g Young 2003: 56; Buede 2009: 172–173). It should be noted, however, that there is no agreement on this issue in the engineering literature. Pahl et al. (2007: 147), for example, allow the inclusions of both requirements that are demands and ones that are wishes, although they advise to indicate the difference in the requirements list. Hull et al. (2005: 79) discuss the possibility of mentioning a mandatory value, a desirable value and the best value.

There are several reasons why it is not advisable, at least not as a general strategy, to restrict design requirements to what is minimally required. One reason is that there is (empirical) evidence that customers and users do not just want their minimal requirements to be met but that they often base their preference for products, and their willingness to buy these products, on product attributes that are not strictly required but add a lot of value for them personally (cf. Matzler and

Hinterhuber 1998; Pahl et al. 2007: 150–151). Companies producing such products thus have good reasons to include these so-called attractiveness requirements in addition to the required properties among the design requirements. A second reason is that restricting the requirements to what is minimally required automatically seems to imply a commitment to a satisficing approach, while doubts can be raised whether that is a good approach to design problems. (I will discuss satsificing in more detail in chapter 6).

It must be conceded, nevertheless, that restricting the requirements to what is minimally required may be part of a design approach in which the solution space is initially constrained to those solutions that meet the required requirements and, next, that a choice is made among those options using a set of evaluation criteria that are desirable rather than minimally required, and which might be formulated in optimizing rather than satsificing terms.[26] The advantage of such an approach is that it does not constrain the solution space too much, which might result in the rejection of options early in the design process that would have been worth considering (Buede 2009: 155). The disadvantage of this strategy is that considerations that are not expressed in the design requirements can also not guide synthesis, i.e. the development of options, so that options that score well on these considerations are less likely to be developed.

Solution independent

A second issue is whether requirements should be formulated in a solution-independent way, as is often considered desirable in the engineering literature (e.g. Magrab 1997: 66; Bray 2002: 14; Hull, Jackson, and Dick 2005: 85; Pahl et al. 2007: 158; Buede 2009: 172). This is often expressed by saying that design requirements should be stated in functional or performance terms or in terms of capabilities rather than in structural or physical terms. The translation of functional requirements in technical features or engineering characteristics is then to be made in the rest of the design process, but is not part of the formulation of design requirements. The main reason for formulating solution-independent design requirements is that they do not unnecessarily restrict the design process, allowing designers to consider more options, including innovative solutions. Similar arguments are given in discussions about legislation and technical codes and standards, which

[26] (Pahl et al. 2007: 147) make a distinction between selection which depends on the fulfilment of the demands and evaluation which is only to be applied to options that already meet the demands and can also include wishes.

usually are formulated independent from specific design processes (e.g Kirwan, Hale, and Hopkins 2002; Coeckelbergh 2006).

In the case of chicken husbandry systems discussed above, the legal requirements were not solution-independent. They were formulated as hardware requirements that are different for different systems in the case of Directive 1999/74/EC. The disadvantage of this formulation is that it blocks innovations, even ones that perform better in terms of the underlying value of animal welfare. In this case, the legislators probably considered performance requirements too vague to guide design and to be upheld in possible court cases. As this example suggests, there may also be arguments for formulating design requirements in solution-dependent terms. Moreover, solution-independence is usually a matter of degree rather than absolute. Performance measures, for example, are often not completely solution-independent. Operationalizations and testing methods for the strength of a material which are well-defined for steel may, for example, be inapplicable or ill-defined for composite materials (cf. Van Gorp 2005). More abstract values, like safety and sustainability, are often solution-independent but usually they are too broad and vague to directly guide the design process as design requirements.

Another reason for doubting the possibility of formulating design requirements that are completely solution-independent has to with the ill-structured nature of design problems that I discussed in chapter 1. As we have seen, one of the implications is that problem formulations are often solution-dependent. In other words, fully defining the design requirements will often only be possible if the solution space is restricted or certain solutions are focused on. So while there are good reasons to formulate design requirements as solution-independent as possible, requiring that design requirements are always completely solution-independent seems a bridge too far.

Verifiable

The third often mentioned requirement is that the design requirements should be verifiable, i.e. that it is possible to check whether they have been met (or the degree to which they have been met). Some authors take this to imply that design requirements should be quantifiably measurable (Sailor 1990; Grady 1993; Buede 2009).[27] While verifiability seems me a reasonable requirement, it does not require quantitative measurement. There are other ways of verifying whether a system

[27] I take quantitative measurement here to mean what is also called extensive measurement (Krantz et al. 1971: chapter 3).

meets certain requirements. In the design of software systems, design requirements may sometimes be verified by simulation and even by logical proof without any quantitative measurements. More generally, verification can also be qualitative and can be based on judgment. The user-friendliness of a system may be verified by asking potential users to use the system and report and judge the experienced user-friendliness. It must be admitted that this type of verification procedures do not always provide a final judgment on the user-friendliness of the system and nor are they error-free. These potential problems, however, are common to all verification procedures; also quantifiable measurements may be undecided for example due to statistical variation and may contain errors.

Although verification does not require quantitative measurement, it involves measurement in a broader sense. Krantz et al. (1971) provide the following general characterization of measurement:

> When measuring some attribute of a class of objects or events, we associate numbers (or other familiar mathematical entities, such as vectors) with the objects in such a way that the properties of the attribute are faithfully represented as numerical properties (Krantz et al. 1971: 1).

When an engineer judges whether a certain design option meets a design requirement this can be understood as assigning a 0 (does not meet the requirement) or a 1 (does meet the requirement) to that option. In as far as the engineering judgment is reliable this can be seen as a faithful representation of a property of the option (does it meet this design requirement?) by a number. All verification then involves measurement, but not necessarily quantitative measurement.[28]

Non-redundant

Non-redundancy requires that each requirement is mentioned once (Hull, Jackson, and Dick 2005: 85).[29] This seems a rather straightforward requirement for the set of requirements but it is not. The reason is that achievement of one requirement may influence the achievement of other requirements. This is so because requirements are often not independently realizable. There are approaches to design

[28] I use the verb 'involve' because sometimes verification may be based on independent measurements but in other cases the verification itself may be the measurement.

[29] Buede calls this: "unique – requirement(s) is (are) not overlapping or redundant with other requirements." This terminology is misleading because it may very well be possible to formulate different sets of design requirements for a design problem each of which is non-redundant. Non-redundancy does not imply or require uniqueness.

that try to guarantee the independent realisability of design requirements, like Suh's axiomatic design approach (Suh 1990, 2001). It may be doubted, however, whether independent realisability is always achievable; after all it depends not only on the design approach but also on features of the world. Moreover, some redundancy between design requirements due to a lack of independent realisability is not necessarily problematic as long the design requirements are primarily used to develop design options. It might be more problematic in evaluation because it may give some requirements more weight than intended. This issue will be further discussed in the next chapter.

Completeness

Completeness implies that all relevant considerations are expressed in the design requirements (Hull, Jackson, and Dick 2005: 85; Buede 2009: 172). It is obvious that completeness is a desirable property of the set of requirements. It will usually, however, be impossible to attain completeness without first considering possible solutions. The reason is that design requirements are often partly solution-dependent. It is only through the proposal of possible design solutions that a design problem gets better structured and design requirements can be more fully formulated. The formulation of design requirements is therefore usually an ongoing effort during the design process. Consequently, design requirements will be adjusted, reformulated and added during the design process. As I will argue in more detail below, designed artefacts almost always have properties beyond the requirements for which they have been designed. Since such properties may turn out to be undesirable, they may be a reason to add additional design requirements if the product is redesigned. As Buede rightly remarks: "Completeness is a desired property but cannot be proven at the time of requirements development, or perhaps ever" (Buede 2009: 172).

Consistency

Consistency refers to the absence of conflicts between requirements. Conflicts between requirements may basically take two forms.[30] One form is logical contradiction. One requirement may require increasing weight, another minimizing it. Such logical contradiction should, if possible, be avoided because it frustrates the

[30] Richardson (1997: 145) distinguishes 5 levels of conflict in addition to logical impossibility.

possibility for the design requirements to guide the design process.[31] More often, however, requirements will conflict *given certain technical possibilities*. Such conflicts will often only become clear during the design process and attempts can be made to resolve these conflicts by developing new technical possibilities. In general, it is neither feasible nor desirable to avoid this type of potential conflict during the analysis stage of the design process. It is not feasible because these conflicts often only become apparent when various possible solutions have been developed and tried out. It is not desirable to avoid such conflict because even if it is known that requirements conflict, given the existing stock of technical solutions, it might be possible to develop new innovative technical options in the design process that avoid or at least soften the conflict. Conflict between design requirements is in fact an important driving force for technological innovation. Conflict between design requirements is more problematic for evaluation and choice in design, topics to which I will turn in the next chapters.

2.6. The role of design requirements in the design process

The formulation of design requirements is an important first step in better structuring the design problem (cf. Vincenti 1990; Simon 1996). One might even hope that the formulation of design requirements results in a well-structured problem, so that the solution of the design problem follows directly or even logically from the design requirements. This hope indeed seems a main motivation behind some of the requirements for design requirements that have been formulated in the literature like being required, quantifiably measurable, complete, non-redundant and free from conflict. Most of these requirements for requirements are, however, quite problematic as we have seen.

In general, formulating design requirements is therefore just a first step in better structuring the design problem. Other activities that are crucial to design like synthesis, simulation and evaluation are needed as well to make the design problem better-structured. It might be that the final set of design requirements makes the design problem well-structured, usually however this final set will be the result of the completion of most of the design process (possibly excluding detail design and prototype testing) rather than solely the result of problem analysis and specification.

The set of design requirements with which the remainder of the design process starts after the analysis stage will usually be incomplete and not free from conflicts.

[31] Strictly speaking, anything follows from logical contradiction, so that any design would do if the design requirements logically contradict each other.

This is not to deny that design requirements play an important role in the subsequent stages. While requirements are not logically determinative for the outcome of the design process, they at least constrain possible outcomes. The formulation of requirements in the early phase of the design process is a first attempt to understand the design problem and imagine possible solutions. Indeed, the formulation of the design requirements may be seen as a first, provisional, ill-defined and very global *representation* of the artefact that will eventually be produced (Goel and Pirolli 1989; Goel 1992). During the design process this global representation will be re-interpreted, changed and translated into (artefact) representations that gradually become more concrete and well-defined, ending up with a design drawing that may function as blueprint for the production process.

Design requirements thus constrain the design process by reducing the number of possible outcomes (Bucciarelli 1994: 127–151; Kroes 1996). In the same vein, they enable the design process. Reflection on the formulation of the design requirements can make the design problem less ill-defined and may suggest certain design solutions. Design requirements will often function as or suggest *design heuristics*, i.e. search rules for possible solutions (Koen 2003). Also more general norms may function as or suggest design heuristics, as happened in the development of alternative housing systems for laying hens (Van de Poel 1998). Design requirements may also play a role in the evaluation of alterative designs or they may suggest *evaluation criteria* (see chapter 4).

While requirements can be seen as a first and incomplete representation of the artefact that is eventually to be produced, the produced artefact can be conceived as the *embodiment* of the design requirements. It should be stressed that the same set of requirements in principle can be embodied in different artefacts and that the ideal or perfect embodiment of a set of requirements in an artefact usually does not exist. Imperfection derives from two sources. One is that usually trade-offs between the requirements will need to be accepted because often not all requirements can be met fully at once.As the designer David Pye has argued:

> The requirements for design conflict and cannot be reconciled. All designs for devices are in some degree failures, either because they flout one or another of the requirements or because they are compromises, and compromise implies a degree of failure.
>
> Failure is inherent in all useful design not only because all requirements of economy derive from insatiable wishes, but more immediately because certain quite specific conflicts are inevitable once requirements for economy

> are admitted; and conflicts even among the requirements of use are not unknown (Pye 1964: 77).[32]

The other source of imperfection is the fact that artefacts always have properties which are not intentionally designed into them. These properties, which are often latent, may manifest themselves in the form of the so-called *secondary effects*. Secondary effects are consequences of artefacts that were not intended during design. They may arise from more or less inherent properties of artefacts but also from the way artefacts are used, maintained, disposed et cetera.

Some secondary effects may be impossible to foresee or affect during design, but as Langdon Winner notes:

> Along with those effects (…) which are absolutely unforeseen and uncontrollable are those which are susceptible to foresight and control but are never limited by either one. To see why they occur in this manner we should consider two more peculiarities of the "unintended consequences" (…): (1) that they are almost always negative or undesirable effects and (2) that unintended consequences are not not intended (Winner 1977: 97).

The distinction between 'not intended' and 'unintended' is the distinction between what is deliberatively avoided (as much as possible or feasible at least) and what is not taken into account or taken for granted, even if it may be regretted. Winner's suggestion is that the unintended negative consequences of technology are often not deliberatively avoided due to excusable ignorance but because the developers of technology prefer to neglect them because it makes it easier or less expensive to develop new technology. As a result, "[n]egative side effects… are experienced as necessary evils that we are obliged to endure" (Winner 1977: 98).

Whatever the exact reasons why possible secondary effects of technology are sometimes neglected in design, from a moral point of view this neglect seems undesirable. It indicates that certain relevant values are apparently not properly taken into account in the design process, i.e. the set of design requirements is incomplete. The lesson for incorporating values in design is thus that the range of value considerations often is or should be broader than those that might seem relevant at the start of the design process when the design requirements are formulated.

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[32] Pye goes on to argue that design is therefore necessarily arbitrary. I disagree. Although no logical necessity is involved, I believe choices in design can be made in a practically rational way even if design requirements conflict. This will be the topic of part 2.

This observation is in line with a point earlier made: the formulation of design requirements is not restricted to the first phase of the design process but is, or at least should be, an ongoing process and design requirements may be changed or added as the design problem and possible solutions evolve. New design requirements and new relevant value dimensions may even arise when a product is used. Design, and hence the incorporation of values in design, is an iterative process. Iterations occur not only within the design process of one specific artefact, but also in successive or ongoing design processes in which experience with the earlier use and operation of a technology are taken into account.

2.7. Conclusions

In this chapter I have discussed the values hierarchy and the relations of specification and *for the sake of* as ways to relate general and abstract values to specific design requirements that can guide the design process. These conceptual tools can be used to translate values into more specific design requirements. They may also be used to reconstruct for the sake of which values certain design requirements are pursued. Usually values hierarchies will be constructed by a combination or iteration of bottom-up and top-down moves, so adding an element of reflection and critical discussion to the formulation of both values and design requirements in the design process.

As we have seen the specification relation is non-deductive and context-dependent. It implies certain value judgements. Although I have proposed certain criteria to judge the adequacy of a specification, often more than one specification will be reasonably defensible. Given that in design usually one specification has to eventually be chosen, one might wonder how to choose between competing reasonable specifications or how to deal with disagreements between the different parties involved in design about the specification to be used in the actual design process. In chapter 7 I will have more to say on these issues; for the moment I only want to point out that the approach proposed in this chapter at least helps to trace more precisely the value judgements and possible disagreements about them, even it does not offer a way to solve these conflicts.

More precisely, the reconstruction of a values hierarchy makes the translation of values into design requirements not only more systematic, it makes the value judgements involved also explicit, debatable and transparent. They become explicit in the specific translations that are made between the different levels of a values hierarchy. This explication creates room for critical reflection on the translations made and makes these debatable between the parties involved. Moreover, a values hierarchy may be helpful in pinpointing where exactly there is disagreement

about the specification of values in design. Finally, a values hierarchy may, once the designers have chosen a specific specification, make those choices, and especially the implied value judgements, more transparent to outsiders. This is important because design usually impacts on others than just the designers. Although transparent choices are not necessarily better or more acceptable, transparency seems a minimal condition in a democratic society that tries to protect or enhance the moral autonomy of its citizens, especially in cases that design impacts on the life of others than the designers, as is often the case.

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Organisational Safety Culture Principles

1. What is this thing called culture?

1.1. Man and culture

The scientific study of culture shows great variety and various disputes and scholars often differ on what culture actually 'is'(Keesing 1981). Unlike animals, humans develop a culture. Whereas the meaning of an animal's behaviour at one end of the world will be comparable to the meaning of a similar animal's behaviour at the other end, the ideational systems and convictions of humans from both these ends are often quite dissimilar. According to Geertz, there is no culture without humans but, also, 'more significantly, without culture no men'(Geertz 1973: 49).

An early notion, still echoing imperialistic times, placed cultures on a single continuum ranging from savage (low) to civilised (high), with high cultures obviously enjoyed by the colonialists and low cultures held by the conquered natives (Avruch 1998). This view could be labelled 'colonialist,' being both ethnocentric and evaluative and putting much emphasis on refinement and (evolutionary) development. This notion of social evolution was later dismissed by many in favour of a descriptive stance, emphasising the uniqueness and variety of cultures, none of them superior over or more developed than the others (*ibid*.).

An important function of culture is related to the reduction of uncertainty (Van Hoewijk 1988) or even anxiety (Schein 2004), which, consequently, leads to more continuity, because less time is spent on various mutual adjustments within a group. The fact that people know what to expect in a variety of situations – e.g. with regard to particular rituals (like celebrations, meetings, appointments and so on), the expression of emotions, dress codes, behaviours, *et cetera* – makes

life more predictable and, hence, more fluent. Culture has also been linked to adaptation (Schein 1992) and habituation. Habituation is well-developed in all organisms that have a nervous system – the working of this mechanism has been described in as primitive a life form as the marine snail (Kandel & Schwartz 1985: 817 ff.).[1] Adaptation is important for learning, for continuity and therefore for survival. Forces from outside the organism that demand its adaptation will initiate change;[2] in this view, cultures are considered both functional and well-adapted to their environment. However, while adaptation and learning are both necessary aspects of culture, they neither define its essence nor its working mechanisms.

As early as 1952 Kroeber and Kluckhohn had already compiled a list of 164 definitions of culture (Kroeber & Kluckhohn 1952), so it does not appear useful to embark on own definitional cruise. Hofstede defines culture briefly as 'the collective programming of the mind, which distinguishes the members of one group or category of people from another' (Hofstede 2001: 9) and considers culture 'mental software.'[3] He distinguishes three levels of such mental programming (Hofstede 1991: 6; 2001: 3):

1. Human nature: universal;
2. Culture: collective; and
3. Personality: individual.

Human nature corresponds to the programs all humans around the world are instilled with, but this 'software' can be influenced by both culture and personality. For instance, the way an individual expresses his or her anger will be determined both by this person's personality and culture (and situational conditions, but these are kept out of the discussion for the time being). Applying the psychoanalytical idiom to this three-way split, human nature would represent the *Id*, personality would be considered the *Ego* and culture, also encompassing various assumptions about ethics and behaviour, would represent the *Superego*. Considered in this way the attention for (organisational) culture from a managerial point of view is certainly not surprising.

Hence, culture is distinguished from human nature and personality in that it is shared by a defined group of people, whereas human nature and personality are not. Culture is often considered the 'collective memory'[4] of a group and is

[1] For instance, Castellucci et al. (1978) have shown that repeated stimulation of a single nerve cell results in this cell not responding to that stimulus anymore.

[2] Please note that Schein (Schein 1992: 298 ff.) follows a similar reasoning about culture change.

[3] Following Geertz, who refers to 'plans, recipes, rules, instructions, [...] programs' (1973: 44).

[4] Human nature is shared by everybody and a personality is held by only one person. Additionally, Hofstede considers culture the 'personality' of a group (2001: 10).

therefore thoroughly intertwined with the history of that group. Moreover, the term 'memory' implies that culture is learned, not inherited. Importantly, one person can belong to many groups and can therefore share several cultures with different people. This particular characteristic makes the study of culture extremely difficult, because to what particular culture should any observed or otherwise assessed regularities of groups be attributed? This issue will be taken up more extensively in Section 2.3.

(National) cultures should not be compared normatively. However, within its bounds a culture provides norms for thoughts and action, perceptions and behaviour. Therefore, within a (national) culture actions and justifications for these actions can be compared to the norms that have developed within that culture (Hofstede 2001: 15). Indeed, such norms can become part of the culture and define its core, alongside its values. Consequently, culture provides one of the anchors for behaviour. This behavioural aspect is actually not captured in the definition supplied by Hofstede. Anthropologists Spradley and McCurdy (1975) define culture as 'the acquired knowledge people use to interpret experience and generate behavior.' Combining this definition with Hofstede's results in:

> Culture is the acquired and collective knowledge groups or categories of people use to interpret experience and generate behaviour, which distinguishes them from other groups or categories of people.

In this definition the learned and shared aspects of culture as well as its sense making and action components are captured. As satisfying a definition as it might seem, it still misses the fuzziness of the concept, which is captured in Spencer-Oatey's (2000) definition:

> Culture is a fuzzy set of attitudes, beliefs, behavioural conventions, and basic assumptions and values that are shared by a group of people, and that influence each member's behaviour and each member's interpretations of the 'meaning' of other people's behaviour.

Attempting to reveal the essence of a culture raises an important question; i.e. to what extent are cultures comparable and to what extent are they unique (Hofstede 2001: 24 ff.)? This distinction is discussed in various (social) sciences, e.g. sociology, anthropology, cross-cultural psychology, and brings along its own vocabulary (*ibid.*). Basically, it pertains to the issue of generality and specificity; *Gestalt* (unique holistic configurations) versus *Gesetze* (general laws); *idiography* versus *nomothetic*; and *emic* (as in phonemic, i.e. unique) versus *etic* (as in

phonetic, i.e. general). Evidently, this discussion also sheds some light on the issue of safety culture and it will be taken up further below. An argument of the generalists could be that each group (collective, category, society) has to face similar problems during their lifetime. However – as the specifists would retort – each group will develop solutions based on their unique personal situation. It would be too much of a simplification to narrow this discussion down to a 'basic problems focus' versus 'unique solutions focus' dichotomy although the aspect of survival is quite important in this discussion. Survival of the organisation is also the primary incentive for change in Schein's conception of organisational culture, resulting in (external) adaptation and (internal) integration (1992: 51 ff.).

An outcome of a generalist approach is that cultures can be described with a limited number of aspects, e.g. dimensions, facets or factors. A unique culture approach does not have this common underlying framework and its descriptions are limited to single cultures. However, either approach can ultimately lead to a third approach, that is, a typology of cultures. All three approaches are well represented in the organisational culture literature and can be discerned also in literature on safety culture. Again, this topic will be discussed more extensively below.

Summarising, humans develop a culture when they interact and try to achieve something. This culture is primarily locally defined. Having acquired this culture not only means that an influence is exerted on behaviour, but also that other people's behaviour is interpreted in this culture's way.

1.2. Layers of culture

Next to the levels of mental programming present in humans – i.e. universal, collective and individual – and the various levels of aggregation at which culture can be studied – e.g. societal, regional, occupational, organisational – most scholars consider culture as something consisting of a core surrounded by one or more layers, not unlike the anatomy of an onion. Whereas the core is something (deeply) hidden, the culture projects itself gradually through and onto the outer layers. The more remotely a layer is located from the core, the more easily it can be observed but also the more indirect, or interpretive, its relation with the core becomes. This simply implies that it is not straightforward to understand a culture from its outer layer(s). With regard to changing a culture, a similar rule is sometimes put forward: the more deeply a layer is located, the more difficult it becomes to actually change it (Meijer 1999; Sanders & Neuijen 1987). Hofstede, citing Bem, argues that a particular culture can be more effectively changed by starting with the practices of the outer layers, not the values of the core (Bem 1970; Hofstede

2001: 12). The latter change only gradually, with different time estimates for different levels of culture. For instance, a substantial change in national culture might take no less than a millennium (Hofstede 2001), whereas an organisational culture around twenty-five years (Schein 1992).Various conceptions of the layers of culture are presented in Table 1.

Table 1. The layers of culture according to various authors

Author(s)	Central core	Layer 1	Layer 2	Layer 3
Deal & Kennedy (1982)	Values	Heroes	Rites and rituals	Communication network
Van Hoewijk (1988)	Fixed convictions	Norms and values	Myths, heroes, symbols, stories	Codes of conduct, rituals, procedures
Hofstede (2001)	Values	Rituals	Heroes	Symbols
Meijer (1999)	Fundamentals	Practices		
Rousseau (1990)	Fundamental assumptions	Values	Behavioural norms	Patterns of behaviour; and artefacts (= 4th layer)
Sanders & Nuijen (1987)	Values and principles	Rituals	Heroes	Symbols
Schein (2004)	Basic underlying assumptions	Espoused values	Artefacts	
Spencer-Oatey (2000)	Basic assumptions and values	Beliefs, attitudes and conventions	Systems and institutions	Artefacts and products; rituals and behaviour
Trompenaars & Hampden-Turner (1997)	Basic assumptions	Norms and values	Explicit culture (e.g. behaviour, clothes, food, language, housing)	

All authors have something quite deep and profound positioned at the core – values, convictions, principles, fundamental or basic assumptions – but beyond that there are differences, not so much concerning the nature of the layers, but regarding their position in the onion. Importantly, of the authors mentioned in Table 1 the scholars Hofstede, Spencer-Oatey and Trompenaars & Hampden-Turner focus mostly on national culture, whereas the others have primarily organisational culture in mind. Regarding organisational culture, Hofstede argues that the core – i.e. the values – is less relevant for the study of organisations, although it offers a reflection of the organisation's national values, i.e. the values of the country where the organisation is situated. Hofstede therefore maintains that the notion

of (national) culture does not apply so much to differences between organisations within a country. They only differ in what he calls 'practices,' i.e. the outer three layers of his onion: rituals, heroes and symbols (Hofstede 1991: 182–183).

Schein makes no difference amongst the more visible aspects of culture, i.e. between rituals, heroes and symbols, all of which he sweeps under the heading of 'artefacts' along with all visible behaviour.[5] However, he divides the core into 'espoused values' and 'basic assumptions,' hereby indicating that he does not take the values for granted that members of an organisation express when asked about these. Schein also makes a point of calling his core 'basic assumptions' and not 'values.' To him, values are still negotiable whereas basic assumptions are not (Schein 1992: 16). As it can be seen in Table 1, more authors prefer this distinction between (basic) assumptions on the one hand, and values on the other; this way values (and attitudes and beliefs) are modelled to still change more radically, whereas the (basic) assumptions will not.

Spencer-Oatey introduces the notion of institutions, a topic that will be discussed later when the process of culture development is discussed. Institutions either teach or otherwise develop and disseminate some of the values of a culture. As it is clear from the Table, at this stage these values are not internalised yet, to the extent that they are cultural values.

This rather extensive discussion should make another point clear, namely that the labels given to the layers are typically assigned from an analyst's point of view. For a member of a particular culture these aspects are thoroughly intertwined and their meaning is obvious. It is therefore the researcher who labels these activities as such and in many cases their difference is not clear-cut.

Regarding research on culture it is possible to distinguish two contrasting approaches; one approach considers culture a socio-cultural (i.e. behavioural) system, whereas the other considers it an ideational system, i.e. a system comprising ideas, concepts, rules and meanings (Keesing 1981: 68). Whether it is sufficient to observe the practices and not understand their underlying rationale seems much more a matter of preference for a particular paradigm than something that can be resolved through scientific inquiry. On the one hand, researchers observing only practices sometimes might be bothered by their inconsistency, their irrationality or their incongruence and might end up relying on basic, behavioural psychology

[5] Pedersen and Sorensen, taking Schein's research model as a starting point, bring some diversity to his rather amorphous artefacts, distinguishing (1) physical symbols, (2) language, (3) traditions and (4) stories amongst them, all of which they consider important for a cultural analysis (Pederson & Sorensen 1989: 29).

(cf. Avruch 1998: 19). On the other hand, researchers focussing on the core have a hard time untangling it.

It is, however, important to look a little deeper into what is inside the core. Several authors refer to the core as 'deep' (Schein 1990: 109). This immediately triggers the question as to what deep exactly is, or entails. Deep appears to refer to something fundamental and pre-conscious. People become emotional when their fundamentals are questioned or under attack (Avruch 1998; Hofstede 1991), often without being aware why this is so important to them. Moreover, '[t]he more deeply internalised and affectively loaded, the more certain images or schemas are able to motivate action'(Avruch 1998: 19).

It is quite illuminating to bring up the reason for Schein to consider organisational culture as something that goes beyond the notion of 'practices.' After the Korean War, Schein and his colleagues worked closely with prisoners of war (POWs) who had been brainwashed by the Chinese.[6] Whereas some of them simply distanced themselves from the ideas being forced upon them, others had adopted a communist worldview and had even confessed to 'crimes' they did not commit, that is, not from a Western point of view. Somewhat later, Schein began to see parallels between the beliefs of these POWs and the beliefs schools, private and public organisations try to establish in their pupils and personnel, albeit through a much milder process (*ibid.*). According to Schein, it is possible to provide people with such strong tacit beliefs, which are indeed much deeper than the more superficial 'practices' Hofstede has in mind regarding his distinction between organisations. This is not to say that Schein's basic assumptions and Hofstede's values coincide. Hofstede's values are indeed acquired at a much earlier stage – Hofstede claims before the age of ten – and are therefore quite static and rather fixed. Schein's basic assumptions are more dynamic and subject to change, but changing these requires much effort and unleashes 'large quantities of basic anxiety' (Schein 1992: 22) because members of the organisation lose many of their certainties for a period of time. It is therefore not surprising that this organisational change process has been likened to the process of mourning (Kets de Vries 1999).

Yet, culture is not only deep because it is so fundamental and covert, it is also immensely patterned and therefore related to everything we think, perceive and do. When attempting to change one belief, we have to change many related ones, and much that has been built upon these. The 'large quantities of basic anxiety' and the process of mourning mentioned here are quite understandable when such basic belief networks are taken apart.

[6] Afterwards, the process through which these POWs have been converted by the Chinese was named 'coercive persuasion' (Schein 1992: 327–329; 1999).

Trying to formulate such deeply seated assumptions, these 'webs of significance' as Geertz calls them (1973: 5), will be particularly difficult because they are so taken for granted (Schein 1992) that, within the boundaries of a culture, they are never challenged and, consequently, never have to verbalised. Because of its fundamental nature, culture can be blinded by itself to itself. Schein's distinction between basic assumptions and their verbal counterpart, i.e. espoused values, seems therefore quite valid and sensible. Comparable reasoning can be found with Bloch (1998) who purports that much (conceptual) knowledge – and, hence, also cultural 'knowledge' – is essentially non-linguistic and acquired primarily through experience, not through explanation, i.e. communication. When such knowledge is 'rendered into language,' its character is also changed (*ibid*.: 7). Hence, what is considered 'deep' can also be considered non-linguistic and implicit. Making this deep knowledge explicit also changes its overall character.

Summarising, the whole idea behind the onion model seems to depict the essence of culture as something hidden rather deeply under a layered set of more or less visible manifestations upon which it exerts its influence. These layers can function as a key to the nature of the underlying culture.[7]

1.3. The development of culture

A straightforward account of the development of culture comes from Hardin (2009); simply stated: (behavioural) experience leads to knowledge leads to culture. This is not to say that all experience leads to knowledge and that all knowledge leads to culture. First of all, because culture is shared, this knowledge should be shared too. Moreover, for experience to become shared knowledge it should be shared between (some of) the members of a group and an agreement should be reached on what the experience is about and what the knowledge should entail.

Halfway the 1960s, Berger and Luckmann published *The social construction of reality*, in which they put forward a process model along which societies develop their version of reality (Berger & Luckmann 1966). Organisations too, can be regarded as social communities that also share a particular version of reality, on which they act and respond. Berger and Luckmann's model has been taken as a starting point for the model outlined below. This model describes the process of organisational culture formation and its internalisation over time.

[7] In using the culture concept this way, one should be cautious for the reification of culture with a thing that can act, almost on its own (Avruch 1998: 14). Such notions often lead to quite simplistic linear models of influence and modification.

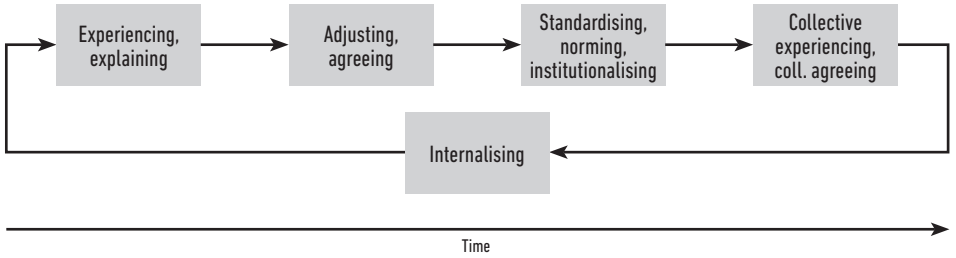

Figure 1. The development of organisational culture based on a model by Berger and Luckmann (1966)

In Figure 1, a model of culture development is put forward, which describes the formation of cultures in groups, like organisations. The first box of the model pictures the situation a member of the group finds himself in; the individual is trying to make sense of the experiences he encounters. With regard to safety and risk these are particular perceptions of both constructs that will partly determine this individual's behaviour, e.g. what is safe and risky behaviour. The result of this process is an individual's understanding of reality. This particular understanding is brought into the second box, the process of interaction with group members. This interaction is often based on communication, i.e. dialogue, discussion, correction, and results in mutual adjustments, agreements and various expectations of each other's behaviours. The outcome of this box are shared understandings, e.g. standards of behaviour, roles and norms. In the third box the formal processing of standards and norms is pictured, i.e. the establishment of norms and the institutionalisation of behaviour and expectations. The fourth box pictures the situation in which norms, standards and expectations are accepted to the extent that they are considered the 'best' or, perhaps, the 'only' way of doing things. Members of the group share a comparable understanding of reality, at least with regard to the part of reality the group acts on. This understanding is internalised by the members of the group and forms the 'basic assumptions' with which individuals within the group understand reality.

This model makes a few things clear with regard to culture. Firstly, this process takes some time to complete. Secondly, it is not easy to predict the outcome of this process, as it is dependent on, for instance, the composition of the group, the communication the group members have, the distribution of power within the group and the particular context the group operates in. Thirdly, the outcome is more arbitrary than intentional, although some members will deliberately try to influence the process. However, the result may be that particular standards are established which are not the result of consensus and are therefore not internalised

as 'basic assumptions' but rather as 'obligations,' i.e. 'the way we *have* to do things around here' instead of 'the way we do things around here.'

Obviously, when individuals enter a group, this process has been going on for some time and therefore many assumptions are already widely established. The individual is then either trained or otherwise socialised into the group. It may be that the individual does not agree with the various assumptions of the group and he can either pretend that he does or leave the group. Going against the assumptions is yet another option but, depending on the age of the group and various other conditions, this is often a futile quest.

Importantly, this is not the only way a culture develops itself. For instance, Schein describes a process of culture formation based on the reduction of anxiety all members have when facing a new group that has to work together from some time. Initially, the group has to resolve the issue of power and has to develop routines that work for them. After that, the group can start working within the boundaries they have developed for themselves (Schein 2004: 63 ff.). Nevertheless, a process of adjustment and agreement is also at work here, leading to a shared understanding of what is going on.

In the next chapter, the concept of culture applied to organisations will be explored in more detail.

2. Culture and organisations

2.1. The organisational context of culture

According to Schein, an organisational culture develops in organisations that have existed for some time and that have experienced significant external or internal difficulties or changes. Alongside the influence of founder(s) of a company or of significant leaders (heroes), the solution for problems that are effectively resolved or overcome might become part of the leading but tacit assumptions a company entertains (Schein 1992). Such internal difficulties could very well be major safety problems, like fatal accidents, explosions or releases of dangerous chemicals, but also reorganisations or retrenchments. External problems are often of an economic nature, like pending closure or loss of customers, but could also arise because of new legislation or drastic technological changes (Hofstede 2001, Exhibit 1.5). Organisational culture could be considered the by-product of the adaptation that follows upon these difficulties; viewed this way, organisational culture is a product of social ecology.

When considering organisations, three major components can be distinguished that 'work' together to generate the desired output. These aspects are structure, culture and processes and they are dynamically interrelated (e.g. see Hofstede 2001; Van Hoewijk 1988), which means that they all influence and are influenced by each other. Together they also provide the context in which behaviour, and hence also safety related behaviour, takes place.[8]

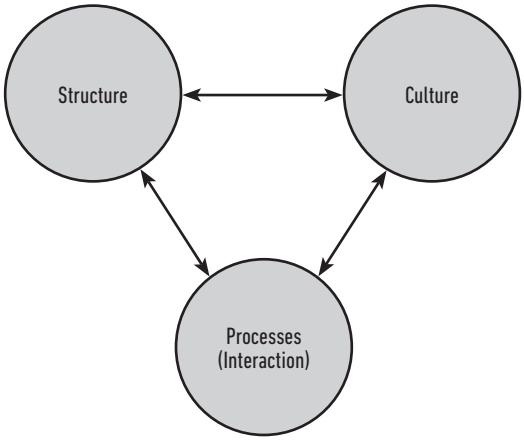

Figure 2. The organisational triad: structure, culture and processes/ interaction.

Organisational structure can be defined as 'the division of authority, responsibility, and duties among members of an organization' (Whittington & Pany 2004). The structure primarily outlines the formal organisation – i.e. how the work should be done and by whom. From the point of view of management, an efficient structure facilitates both effective coordination and communication. With regard to the structure of organisations several scholars have proposed taxonomies of which Mintzberg's is perhaps the most well-known (Mintzberg 1979, 1980, 1983). These taxonomies offer solutions for structuring organisations in relation to their mission, main output(s) and environment. Apart from the 'organisational' structure all 'physical' structure can also be subsumed under this heading, e.g. the buildings, the hardware and the technology the organisation uses, as well as the various systems the organisation uses to carry out their processes in a uniform way and to control these.

[8] Hofstede makes a distinction between strategy, structure, control and culture (Hofstede 2001: 408 ff.). It is not difficult to translate his 'controls' into the 'processes' of the present model. Moreover, I see his 'strategy' as the outcome of processes at the highest (strategic) level of the organisation, therefore this element in his model could be considered redundant.

The culture is the basic assumptions, the underlying tacit convictions, described as a group's shared understanding above. For instance – 'We need a lot of supervisors because our people need to be watched constantly.' Such a conviction will be found reflected in the structure of the organisation and therefore also on the work floor.

The processes are the actual processes and interactions going on in the entire organisation. These processes are often formally described in the structure. Task execution at all levels might be according to what has been laid down in the structure, but this does not have to be the case. For instance, some supervisors do not watch constantly, or do not correct workers, although they see them make mistakes or violations. The reason for this might be structural – the wrong man in the right place – or cultural – the convictions of a group of people do not match up to the structure.

The tri-partition can be projected onto the various steps of the development process of culture described above, where 'processes' matches with the first two steps of sensemaking and agreement, 'structure' with the step of formalisation and institutionalising and 'culture' with the remaining steps of collective agreeing and internalising.

An important implication of Figure 2 is that an organisation's culture cannot be isolated from its structure or its processes. Harrison & Stokes (1992) actually take structural characteristics (high vs. low formalisation and high vs. low centralisation) to construct quadrants that define four culture types ('archetypes') – i.e. the role, achievement, support and power culture. Comparable taxonomies can be found in Handy (1995) (Zeus, Apollo, Athena and Dionysus culture) and Cameron and Quinn (1999) (Hierarchy, Market, Clan and Adhocracy culture). This makes a strong case for a holistic exploration of organisational culture, i.e. research that also includes structure information and data from various organisational processes. Figure 2 brings yet another issue to the fore, namely that of how to position culture within an organisation. This subject will be taken up in the next paragraph.

2.2. The position of culture in an organisation

Looking at Figure 2, one could conclude that an organizational culture can be isolated quite easily from the organizational structure and processes. Regarding the position of culture in an organisation four approaches can be distinguished (Frissen 1986):

1. Culture as contingency factor
2. Culture as subsystem of the organisation
3. Culture as an aspect system of the organisation

4. The organisation as a cultural phenomenon

A somewhat similar classification can be found with Smircich (1983), who states that an organisational culture can be viewed as either an independent or external variable; as an internal variable within an organisation; or as a root metaphor representing a collective view on life and experience.

Hofstede can be considered a proponent of the first approach, in that he considers an organisational culture primarily a product of national culture. Organisations within a country only differ in their 'practices,' i.e. the outer layers of the culture onion, not so much in their values. When culture is considered a subsystem it is seen as functioning relatively independently next to other subsystems and can therefore be singled out easily for any further analysis. When culture is regarded as an aspect system, culture cannot be separated so easily, because it is ingrained in many subsystems of the organisation. Finally, when immersing oneself deeply in an organisation, one will probably get the impression that the organisation not so much has a culture but basically is a culture, i.e. is a cultural phenomenon. In this view culture is considered a 'root metaphor' (*ibid*.), 'a way of looking at life within a collectivity' (Martin 2002: 42), and culture stops being a research variable. So doing, we have arrived at the fourth approach.

Frissen (1986) presents his approaches not as mutually exclusive but rather as successive stages of research into an organisation's culture. When starting a project, culture is often considered as something influencing an organisation (culture as a contingency factor). One then tries to isolate culture and study it in more detail (culture as a subsystem) and in its manifestations (culture as an aspect system). When the investigation is both deep and broad, culture will be encountered not so much as a part or aspect but as something the organisation invariably is – culture as a root metaphor. Once again, however, one should be wary of reification, which is sometimes hard to resist (Avruch 1998). In the next paragraph, the concept of organisational culture will be examined further, looking at the issue of diversification of culture, i.e. culture and subcultures.

2.3. Cultures and subcultures

Organisational cultures can be defined as having one unifying culture. Several scholars, like Schein, held this position for some time and this notion might have been inspired by research done on national or indigenous cultures. Organisational culture research conducted with standardised questionnaires often implies a common set of dimensions or scales on which such cultures primarily differ and hence also contains the notion of a single culture, although with local nuances. Moreover,

the word 'organisational' already seems to imply a large, monolithic entity and certainly not something that is disintegrated or even fragmented.

However, organisations are quite open systems with leaders changing places rather often. Furthermore, many organisations are spread over more than one building or location. Most members of the organisation then do not have a chance to interact and develop much together as a collective. Additionally, members bring along their own cultures – for instance, their national culture, their regional culture, their professional/occupational culture, their religious culture and their (socioeconomic) class culture. It is therefore quite possible that no specific organisational culture develops, especially when organisational setbacks stay comfortably away (e.g. Guldenmund, Ellenbroek, & van den Hende 2006), assuming that such upheaval initiates the (re-)formation of a culture. However, local subcultures might also develop; for instance, based on the professional background of members or some challenging events a certain group had to face in the past. When members have a similar educational background, they do not even have to interact to share common cultural features. This seems to be the case in Schein's interpretation of subcultures (Schein 1996) and might also underlie Jones and James' findings at the US navy (Jones & James 1979).

Nowadays, the notion of a unitary organisational culture has lost popularity in favour of a view promoting differentiation (Martin 2002; Richter & Koch 2004). In this view, (an organisational) culture is not considered unitary but consists of multiple subcultures. A quite radical view is based on social constructivism and purports that culture is predominantly dynamic and much more defined situationally, i.e. a fragmentation view (Martin 2002). The heart of the matter lies perhaps between these latter two views, in that culture as basic assumptions will be the ultimate result of continual interaction between group members, partly shown situationally and partly shown universally.

Additionally, whatever the point of view – i.e. integration, differentiation or fragmentation – within a group or population culture can very well be 'socially distributed' (Avruch 1998: 18 ff.). That is, individuals belonging to a particular culture do not share their cultural content perfectly; this phenomenon was already hinted at in the discussion of Figure 1 above. Additionally, culture can be 'psychologically distributed' within a group as well, meaning that a cultural content can be deeply ingrained in one individual whereas in another it is a shallow cliché (*ibid*.).[9]

One could question whether the characteristics of culture that have been discussed earlier, apply in equal force to the concept of organisational culture. As already commented above, the word 'organisational' seems to suggest a large

[9] See also Schein's experiences with POWs, discussed above.

entity. The word 'culture' elicits the work and paradigms of anthropologists and sociologists and invites their ontology and epistemologies into the realm of organisation research. Indeed, initially the concept of culture as applied to organisations seemed rather attractive and provided explanations for certain phenomena that went unexplained previously. But organisational research also supplies managers with new ideas and ideologies and organisational culture became also something they wanted to manage, to control. Consequently, organisational culture became another instrument with which managers tried to put things their way. At that moment some scholars of organisational culture pulled out, because they did not feel like contributing to yet another management tool (Salzer-Morling 2003).

A similar process can be recognised in the development of the safety culture concept. The first anthropologist has already stood up and summoned the research community to more sensitivity and (safety) managers to more modesty regarding the assessment and control of (safety) culture (Haukelid 2008). The current discussion will now be narrowed down to the safety culture concept, which will be held up against the theoretical light of (organisational) culture that has been kindled in the previous discussion. In the next few paragraphs the assessment of safety culture will be reviewed and analysed.

3. Organisational culture and safety

Ever since INSAG coined the term 'safety culture' to denote the far from optimal conditions and decision processes at the Chernobyl nuclear power plant (International Nuclear Safety Advisory Group, 1986), it has become part of the standard explanatory safety vocabulary. Safety culture became a term with which people all around the globe explained everything they could not explain or understand otherwise. Whether the concept itself remained fuzzy, did not seem to matter much. However, this fuzziness is both its strength and weakness. Indeed, (groups of) people sometimes seem to perform in dark mysterious ways (Kets de Vries 1999) and when groping for an explanation a concept such as safety culture is highly attractive. A similar (initial) attraction can be pointed out in the development of the organisational culture concept (Salzer-Morling 2003); a discussion of the weakness of such a concept will be taken up below.

As with culture and organisational culture, safety culture has been defined by different authors differently, although many authors seem to refer to the same notion of shared basic assumptions, a shared understanding of reality (Antonsen 2009). How safety culture is studied will be discussed next, organised according to the three major approaches, the academic, the analytical and the pragmatic

approach. For each of these approaches the dominant paradigm, the primary research methods and some example studies will be given.

3.1. Academic or anthropological approach

The primary research methodology of cultural anthropology is field research (ethnography), which is qualitative in nature. Its purpose is to describe and understand a culture rather than evaluate it and, hence, it is non-normative, or value free. Moreover, the subject is never fitted onto some researcher's pre-existing notions. Because of these characteristics, it is not well-suited for a comparative research. Applied to organisations, culture is considered as something an organisation *is*, rather than *has*. This approach is labelled 'academic' for it is employed almost exclusively by academics and it is hardly used outside the scientific realm (Hofstede 1991: 180), although the International Atomic Energy Agency (IAEA) is currently advocating a safety culture self-assessment (SCSA) for its member states, involving just such an approach.[10] Schein has adopted this approach in what he calls 'clinical research' (Schein 1987). The term 'clinical' already betrays the fact that some evaluation is taking place, but this is more in terms of a discrepancy between a given organisation's ambitions or intentions and what it actually accomplishes. In terms of safety this can become pertinent when a company claims to put safety as its number one priority, but nevertheless has many accidents.

The research method can be narrative research, a phenomenological study, a study using grounded theory, an ethnography or a case study (Creswell 2007), or various combinations thereof. Ideally, the research starts with a problem definition or an issue turned into a problem to focus the investigation; for instance, the discrepancy between safety priority and performance mentioned above. Research techniques include interviews, observations, document studies and whatever else the company brings forth that may hold clues for its underlying assumptions (e.g. Guldenmund 2010, for an overview). What is important, however, is that information is collected with sufficient context, so that it can be interpreted accurately.

Whatever research method is chosen (case study, grounded theory, etc.) the results are (almost) never quantified because it is meaning and interpretation and not some numerical abstractions and calculations that drive the research. Moreover, numbers are never taken as data abstracted from an objective world, which would be in conflict with the research paradigm. The result is a 'thick description' (Geertz 1973), or a 'theory,' of the culture of an organisation (cf. Glaser & Strauss 1967). When the description or theory turns out to be incomplete or 'wrong,' the theory

[10] The accompanying document for this approach is still under development (per June 2013).

is adjusted to accommodate the contrasting empirical findings. Falsification can occur when another researcher with the same data comes to a different description or theory. In this approach safety culture is considered to be a nominal variable.

Current safety culture literature is still not well endowed with qualitative studies. This might be due to both publication policies, i.e. encouragement of quantitative rather than qualitative studies, and limitations regarding length of papers. Books describing such studies are equally absent. Moreover, methods are limited to either studies building on grounded theory (e.g. Berends 1995; Stave & Törner 2007; Walker 2008) or case studies (e.g. Brooks 2008; Farrington-Darby, Pickup, & Wilson 2005; Guldenmund 2008; Meijer 1999).

3.2. Analytical or psychological approach

This approach is the study of safety culture through (self-administered) questionnaires, which is the primary research instrument of (social and organisational) psychologists. This approach could be considered 'analytical' in that it considers safety culture an attribute of an organisation, i.e. something an organisation *has*, rather than *is* (cf. Hofstede 1991, but see also Section 2.2 above) and isolates parts of it that are considered important or indicative to assess.

The field of safety culture is very much dominated by questionnaire studies; possibly because surveys are deceptively simple to use; probably also, because questionnaires are so popular with organisational psychologists. In various papers this approach has been disqualified as culture research and has been placed under the heading of safety climate (Collins & Gadd 2002; Glendon & Litherland 2001; Guldenmund 2000). Safety climate is considered to be a transient psychological variable, much less stable than safety culture.

Questionnaire studies generally follow this routine. First, potential concepts or facets of interest are identified that together make up the construct; this could be the result of a qualitative study. Based on these a questionnaire is composed using questions that cover the pertinent concepts best. This is at first an assumption, which is tested in a subsequent survey where the questionnaires are put to an appropriate population. Subsequent data analyses should reveal whether the assumed concepts are actually present in the responses. The concepts are often conceived as dimensions spanning a multidimensional space; (sub-)cultures then become positions in that space. Additional analysis methods can model various

relationships between the concepts that make up the culture construct and other numerical variables from outside the questionnaire. This way culture is caught in a web of concepts.

Paradigmatically, this appears to be a positivistic, (semi-)quantitative approach, because the questionnaire results are numerical as the questions are often answered on a numbered response scale (e.g. a Likert-scale or a semantic differential).[11] However, the analytical approach also has qualitative – that is, interpretive – elements to it. For instance, although the questionnaire should have a solid theoretical underpinning (as reflected in the chosen concepts), a subsequent analysis could go beyond these concepts and aim for new and/or improved ones. Nevertheless, the final goal is to develop a robust set of general concepts (factors, dimensions, scales, facets) on which organisations can be assessed and, if necessary, compared. These latter characteristics make the analytical approach, in contrast with the previous academic approach, well-suited for comparative research. Such comparisons are, in principle, non-normative; that is, the mean scores do not have an evaluative sign to them, although the underlying individual responses might be based on such evaluations, preferences or perceptions (cf. Hofstede 2001: 15 ff.).

There are several important aspects to this approach, however, that are sometimes overlooked. For one thing, the numbers obtained from the rating scales are basically at the ordinal level of measurement. When such numbers are treated as though they are at a higher measurement level, it should at least be checked whether this assumption is justified. For another, although safety climate is not culture, it is still an emergent property of a group and therefore the within-group agreement, i.e. the coherence, should be tested (e.g. Zohar & Luria 2005). There are several indices available for this purpose, see Bliese (2006) for an overview.

The analytical approach can be considered a research methodology, which can be employed in either a case study or a (comparative) survey encompassing several organisations. Its research technique is a standardised questionnaire that is typically self-administered. It can be administered either group-wise, for instance at the start of a company training session, or sent to the worker's home addresses.

Summarising, viewed from the analytical perspective culture is a multidimensional construct and different cultures can be positioned at diverse positions in that space. These dimensions are either given beforehand or determined through analysis. An organisation's position in the culture space is calculated using questionnaire responses, often by using the mean as a descriptor of a dimension. There

[11] There is a way of putting the questionnaire to qualitative use. The analysis then is not aimed at spanning a multidimensional space and projecting cases in it. The responses are used to generate themes, which are used in subsequent (qualitative) research (for example, see Guldenmund 2008).

is abundant literature about research applying the analytic approach; aimed at the development of a questionnaire (e.g. Berends 1995; DeDobbeleer & Béland 1991; Díaz-Cabrera, Hernández-Fernaud, & Isla-Díaz 2007; Human Engineering Ltd. 2005; Kines et al. 2011), a case study (e.g. Guldenmund 2008; Havold 2005; Reiman & Oedewald 2004), a comparative study (e.g. Nielsen, Rasmussen, Glasscock, & Spangenberg 2008; Reiman, Oedewald, & Rollenhagen 2005; Zohar & Luria 2005), or modelling relationships (e.g. Cheyne, Cox, Oliver, & Tomæs 1998; Johnson 2007; Neal & Griffin 2006).

3.3. Pragmatic or experience-based approach

There is yet another approach that can be distinguished in safety culture research. While the previous approaches could be considered descriptive, the pragmatic approach is normative. From an academic, interpretative point of view a culture can be neither 'good' nor 'bad'; such evaluations having been replaced by a relativist position. From the 'academic' perspective cultures are largely functional and have meaning in relation to their context and history. However, an organisational culture might be considered dysfunctional in relation to its future, for instance in relation to particular ambitions or goals. Such ambitions can be about many things, and therefore also about safety. For example, an organisation's ambition might be to have 'zero' accidents but serious accidents might still occur occasionally.

This normative approach has been labelled pragmatic because its content is not so much the result of empirical research on cultures but rather based on experience and expert judgement. In practice, the pragmatic approach concentrates on both the structure and processes or interactions of an organisation, which, because of their dynamic interplay, will influence the culture in the long run (see Figure 2). Applied approaches concentrating on processes often focus on desired behaviour and the correction of deviations (e.g. DuPont's STOP™ or ProAct Safety's Lean Behavior-Based Safety℠). It is thought that a change in behaviour will result in subsequent cultural adjustments. According to cognitive dissonance theory (Eagly & Chaiken 1993: 469 ff.), attitudes and thoughts about particular behaviours will change in the long run when the two are incongruent and the desired behaviour is rewarded.

Typically, it is prescribed in detail what an organisation should do to obtain an advanced or mature status; that is, what processes should be implemented supported by an accompanying structure. Geller's Total Safety Culture (Geller 1994) is a prime example of this approach, and the IAEA requirements and characteristics for nuclear power plants are of a similar nature (International Nuclear Safety Advisory Group 1991). Descriptive approaches towards culture such as the ones already

discussed are of less relevance here, because it is not the organisation's current status but deviations from a predefined norm that are assessed and considered. However, knowledge of the current status might result in dissatisfaction with management, which can be helpful in providing the organisation with a sense of urgency to change. Moreover, such knowledge also provides information on what structure and processes are suitable given the current status.

Lately, stages or levels of organisational maturity with regard to safety management have become fashionable (e.g. Energy Institute, undated; Lardner 2004; Parker, Lawrie, & Hudson 2006; Westrum 2004). Each level describes common local attitudes and behaviours in relation to safety, especially in relation to incident and accident prevention, reporting, investigation and solutions. An initial diagnosis of the current organisational status in relation to these attitudes and behaviours might be prepared. However, the main objective is to ascend the safety maturity hierarchy. This might be accomplished by following the behavioural approach above, i.e. an emphasis on processes and behaviours in these, or with more structural adaptations. It is again assumed that culture will follow in the wake of these interventions. This approach assumes, rather implicitly, that safety culture is something an organisation has, or does not have; that is, mature 'generative' or 'cooperating' organisations have 'it,' whereas immature 'pathological' or 'emerging' (Energy Institute, undated; Lardner 2004; Westrum 2004) organisations do not.

The level of development of an organisation is assessed through behaviourally anchored rating scales, with either overt or covert ordinal scales. These assessments are always done in groups for two important reasons. Firstly, it is a group's shared opinions one is after, not the mean score of a group of employees. Secondly, it is not so much the rating but the ensuing discussion that follows because of this rating process that is considered the most important outcome. Nevertheless, scores are calculated and reported back to the organisation.

From the point of view of the interpretative academic approach the inferences that are made about an underlying culture solely based on descriptions of behaviour are committing a mortal sin. According to this approach, it is impossible to infer such meanings based on observed behaviour. Geertz, quoting the philosopher Ryle, illustrates this nicely by comparing a wink, with a twitch with a parody of a wink: all three look much the same, but have quite different meanings indeed (Geertz 1973: 6 ff.).

Summarising, regarding the matter of safety culture and its assessment, there are several aspects that require particular attention:

1. From an academic viewpoint, culture is a value-free concept (a nominal variable) whereas safety is not. The required purpose of safety culture assessments is not descriptions but evaluations, preferably with

recommendations on how the underlying culture can be improved to support safety (more).

2. Safety is about behaviour, whereas culture is about the meaning of behaviour. The relationship of culture with behaviour is partly dependent on the strength with which the core assumptions are held. Hence, knowledge about the direction of assumptions is not sufficient; also their intensity is important for behaviour.
3. The assessment of culture is therefore complicated and certainly not straightforward. Behaviour has become the major focus with allusions to an underlying culture. In the end, the actual meaning of the observed behaviour becomes much less important than the behaviour itself.

4. Influencing organisational safety culture

Most organisational safety culture assessments are not carried out for their own sake. Management is either interested in a diagnosis to compare it with a previous one or to benchmark with peer organisations, or the diagnosis is followed by a so-called gap analysis, where the present status of culture is compared with an ideal or optimal one, resulting in one or more recommendations to improve the current status. Enough has been said about safety culture assessment in the previous section. With regard to influencing culture, some final remarks will be made.

When discussing Figure 1, it was already observed that the output of the development process is never an intended outcome, but rather the product of many different forces working on the group at various points in time. In that sense, the resulting culture is not so much an optimal 'textbook culture,' but rather something that seems to work, in this group under these conditions. When the group remains successful in its accomplishments, the accompanying set of basic assumptions is reinforced and strengthened.

This does not mean that any attempts can be made to influence the current safety culture, by influencing its development process. To choose particular influences, Figure 1 can be taken as a starting point and interventions can be chosen that might influence the several steps within the model. In Figure 3 generic interventions are suggested, that might influence these various steps. Carrying out multiple interventions at the same time does seem to be more effective in influencing this process, rather than doing a single one or a few in succession (Hale, Guldenmund, van Loenhout, & Oh 2010).

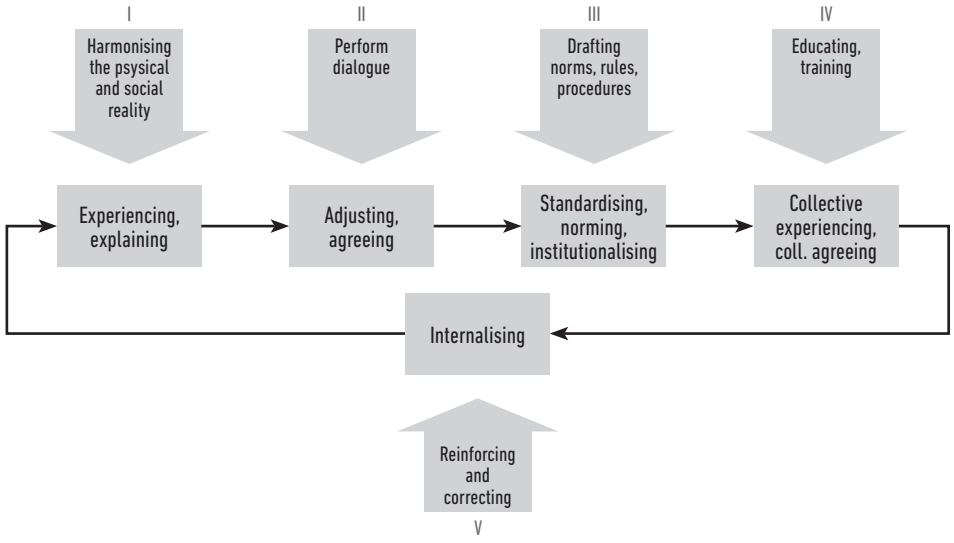

Figure 3. Generic influences on the development process of (organisational safety) culture

The generic influences in Figure 3 are as follows.

1. Harmonising the physical and social reality. The first step in the model describes the sensemaking processes of the individual members of the group, their understanding of reality. Possible influences that might affect this process are aimed at ensuring that parts of the physical and social reality are comparable across the organisation; e.g. similar technology, instruments, personal protection equipment, workplace layout, campaigns, etc. with regard to the physical reality. With regard to the social reality possible influences are leadership styles, rituals (e.g. meetings, celebrations), (systems for) recognition, etc. The aim of these interventions would be to create similar meanings, a comparable 'reality' across the organisation.
2. Perform dialogue. This is a crucial step in the development of culture and influences should be aimed at performing this dialogue across the organisation to ensure that consensus is reached to the extent that most people in the organisation have a comparable understanding of the reality they act on. Possible examples of interventions are STOP-GO cards or Last Minute Risk Assessments, rules for approaching and correcting

people, reporting of unsafe situations, etc.[12] It should be noted that steps one and two of the culture development process are iterative and remain so until a particular degree of consensus is reached (or a consensus is enforced, but this usually means that the ensuing rules are not sufficiently supported by the majority and therefore are also not internalised).

3. Drafting norms, rules and procedures. At this stage the consensus on (parts of) reality that has been reached at stage two can be formalised and institutionalised. Because of the shared consensus, the ensuing rules are recognised and understood by the majority of the group. Importantly, some rules are not formalised to the extent that they not are written down, yet they function as such within a group.
4. Educating, training. After formalising the rules, they can be trained or otherwise disseminated amongst the members of the group. New members will often start at this step, although when things do not make sense to them, they might also speak up and processes at steps one and two will become pertinent too. When an organisation is operating for some time, new members will have less and less impact and they either agree with the rules (or pretend they agree), or leave the company. This situation can change when the existence of the company, and therefore of the group, is threatened, or when the group is otherwise facing a significant challenge.
5. Reinforcing, correcting. To secure the basic assumptions of a culture they have to be reinforced for some time. After a while, they become self-explanatory and objective to the extent that members of the organisation cannot imagine understanding or approaching reality otherwise. This basic understanding is again influencing the sensemaking of step one.

5. Summary

Culture is a prerequisite for human beings to be able to live, to understand their surroundings, to work together. There are many definitions around, but these often differ in their wording, but not so much in their essence (e.g. Antonsen 2009). Culture is the result of a process based on sensemaking and interaction and adjustment within a group, yet it is never an intended result but rather a *modus vivendi* developed by the group while operating together. Culture transcends the individuals that share the culture, as it is passed on and, relatively, enduring.

[12] Stopping the production process should result in a dialogue about what is safe and what is not. The same goes for reports of unsafe situations.

Conceptually, culture can be thought of as a group's shared understanding of reality, as a way of looking at and experiencing that reality and all the things that happen in it. Culture research is aimed at describing the lens through which a particular group experiences its reality. Culture can be studied at different levels, the level of the nation considered to be the highest one. The construct can be modelled as something consisting of an invisible and relatively intangible core that is projected onto one or more outer layers, which are taken as the manifestations of the core. The core represents the basic assumptions of the group that help them understand reality. Built onto these are various norms, rituals, institutions, symbols and behaviours, which are particular expressions of the core.

Three ways of approaching culture are available, the academic, the analytical and the pragmatic approach. The academic approach makes use of qualitative techniques and results in a thick description of a culture, which is value-free. The analytical approach is based on self-administered questionnaires and makes comparisons between (sub-)cultures possible. Finally, the pragmatic approach uses developmental hierarchies to describe cultures with. Organisations are supposed to aim for the highest steps on these hierarchies.

The culture development process might be used to formulate general intervention strategies that could influence the different steps of this process. In general, several interventions working at the same time might be more effective that carrying them out in succession or doing a few.

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Soil: Threats and Protection. Sustainable Agriculture

1. Soil: threats and protection

1.1. What is soil?

Soil is generally defined as the top layer of the Earth's crust, formed by mineral particles, organic matter, water, air and living organisms. It is the interface between earth, air and water and hosts most of the biosphere (COM (2006) 231). A typical sample of mineral soil comprises 45% minerals, 25% water, 25% air, and 5% organic matter, however, these proportions may vary. Soil is considered the "skin of the Earth" with interfaces between the lithosphere, hydrosphere, atmosphere and biosphere (Chesworth 2008). It is the end product of the influence of the climate, relief (elevation, orientation, and slope of terrain), biotic activities (organisms), and parent materials (original minerals) interacting over time (Gilluly et al. 1975). Soil continually undergoes development by way of numerous physical, chemical and biological processes, which include weathering associated with erosion.

Soil provides people food, biomass and raw materials. It serves as a platform for human activities and landscape and as an archive of heritage and plays a central role as a habitat and gene pool. It stores, filters and transforms many substances, including water, nutrients and carbon. In fact, it is the biggest carbon store in the world (1,500 gigatonnes) (Adriano et al. 1998; COM (2006) 231).

Soil is an extremely complex and variable medium. Over 320 major soil types have been identified in Europe and within each there are enormous variations in physical, chemical and biological properties. Soil's structure plays a major role in determining its ability to perform its functions. Any damage to its structure also damages other environmental media and ecosystems. Soil is subject to a series of

degradation processes or threats. These include erosion, decline in organic matter, local and diffuse contamination, sealing, compaction, decline in biodiversity, salinisation, floods and landslides. A combination of some of these threats can ultimately lead arid or sub-arid climatic conditions to desertification (COM (2004) 231).

As soil formation is an extremely slow process, soil can be considered essentially as a **non-renewable resource**. With a very slow rate of soil formation, any soil loss of more than 1 t ha^{-1} y^{-1} can be described as irreversible within a time span of 50–100 years.

Soil is a dynamic and living resource, which needs minimal and suitable conditions to carry out its indispensable functions for its conservation, to produce food and for supporting the environment quality (Doran and Parkin 1996).

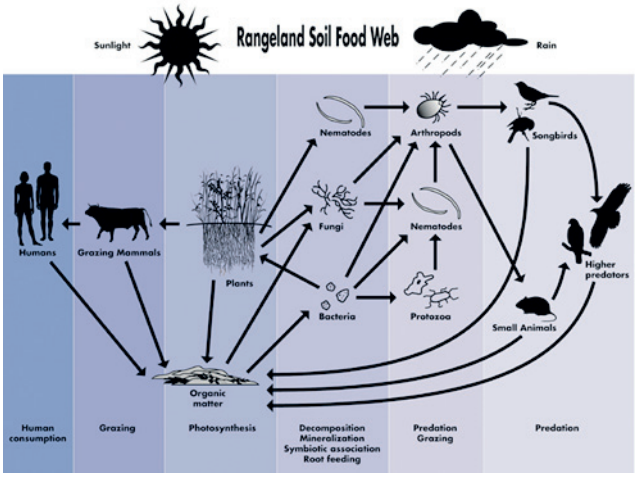

Figure 1.1. The Soil and Human Food Web (source: NRCS:http://www.nrcs.usda.gov).

The soil can be thought of as a medium providing society with various benefits or services. Life on Earth would be impossible without the soil and all the things that it performs for the humanity. Whatever people eat, drink or breathe, or wear, it almost all comes from the soil or is dependent upon it (Fig. 1.1). Owners of soil or land might appreciate its value in supporting the foundations of their house

and in providing a garden. Less obvious are the many other benefits the soil is providing, both to them and their descendants. Soils regulate neatly all of the water and bio-geo-chemical cycles that are critical for maintaining critical elements of both the climate and biodiversity. Interference with these processes and ecological health of the soil is a major factor that underlies climate change and biodiversity loss.

There is a large number of soil types across Europe, while the distribution of the major soil types has been recorded in maps as for example within the European Soil Information System (EUSIS). In particular, the Soil Geographical Database of Europe at scale 1:1,000,000 (Fig. 1.2) can be used to summarize the distribution of the major soils of Europe.

Therefore, considering this variability, it is obvious that the distribution of soil types should be taken into account in designing a soil protection strategy. Uncommon soil types may deserve special attention as unique habitats for a number of organisms, making them potentially eligible for specific protection measures. The European Union has made a Directive to investigate and conserve European ecological habitats, a directive called HABITAT and it is important to include some soil habitats in the list of habitats to be protected within the Natura 2000 network.

HABITAT and Natura 2000. In May 1992, European Union governments adopted legislation designed to protect the most seriously threatened habitats and species across Europe. This legislation is called the Habitats Directive and complements the Birds Directive adopted in 1979. At the heart of both these Directives is the creation of Natura 2000, which is a network of areas designated to conserve natural habitats and species of wildlife which are rare, endangered or vulnerable in the European Community. The Birds Directive requires the establishment of Special Protection Areas (SPAs) for birds. The Habitats Directive similarly requires Special Areas of Conservation (SAC) to be designated for other species, and for habitats. Together, SPAs and SACs make up the Natura 2000 series. All EU Member States contribute to the network of sites in a Europe-wide partnership from the Canaries to Crete and from Sicily to Finnish Lapland.

Soils are the home of one of the largest pools of *biodiversity* on Earth. There is an enormous number of organisms living in soil, mostly belonging to species yet to be fully described and studied. There is more biomass inside the soil than on it (Fig.1.3).

Only little is known about this ecosystem, mostly due to the lack of methods for effectively isolating the different organisms present in the soils of the world. Only few species have been fully described and isolated, often leading to the discovery of new sources of pharmacologically active natural substances, like, for example, penicillin.

Soil biodiversity reflects the mix of living organisms in the soil. These organisms interact with one another and with plants and small animals forming a web of biological activity. Soil is by far the most biologically diverse part of Earth. Soil

biota play many fundamental roles in delivering key ecosystem goods and services, such as releasing nutrients from soil organic matter, forming and maintaining soil structure and contributing to soil water entry, storage and transfer (Lavelle and Spain 2001).

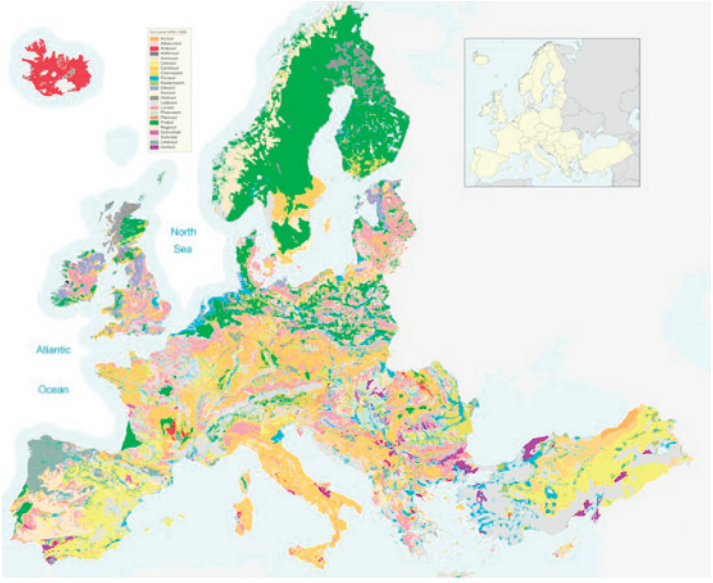

Figure 1.2. The European Soil Database ver. 1.0. Distribution of major soils groups is shown in inset (source: European Soil Bureau, 2004)

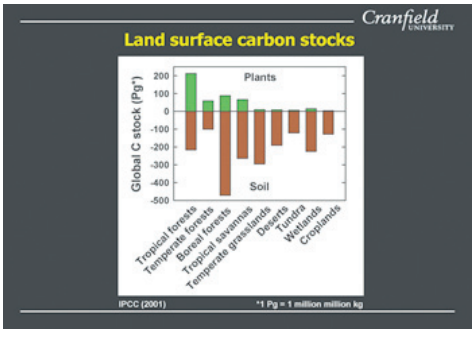

Figure 1.3. Land surface carbon stocks (source: IPCC 2001)

Soil biodiversity is defined by the variation in soil life, from genes to communities, and the variation in soil habitats, from micro-aggregates to entire landscapes (UN, 2000).

1.2. Soil Quality and Soil Health

The concept of soil quality emerged in the early 1990s, and the first official definition of this term was proposed by the Soil Science Society of America Ad Hoc Committee on Soil Quality (S-581) in 1997 (Karlen et al. 1997).

Soil quality was defined as "the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation." For the committee proposing this definition, the term soil quality is not synonymous with soil health, and they should not be used interchangeably. Soil quality is related to soil functions, whereas soil health presents the soil as a finite and dynamic living resource (Doran and Zeiss 2000).

Soil health is defined as "the continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity, maintain the quality of air and water environments, and promote plant, animal, and human health" (Doran et al. 1996).

These two definitions may appear similar, but soil health concept directly mentions plant health, which is not the case in the definition of soil quality of Karlen et al. (1997). In a simple manner, the Natural Resources Conservation Service of the United States Department of Agriculture proposes on its website (soils.usda.gov/sqi, 2005) the following definition: "soil quality is how well soil does what we want it to do." Because of the numerous possible uses of soil, the meaning of the term soil quality heavily depends on the ecosystem considered. In agricultural soils, plant and animal productivity and health would be of the greatest importance, whereas it would not be the same in urban soils. Even in a given ecosystem, e.g. cultivated soils, their multifunctionality makes it difficult to define a healthy soil without first defining the targeted goal or aim. Such goals could be plant health, atmospheric balance, avoidance of erosion, etc.

1.3. Soil threats and degradation

Soil degradation is a serious threat for an increasing number of areas all over the world. It is defined as "**a process that causes deterioration of soil productivity and low soil utility as a result of natural or anthropogenic factors which namely are displacement of soil material, and internal soil deterioration**" (Dwivedi 2002; Wim and El Hadji 2002).

Globally, it has been estimated that nearly 2 billion hectares of land are affected by human-induced soil degradation. The soil degradation processes recognised by the Commission are water, wind and tillage erosion; decline of soil organic

carbon; compaction; salinisation and sodification; contamination; and declining soil biodiversity. Loss of organic matter and soil biodiversity and consequently reducing soil fertility are often driven by unsustainable agricultural practices such as overgrazing of pasturelands, over intensive annual cropping, deep plugging on fragile soils, cultivation of erosion-facilitating crops (e.g. maize), continuous use of heavy machinery destroying soil structure through compaction, unsustainable irrigation systems contributing to the salinisation and erosion of cultivated lands. In addition, intensification of agriculture, some of which is linked in the European Union to the implementation of the Common Agricultural Policy (CAP), may accelerate loss of soil through erosion. The degree of soil degradation depends on soil's susceptibility to degradative processes, land use, and the duration of degradative land use (EEA-UNEP 2000).

The processes of soil degradation have major implications on:

- Global carbon cycle, mainly due to the decrease in soil organic matter and the release of CO_2 to the atmosphere,
- Reduction in soil buffering capacity that is the capacity of soil to adsorb contaminants,
- Water and air quality,
- Biodiversity,
- Food production, food and feed safety, and
- Human health.

1.3.1. Erosion

Soil erosion is the wearing away of the land surface by physical forces such as rainfall, flowing water, wind, ice, temperature change, gravity or other natural or anthropogenic agents that abrade, detach and remove soil or geological material from one point on the Earth's surface to be deposited elsewhere. Soil erosion is a natural process that can be exacerbated by human activities.

Soil erosion is increasing in Europe. Precise erosion estimates are not possible due to the lack of comparable data, therefore, it is difficult to assess the total area of the EU affected by erosion (SEC (2006) 620, Impact assessment of COM (2006) 232 Soil strategy). However, soil erosion is recognized as one of the most important soil degradation process worldwide. An estimated 115 million hectares or 12% of Europe's total land area are subject to water erosion, and 42 million hectares are affected by wind erosion (Thematic Strategy for Soil Protection COM (2006) 231). At present, it is estimated that in the Mediterranean region water erosion could

affect the loss of 20/40 ton/ha of soil after a single cloudburst, and in extreme cases the erosion could be even more than 100 ton/ha.

The major drivers for water erosion (Photo 1.1) are intense rainfall (particularly pronounced in clay soils after long droughts), topography, low soil organic matter content, percentage and type of vegetation cover and land marginalisation or abandonment. Following the geographical distribution of these major drivers, several areas with a high risk of erosion (including some hotspots) are located in the Mediterranean regions (Fig. 1.4). Erosion risk is also observed across western and central Europe. Even though the risk is relatively limited in e.g. France, Germany and Poland, water erosion can still be a substantial problem here. On the other hand, the analysis shows hilly to mountainous areas (the Pyrenees, the Apennines and the Alps) with very low or no erosion risk. These are largely forest areas with soils stabilized through tree roots.

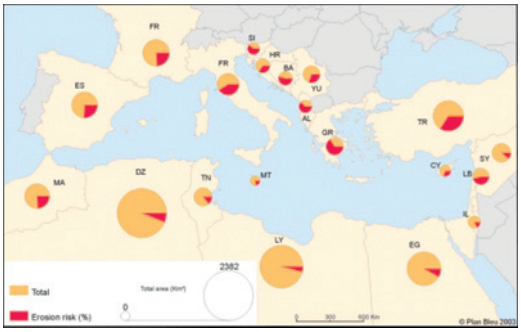

Figure 1.4. Surfaces threatened by erosion in the countries of the Mediterranean rim (%) (FAO data, TERRATSAT 2001)

Wind erosion (Photo 1.2), involving a removal of predominantly the finest soil particles, results in an ongoing decrease in soil fertility, so that the effects of wind erosion on agricultural productivity are detectable only after years or decades.

Soil's susceptibility to wind erosion is determined by its erodibility (mainly soil texture and organic matter content) and the climate's erosivity (mainly wind velocity and direction and precipitation). Wind erosion is additionally influenced by the interactions of various components (such as land use) resulting in a high temporal variability in the actual wind erosion risk of a particular site. The highest number of erosive days on bare soil per year (calculated over the last 30 years) is found across the sand belt covering southeast England, the Netherlands, northern Germany and Poland. Additionally, the areas exposed to high wind speed along coastlines show elevated levels of wind erosion.

(a) (b)

Photo 1.1. Water erosion (a) and flooding erosion (b) (Van-Camp et al. 2004)

(a) (b)

Photo 1.2. Tillage erosion (a) and wind erosion (b) (Schäfer et al. 2003)

1.3.2. Organic matter decline

Soil Organic Matter (SOC) is a key component of soil, controlling many vital functions, is a source of food for soil fauna and contributes to soil biodiversity. Soil organic matter provides the physical environment for roots to penetrate the soil and for excess water to drain freely from the soil. Organic matter can hold up to 20 times its weight in water, contributing to the water retention capacity of soils.

SOC accounts for more than 95% of the total carbon accumulated in pastures and perennial crops and nearly 100% of the total carbon accumulated in cropland ecosystems. SOC contributes to the *resilience* of agricultural ecosystems, and increases sustainability of rural livelihoods, which minimizes the negative socio-economic and environment consequences of agricultural practices (SCAPE 2005). In addition, SOC is among the mandatory items to be reported for agricultural land use under the Kyoto Protocol, and it is one with the highest potentials both in terms of enhancement of carbon sink and reduction of carbon emission. SOC

decline is particularly evident in the soils of many southern European countries, but it is also evident in parts of France, the United Kingdom, Germany, Norway and Belgium. A key driver is the conversion of woodland and grassland to arable crops. The soils of the 27-EU Member States are estimated to store between 73 and 79 billion tonnes of carbon (Jones et al. 2012).

SOC is a characteristic that is mostly affected by bioclimatic conditions and land use. Some 45% of soils in Europe have low or very low organic matter content (0–2% organic carbon).

However, in recent years both land use and climate have undergone dramatic changes that, in turn, cause changes in SOC. With regard to the EU, the changes are particularly driven by numerous land use regulations (e.g. Nitrate Directive, Water Framework Directive, Biodiversity, Climate Change, Natura 2000, etc.). In addition, many regions of the EU are experiencing climate evolution, such as temperature rise and changes patterns of precipitation (IPCC 2007). As a result of combined land use and climate changes in the EU, the loss of SOC is substantial and is estimated at the rate equivalent to 10% of the total fossil fuel emissions at the pan-European scale (Janssens 2004).

What is resilience? Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future. Humans are part of the natural world. We depend on ecological systems for our survival and we continuously impact the ecosystems in which we live from the local to global scale. Resilience is a property of these linked social-ecological systems (SES). "Resilience" as applied to ecosystems, or to integrated systems of people and the natural environment, has three defining characteristics:

- The amount of change the system can undergo and still retain the same controls on function and structure.
- The degree to which the system is capable of self-organization.
- The ability to build and increase the capacity for learning and adaptation.

1.3.3. Salinisation and sodification

Salinisation is the result of the accumulation of salts and other substances from irrigation water and fertilizers, whereas sodification concerns an increased content of exchangeable sodium (Na^+). High levels of salts will eventually make soils unsuitable for plant growth. It affects approximately 3.8 million ha in Europe. The main driver is the inappropriate management of irrigated agricultural land (Jones et al. 012).

While several studies show that salinization levels in soils in countries such as Spain, Greece, Romania and Hungary are increased (de Paz et al. 2004), systematic data on trends across Europe are not available. When alkalinity takes place, the high pH level does not, in most cases, permit plant life. Excess sodium on

the exchange complex results in the destruction of the soil structure that due to a lack of oxygen, cannot sustain either plant growth or animal life. Alkaline soils are easily eroded by water and wind.

1.3.4. Sealing

Sealing occurs when agricultural or non-developed land is lost to urban sprawl, industrial development or transport infrastructure (Photo 1.3). It normally includes the removal of topsoil layers and leads to the loss of important soil functions, such as food production, water storage or temperature regulation. On average, built-up and other man-made areas accounts for around 4% of the total area in the countries of the European Economic Area (data exclude Greece, Switzerland and the United Kingdom), but not all of this is actually sealed. Member States with high sealing rates over the period 2000–2006, exceeding 5% of the national territory, are Malta, the Netherlands, Belgium, Germany, and Luxembourg (Prokop et al. 2011). Between 1990 and 2000, at least 275 ha of soil were lost per day in the EU, amounting to 1000 km^2/y. Between 2000 and 2006, the EU average loss increased by 3%, but by 14% in Ireland and Cyprus, and by 15% in Spain. In the period 1990–2006, 19 Member States lost a potential agricultural production capability equivalent to a total of 6.1 million tonnes of wheat, with large regional variations (Jones et al. 2012).

Photo 1.3. Soil sealing

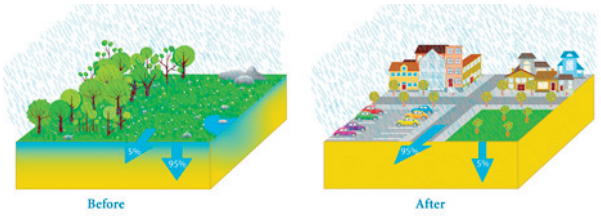

Figure 1.5. Impact of soil sealing on the natural water cycle

As a result of this soil sealing, the natural water cycle is altered, producing larger volumes of runoff and higher peak flows (Fig. 1.5). It also precludes rain from infiltrating the ground and recharge aquifers.

1.3.5. Landslides

Landslides are the gravitational movement of a mass of rock, earth or debris down a slope. Landslides occur when the stability of a slope changes from a stable to an unstable condition. Such changes can be caused by a number of factors, acting together or alone. Natural causes of landslides include groundwater pressure, loss of vegetation cover (e.g. after a fire), erosion of the toe of a slope by rivers or ocean waves, saturation by snowmelt or heavy rains and earthquakes. Human causes include deforestation and removal of vegetation cover, cultivation, construction and changes to the shape of a slope. Landslides can be very slow moving or very rapid.

Currently, there are no data on the total area affected in Europe, although estimates have been made for Italy (7%), Portugal (1%), Slovakia (5%) and Switzerland (8%). The main landslide-prone regions include mounntain ranges such as the Alps, the Apennines, the Carpathians, the Balkans; hilly areas on landslide-sensitive geological formations (e.g. in Belgium, Portugal and Ireland); coastal cliffs and steep slopes (e.g. in the United Kingdom, France, Bulgaria, Norway and Denmark); and gentle slopes on quick clay in Scandinavia. Landslides are possibly the most serious environmental issue in Italy (Jones et al. 2012).

1.3.6. Soil compaction

Compaction can detrimentally affect a number of soil functions by reducing the pore space between soil particles, increasing bulk density and reducing or totally destroying the soil's absorptive capacity (Fig. 1.6a). Reduced infiltration increases surface run-off and leads to more erosion while decreasing groundwater recharge (Fig. 1.6b).

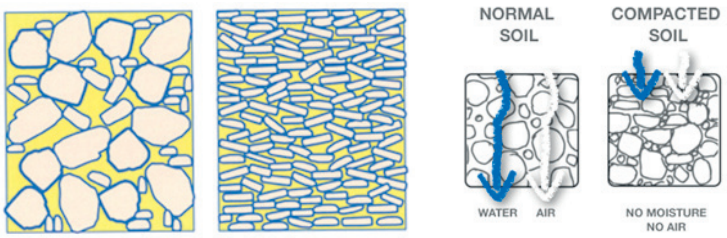

Figure 1.6. Decreasing of soil porosity and soil structure due to compaction (a); Reduction in soil infiltration due to compaction (b)

Heavy loads on the soil surface that cause compaction in the subsoil are cumulative and cause the bulk soil of the subsoil to increase significantly (Photo 1.4). Compaction results in a greatly reduced crop rootability and permeability for water and oxygen. The worst effects of surface compaction can be rectified relative easily by cultivation, and hence it is perceived to be a less serious problem in the medium to long term. However, subsoil compaction can be extremely difficult and expensive to alleviate and remedial treatments usually need to be repeated. Indeed, once the threshold of the pre-consolidation stress is reached, compaction is virtually irreversible (Ruser et al. 2006).

Photo 1.4. Heavy loads causing soil compaction, destroying soil structure and decreasing soil porosity (plate-like structure at the compacted soil layer)

A direct impact of compaction and associated decrease of soil porosity is the reduction in the available habitats for soil organisms. In particular, soil organisms living in surface areas, such as earthworms. Compaction damages earthworm tunnel structures and kills many of them. Alteration of soil aeration and humidity status due to soil compaction can also seriously impact the activity of soil organisms. Oxygen limitation can modify microbial activity, favouring microbes that can withstand anaerobic conditions. This alters the types and distribution

of organisms found in the rest of the soil food web. In addition, compaction can significantly reduce the number of microarthropods involved in biological regulation. The degree of impact varies with both the type of microarthropod and soil. Although microarthropod populations may recover, this can take several months.

1.3.7. Biodiversity

Rapidly advancing soil degradation is severely threatening soil biodiversity, eventually leading to the extinction of species yet to be discovered and fully studied. Implications for human health of the degradation of the soil ecosystem need still to be fully understood.

Hence, soil degradation by erosion, contamination, salinization and sealing all threaten soil biodiversity by compromising or destroying the habitat of the soil biota. Management practices that reduce the deposition or persistence of organic matter in soils, or bypass biologically mediated nutrient cycling, also tend to reduce the size and complexity of soil communities. It is, however, notable that even polluted or severely disturbed soils still support some level of microbial diversity.

Little is known about how soil life reacts to human activities but there is evidence that soil organisms are affected by SOM content, the chemical characteristics of soils (e.g. pH, the amount of soil contaminants or salts) and the physical properties of soils such as porosity and bulk density, both of which are affected by compaction and sealing.

A limited number of data concerning the dynamics of soil biodiversity are available and these generally refer to a few groups of soil organisms. Mushrooms, for instance, are a group of soil organisms for which a relatively long history of records exists. From this type of data set, it has been possible to show mushroom species decline in some European countries. For example, a 65% decrease in mushroom species over a 20-year period has been reported in the Netherlands and the Swiss Federal Environment Office has published the first-ever "Red-List" of mushrooms, detailing 937 known species that face possible extinction in Switzerland (source: Swissinfo 2007 http://www.swissinfo.ch).

1.3.8. Contamination

Both terms, contamination and pollution, are used synonymously. However, according to the definition given by Knox et al. (2000, 2001), trace element contaminated soils are not considered to be polluted unless a threshold concentration exists that begins to affect biochemical and biological processes. Soil pollution is

as old as man's ability to smelt and process ores, and goes back as far as the Bronze Age (2500 BC).

Pollution cases may be, according to their spatial dimensions, classified into the following two main types:

Diffuse sources (*nonpoint sources*). Nonpoint sources are related to diffuse processes or human activities that cover large areas. Diffuse soil contamination is in general associated with atmospheric deposition, certain agricultural practices (soil amendment with sewage sludge, application of manure, mineral fertilizers, pesticides, fumigation) and inadequate waste and wastewater recycling and treatment. Pollutants can be washed by rainfall both into the soil and from soil into surface and groundwater. Currently, the most important soil contamination problems from diffuse sources are atmospheric deposition of acidifying and eutrophying compounds or potentially harmful chemicals, deposition of contaminants from flowing water or eroded soil itself, and the direct application of substances such as pesticides, sewage sludge, fertilizers and manure which may contain heavy metals.

Heavy metals, together with excessive nitrogen inputs, are regarded as the main sources of contamination in agricultural soils and may be caused by human activities, such as fertilization and amendment practices, used to increase soil productivity. Metals like Hg, Cd, As, Pb can contaminate the soil gradually and damage soil and ecosystem functioning. These contaminating elements will become part of the nutrient cycling resulting in biodiversity decline, water pollution and consequently a potential danger for human health (Imeson et al. 2006). The excessive application of fertilizers or manures usually exceeds the functional soil ability to retain and transform nutrients and influence the soil capability to provide nutrients for plant growth and also its buffering and filtering capacity (Maréchal et al. 2008). The saturation of soil with nitrogen or phosphate, have led to losses of nitrates and saturation soil with phosphate, which move into groundwater waterways and coastal systems, causing eutrophication (Van-Camp et al. 2004).

Effects of emissions from nonpoint sources in Europe and the US have been detected even in remote areas such as Antarctica. At a European level, the atmospheric transport of heavy metals is a significant process: 30–90% of the metals emitted from each European country are deposited in other countries. Because this type of pollution may cover very large areas, even countries, the characterization, mapping and remediation, needs more detailed planning and technical installations than localized cases.

Threshold values for soils are difficult to evaluate since heavy metals toxicity and metal bioavailability is not only dependent on the total content in soils but also in other environmental factors (Rodriguez et al. 2008). At European level

only threshold values related to the application of sewage sludge in agricultural soils have been defined (EU Directive 86/278/EC). The determination of natural background values is very difficult since the geochemistry of most of the European ecosystems is greatly influenced by human activities (Reimann and Garrett 2005).

Localized sources (*point sources*). Point sources refer to discrete and localized contamination processes. Point source contamination is often linked to no operational industrial plants, power generation, industrial accidents, uncontrolled industrial, municipal and agricultural waste disposals, and mining activities (Doula et al. 2012). Contaminated sites can pose serious threats to health and to the local environment as a result of harmful substances release to water resources, uptake by plants and direct contact by people. Major pollutants include heavy metals, organic contaminants such as chlorinated hydrocarbons, and mineral oil. Point sources are generally responsible for high pollutants' concentrations in small areas. In such cases, pollution would be spreading from the source in a flow pattern, which is more or less localized and showing concentrations that decrease with increasing distance from the source of pollution.

It is difficult to quantify the real extent of local soil contamination as many European countries lack comprehensive inventories and there is a lack of EU legislation obliging Member States to identify contaminated sites. Estimates show that the number of sites in Europe where potentially polluting activities are occurring, or have taken place in the past, now stands at about 3 million (EEA 2007). Some locations, depending on their use and the nature of the contaminant, may only require limited measures to stabilize the dispersion of pollution or to protect vulnerable organisms from pollution. However, it should be noted that around 250,000 sites might need urgent remediation (JRC 2012).

The largest and probably most heavily affected areas are concentrated around the most industrialized regions in northwest Europe, from Nord-Pas de Calais in France to the Rhein-Ruhr region in Germany, across Belgium and the Netherlands and the south of the United Kingdom. There are approximately 3,000 problem areas including former military sites, abandoned industrial facilities and storage sites which may still be releasing pollutants to the environment leading to groundwater contamination and related health problems (DANCEE 2000). The contaminated sites in Ukraine are about 5 million ha, mostly in human settlements and around the industrial factories, and in Lithuania nearly 3 million ha. In the mining industry, which is a major driver of soil degradation in central and eastern European countries, the risk of contamination is associated with sulfur and heavy metal-bearing tailings stored on mining sites, and the use of certain chemical reagents such as cyanide in the refining process.

Waste landfilling is an important potentially contaminating activity as well. Application of farm manures, sewage sludge, and composted green wastes lead to air pollution (odour and ammonia) and to diffuse water (nitrate and phosphate) pollution. Moreover, the potential of soil contamination is greatly increased in landfills that that do not comply with the minimum requirements set by the landfill directive (Directive 1999/31/EC).

1.3.9. Desertification

Desertification, is defined by the United Nations Convention to Combat Desertification (UNCCD) (UN 1994) as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities." The most recent terminology adopted by the UNCCD includes areas suffering from "desertification, land degradation and drought" and reflects the wider endorsement of the convention by countries that do not have drylands within their national territories. Within the EU, Bulgaria, Cyprus, Greece, Hungary, Italy, Latvia, Malta, Portugal, Romania, Slovakia, Slovenia and Spain consider themselves affected by desertification and are included in UNCCD list (UN 2001). The situation is most serious in Southern Portugal, much of Spain, Sicily, south-eastern Greece and the areas bordering the Black Sea in Bulgaria and Romania. In southern, central and eastern Europe, 8% of the territory current shows very high or high sensitivity to desertification, corresponding to about 14 million ha, and more that 40 million moderate sensitivities are included (JRC 2012). Desertification causes a progressive loss of soil fertility, through the destruction of the structure and composition of the soil, which does not permit good agricultural productions, or the existence of a vegetation with varied natural species (Photo 1.5). The desertification has been wrongly confused with depopulation. However, these two phenomena can in fact be related. The loss of soil fertility ends up leading to a decline in agriculture, to land abandonment and ultimately to emigration.

There are several factors that contribute to desertification, some are natural (intense rainfall events, drought), others are directly related to human activities (agriculture, industry).

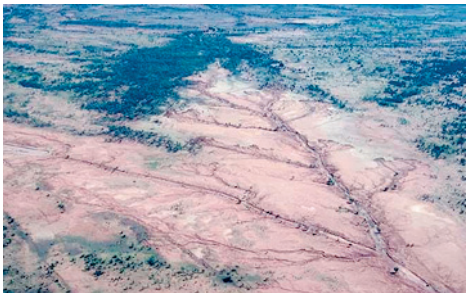

Photo 1.5. Defining desertification – generation of new uncultivable land

Source: http://www.gse.mq.edu.au/units/gse813/CSIRO/environ/desertification.htm

Photo 1.6. Farmers in southern Morocco tried to slow the process of desertification by planting palm and tamarisk trees in an attempt to stabilize the soil (sand) and prevent the dunes from overtaking the agricultural land.

Source: https://courseware.e-education.psu.edu/courses/earth105new/content/lesson09/05.html

Agricultural activities, because they are based on the use of soil, contribute decisively to desertification. Some activities are:

Arable lands

- Removal of the vegetation cover
- Unsustainable agricultural practices (deep ploughing and destruction of soil structure)
- Loss of soil organic matter (e.g. soil wash due to rainfall)
- Compaction-heavy machinery
- Nutrients loss – monocultures (e.g. wheat, vineyards), non-native plants cultivation. Intensive agriculture exhausts the soil's nutrients and minerals needed to sustain plant life
- Pollution/contamination

Irrigated areas

- Excessive use of water – water erosion
- Insufficient irrigation system
- Salinization – formation of salt layers on soil surface

Pastures

- Overgrazing – excessive use of the same pastures. Overgrazing removes the grass and other vegetation that protects the soil from erosion.
- High density of animals per area

Forests

- Deforestation
- Use of fast growing exotic species (eucalyptus)
- Fires

Desertification has substantial economic consequences. The World Bank estimates that at the global level, the annual income lost in the areas affected by desertification amounts to 42 billion dollars each year, while the annual cost of mitigating desertification would cost only 2.4 billion dollars.

Economic pressures can lead to the over-exploitation of land, and usually hit the poor the hardest. Forced to extract as much as they can from the land for food, energy, housing and source of income, they are both the causes and the victims of the desertification. Desertification brings hunger and poverty. People living in areas threatened by desertification are forced to move elsewhere to find other means of livelihood. Usually they migrate towards urban areas or go abroad. Mass migration is a major consequence of desertification. From 1997 to 2020, some 60 million people are expected to move from the desertified areas in Sub-Saharan Africa towards Northern Africa and Europe.

Actions against desertification

- Restore and fertilize land. Use organic amendments, like composts to increase soil organic matter.
- Combat wind effects by constructing barriers and stabilizing sand dunes with local plants (Photo 1.6).
- Reforestation. Trees play several roles, i.e. fix soil, act as wind breakers, enrich soil in nutrients, adsorb water during rainfall.
- Adoption of sustainable agricultural practices (i.e. development of Codes of "Good Farming Practices"). Agriculture diversity must be preserved. Ensure soil "breathing" during certain time periods (no cultivation, no grazing).
- Development of integrated scenarios to change societal behaviors (modern and traditional) of every-day life (social, commercial, professional, etc.) that affect and intensify desertification.
- Education and training of local communities.

1.4. Costs of soil degradation

Although difficult to estimate accurately, soil degradation has economic consequences for the environment and society. The costs of degradation depend on the process, its spatial extent and intensity, the natural characteristics of the location and the socio-economic characteristics of the surrounding area. However, while such factors have been addressed in local case studies, the calculation of a Europe-wide figure is impeded by the fact that much of the data is either unavailable or not comparable. The Impact Assessment document of the Soil Thematic Strategy (EC 2006b) estimates the following costs of soil degradation:

- Organic matter decline: EUR 3.4–5.6 billion/year
- Erosion: EUR 0.7–14.0 billion/year
- Compaction: no estimate available
- Sealing: no estimate available
- Salinization: EUR 158–321 million/year
- Biodiversity decline: the global economic benefits of soil biodiversity are estimated at around EUR 2 billion/year. No figures are available for Europe.
- Desertification: at least EUR 3.3 billion/year
- Landslides: according to the Italian Civil Protection Department, landslides cost the Italian economy between EUR 1–2 billion per year. Other estimates range from 11–600 million per event (EC 2006b).
- Contamination: EUR 2.4–17.3 billion/year (based on single case in France).

No assessment of the costs of compaction, soil sealing or biodiversity decline are currently available. The total costs of soil degradation in the form of erosion, organic matter decline, salinization, landslides and contamination could be up to EUR 38 billion annually for the EU-25. These estimates are necessarily wide-ranging due to the lack of sufficient quantitative and qualitative data.

Evidence shows that the majority of the costs are borne by society in the form of damage to infrastructure due to sediment run-off and landslides, increased healthcare needs for people affected by contamination, treatment of water contaminated through soil. Disposal of sediments, depreciation of land around contaminated sites, increased food safety controls and costs related to the ecosystem functions of soil.

1.5. Soils and human health

Concern about threats to human health is often a top human preoccupation so that any aspect of air and water that is related to human health gains immediate political attention. Knowledge about health related effects of soil degradation is limited. Usually these are perceived in relation to soil pollution by chemicals and the possible role in contaminating the food chain. "Healthy food from healthy soils" is an immediately understandable slogan for anybody and there is an increasing public interest in organic farming. The scientific links between the soil and food quality are very complex and, in some cases, there is no real evidence to help distinguish between real and imaginary risks. Much more evidence exists of a number of other off-site effects of soil degradation with immediate implications for our daily life.

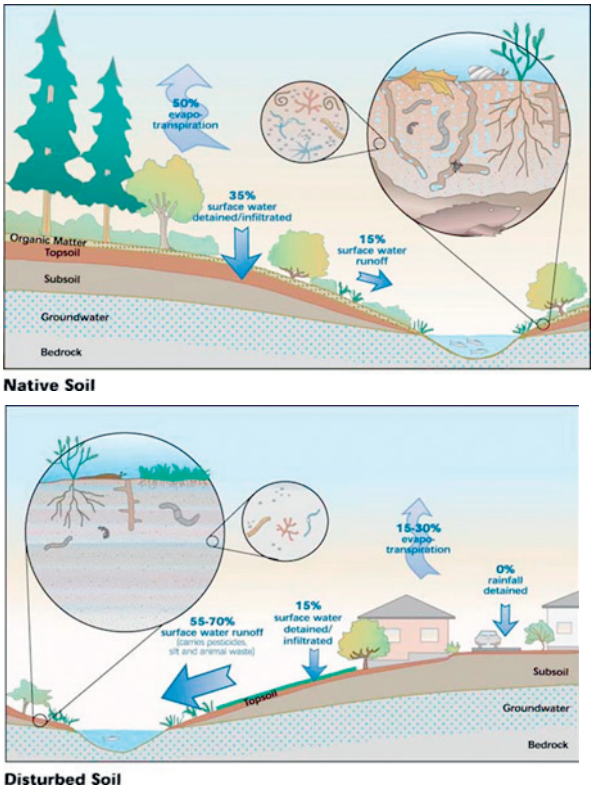

Figure 1.7. Benefits of healthy soils (source: King County Department of Natural Resources and Parks; http://www.ecy.wa.gov/programs/wq/stormwater/municipal/munidocs/soilbmp-manual.pdf)

Drinking water quality is directly linked with soils; soil is a filtering and buffering medium for contaminants. A number of physical and chemical properties of soils result in clean groundwater for people and animals. Overloading a soil with contaminants, as well as, limiting its permeable surface by sealing and compaction, can severely affect its functioning as a filtering (actually the biggest filter on Earth) and buffering medium for water (Fig. 1.7). Drastic changes in soil pH can dramatically affect the retention capacity for contaminants, eventually triggering the sudden release of contaminants in the groundwater.

The off-site effects of *soil erosion* are well-known and they have been frequently reviewed. The silting of artificial water reservoirs implies enormous costs to hydroelectric power plants and water authorities. Less frequently appreciated is the way that sediments from eroded soil can accumulate in river channels; reducing channel capacity, blocking culverts, increasing bank erosion, all of which cause flooding and inundation. Sediments accumulating in channels as a result of erosion have an impact that lasts for decades and centuries. Managing a river to prevent flooding through a loss of channel sediment and discharge capacity needs to be planned over many decades and centuries, as it is for example done in the tributaries of the Rhone Valley. Sediments are often associated with a number of contaminants and nutrients that are major causes of the degradation of bathing water quality in coastal areas with severe economic implications for tourism.

Wind erosion can be also a major threat to human health, particularly in densely populated urban areas. Recent examples exist of massive wind erosion problems all over the world, for instance in China, Australia (Youlin 2001) and Iceland.

Table 1. On-site and off-site damage due to water erosion (Giordano 2002)

On-site damages	Off-site damages
Loss of organic matter	Floods
Soil structure degradation	Water pollution
Soil surface compaction	Infrastructure burial
Reduction of water penetration	Obstruction of drainage networks
Supply reduction at water table	Changes in watercourse shape
Surface erosion	Water eutrophication
Nutrient removal	
Increase of coarse elements	
Rill and gully generation	
Plant uprooting	
Reduction of soil productivity	

Despite the health impacts, many other impacts on communities' daily life that are associated with soil degradation can be mentioned. For example, Table 1 summarizes on-site and off-site effects of the water erosive processes.

On the one hand, there are invariably slow and imperceptible changes taking place in soils that can lead to sudden and unexpected consequences such as desertification and flooding. For example, the risk of desertification on areas producing wheat near Athens (Greece) has been shown to gradually increase as erosion reduces the depth of the soil and the amount of water that it can consequently store at critical periods of the year. On the other hand, a good example of a potential policy surprises is the "chemical time bomb." For instance, the ability of a soil to retain a chemical or buffer a process may suddenly be altered. A classic example is the risk of pollution from heavy metals that have accumulated on agricultural land when trees are planted. If soil pH is critically lowered, the heavy metals present in the former agricultural soils can enter the environment. Another example of an unexpected consequence is the flooding and landsliding that can occur on marls that develop badlands when they are used for agriculture. One of the properties of marls that explains the presence of badlands is the rapid weathering. One or two light showers in such areas can be all that is needed to create mudflows.

1.6. The soil and the global climate and global economy

Specific attention is given to the role of the soil in greenhouse gas emissions and to the concern about soils being "chemical time bombs," which is associated to the non-linear behavior of the soil system. Therefore, policies need to be adaptive and make allowance for the reality of complex evolving systems, avoiding the pitfalls of a command and response strategy (Holling and Meffe 1996). It is only in recent times that the full importance of soils for *global climate change* has been recognized. More research is now devoted to this in order to understand better its role in relation to the increase of greenhouse gases in the atmosphere. Actually, soils in the world contain an estimated amount of ca. 1,500 Gt of carbon (650 Gt in vegetation), and it is therefore the most important compartment of carbon in the terrestrial biosphere. Maintaining and eventually even increasing this large organic carbon pool is of crucial importance for limiting the increase of CO_2 in the atmosphere. A number of agricultural practices have been recognized as having a substantial beneficial effect on soil organic carbon content. Promoting the adoption of such practices would help reverse the current trend of soil organic matter depletion in European agricultural land.

1.7. Soil Remediation

All remediation options have advantages and limitations that make them more or less applicable in any particular case and a wide range of site-specific technical factors determine which remediation options are most appropriate. Some of these factors relate to the nature of the relevant pollutant linkages, such as the type, amount, lateral and vertical distribution of pollutants and affected media, and the properties of pathways. Others relate to the general characteristics of the site, such as its size, location, accessibility, topography and wider environmental setting, and the existence (or proposed construction) of buildings and other structures. The current or intended use of the site also needs to be taken into account to ensure that remediation does not compromise soil functions, including geotechnical properties.

Other factors also affect the choice of the most appropriate option. These include the legal and commercial context within which the site is being handled; the views of key stakeholders (such as site owners, purchasers, funders, regulators and the local community), and the costs and benefits of using any particular option.

The key question

For any individual site, two questions should be answered:

- Does the contamination matter? and, if so
- What needs to be done about it?

The answers to both the questions above depend, to some extent, on when the contamination happened. For "new" contamination, the accepted principle is that deterioration of the environment needs to be avoided. This principle underlies the approach in regimes aimed at controlling potentially polluting activities, such as Pollution Prevention and Control (PPC).

In deciding whether contamination matters, the amount, or concentration, of any contaminants present, is always going to be a significant factor, but it does not provide the whole answer. It is also necessary to consider to what extent the substances present may harm human health or the wider environment, including damage to property. In short, what risk, if any, is caused by contaminants, and is that risk unacceptable? This need to make judgments about the degree of risk also applies to deciding what to do about the contamination. Technical obstacles as well as potentially large costs mean that it is often neither feasible nor realistic to think in terms of total clean-up of past damage. Instead, the goal is to find solutions that identify and deal with risks from contamination in a sustainable way (CLARINET 2003).

In order to facilitate the evaluation of the potential benefits of a remedial action as compared to the impacts that may be caused by it, the following question should be asked prior to initiating the work:

Will the environmental work result in a net positive benefit to the environment?

In most cases, the evaluation of the potential impacts and benefits of conducting a project will show that its merit will be conditional. And it should be recognized that when environmental work is performed for the benefit of a specific location, it is often at the expense of another.

1.7.1. Sustainable remediation

Sustainable development in contaminated land management (CLM) and, more specifically, sustainable remediation is a growing field of knowledge. At a strategic level, remediation of contaminated sites supports the goal of sustainable development through:

- the act of conserving land as a resource
- prevent spreading of pollutants to the air, soil and water
- reducing the pressure on development

Although all these positive effects occur due to remediation some negative effects also arise: on the environment, economy and society. These negative impacts should not exceed the benefits of a remediation (Bardos et al. 2002).

There are no united guidelines or common methodology for sustainable remediation assessments used by all nations in EU or internationally. According to Woodward et al. (2009), this is a possible barrier for implementing sustainable remediation. Another possible barrier is the difficulty to equate results in a consistent metric since many of the factors influencing the outcome needs a qualitative assessment. There is a variety of views and no uniform picture of what sustainable remediation is and how it should be assessed. Lesage and Zoller (2001) have the following view on sustainable remediation.

> Sustainable remediation is developing methods that do not require extraordinary resources, or resources better used elsewhere. It is working with nature, by using supporting natural processes technologies, rather than against it. It is achieving balance between risk mitigation and the expenditures required to achieve it, through optimization based on well-defined criteria.

Work on forming frameworks in the area of sustainable remediation is in progress. In Europe, the Contaminated Land Applications in Real Environments (CLAIRE) has published a document within SuRF-UK (Smith et al. 2010). The document is an attempt to form a framework for assessing the sustainability of soil and groundwater remediation. Other institutions working with these questions

are NICOLE (Network of Industrially Contaminated Sites in Europe) and the former Contaminated Land Rehabilitation Network for Environmental Technologies in Europe (CLARINET). SuRF-UK recommends a tiered approach, qualitative and quantitative assessment, to assess sustainable remediation and stress that the specific tool used is not that important but the process and thought behind the assessment is. SuRF-UK lists a number of decision support techniques with relevance to sustainable remediation assessments. These all seek to assess the environmental, social and economic benefits and costs for remediation alternatives that meet a project goal, (Table 2 – Smith et al. 2010).

Table 2. Decision support techniques with relevance to sustainable remediation assessment, from Smith et al. (2010)

Technique	Environment	Economy	Society	Type	Contaminated Land Management application?
Scoring/ranking systems (including MCA)	Narrow to Wide	Narrow to Wide	Narrow to Wide	Both	Yes
Best Available Technique (BAT)	Narrow to Wide	Narrow	-	Qual	Yes
Carbon footprint (area)	Narrow	-	-	Quan	Yes
Carbon balance (flows)	Narrow	-	-	Quan	-
Cost Benefit Analysis (CBA)	Narrow to Wide	Narrow to Wide	Narrow to Wide	Quan	Yes
Cost Effectiveness Analysis (CEA)	Narrow to Wide	Narrow to Wide	Narrow to Wide	Both	Yes
Eco-efficiency	Narrow	-	-	Quan	-
Ecological footprint	Narrow	-	-	Quan	-
Energy/intensity efficiency	Narrow	-	-	Quan	Yes
Environmental risk assessment	Narrow to Wide	-	-	Both	Yes
Human health risk assessment	-	-	Narrow	Both	Yes
Environmental impact assessment/strategic environmental assessment	Narrow to Wide	-	-	Qual	Yes
Financial risk assessment	-	Narrow	-	Quan	Yes
Industrial ecology	Narrow to Wide	Narrow to Wide	-	Quan	-
Life Cycle Assessment (based)	Narrow to Wide	-	-	Quan	Yes
Quality of life assessment	Wide	Wide	Wide	Qual	-

* Qual = Qualitative; Quan = Quantitative; Both = qualitative and/or quantitative; – = Technique lacks known coverage

The techniques, from Table 1, which are able to handle both quantitatively and qualitatively data and have a flexible coverage in the different elements of sustainable development i.e. the economic, environmental and social categories, are scoring/ranking systems such as Multi Criteria Analysis (MCA) and Combined Cost-Effectiveness Analysis (CEA).

MCA is also highlighted by Ness et al. (2007) as a tool, which enables an integrated assessment of nature-society systems into a single evaluation.

The assessment of remediation is typically based on an assessment of the performance of different alternatives against a list of indicators or criteria.

For the assessment of soil and groundwater, SURF-UK has developed a set of sustainability indicators (Tables 3, 4 and 4). These are divided into three overarching elements; environmental, economic and social, i.e. the elements of sustainable development. Further, 18 categories, six in each element, have been found to be relevant for sustainability assessment.

Table 3. Sustainable Remediation Indicators – Environmental Indicators (Smith et al. 2010)

Element	Category	Issues that indicators might need considered
Environmental 1	Impacts on air	Emissions that may affect climate or air quality, such as greenhouse gases (e.g. CO_2, CH_4, N_2O), NOx, SOx, particulates, O_3, VOCs, ozone-depleting substances, etc. (*Note: does not include any odorous effects, bioaerosols, allergens or dust, as these are included in Social: Impacts on neighbourhoods or regions*)
Environmental 2	Impacts on soil and ground conditions	Changes in physical, chemical, biological soil condition that affect the functions or services provided by soils. May include soil quality (chemistry); water filtration and purification processes; soil structure, and/or organic matter content or quality; erosion and soil stability; geotechnical properties, compaction and other damage to soil structure affecting stability, drainage, or provision of another ecosystem good or service.
Environmental 3	Impacts on groundwater and surface waters	Release of contaminants (including nutrients), dissolved organic carbon or silt/particulates, affecting suitability of water for potable or other uses, water body status and other legislative water quality objectives, biological function (aquatic ecosystems) and chemical function, mobilisation of dissolved substances. Effects of water abstraction included, such as lowering river levels or water tables or potential acidification.
Environmental 4	Impacts on ecology	Direct consequences for flora, fauna and food chains, especially protected species, biodiversity. Introduction of alien species. Significant changes in ecological community structure or function. Impacts of light, noise and vibration on ecology. Use of decontamination equipment that affect fauna (e.g. affecting bird or bat flight or animal migration, etc.).

Environmental 5	Use of natural resources and generation of wastes	Consequences for land and water resources, use of primary resources and substitution of primary resources within the project or external to it, including raw and recycled aggregates. Use of energy/fuels taking into account their type/origin and the possibility of generating renewable energy by the project. Handling of materials on-site, off-site and waste disposal resources. Water abstraction, use and disposal.
Environmental 6	Intrusiveness	Impacts on flooding or increase risk of flooding, alteration of landforms that affect environment.

1.7.2. Objectives of a remedial strategy

Once relevant pollutant linkages have been identified as a result of risk assessment, an important task is the definition of the boundary within which remediation options are considered so that potential conflicts between different objectives can be addressed and the most appropriate overall decision can be made. One way for the definition of this boundary is to specify at the outset of options appraisal a series of objectives that the remediation strategy has to achieve to be considered acceptable to all those involved.

Objectives will be linked to the:

- Degree to which risks need to be reduced or controlled;
- Time within which the remediation strategy is required to take effect;
- Practicability of implementing and, where appropriate, maintaining the strategy;
- Technical effectiveness of the strategy in reducing or controlling risks;
- Durability of the strategy (i.e., will it provide a robust solution over the design life?);
- Sustainability of the strategy (i.e., how well it meets other environmental objectives, for example, on the use of energy and other material resources, and avoids or minimizes adverse environmental impacts in off-site locations, such as a landfill, or on other environmental compartments, such as air and water);
- Cost of the strategy (bearing in mind that the person who makes the decision about remediation may not be the person who has to pay);
- Benefits of the strategy – all remediation strategies should deliver direct benefits (the reduction or control of unacceptable risks) – but many have merits that extend well beyond the boundaries of the site; for example, remediation may enhance the amenity or ecological value of an area or contribute towards improved economic activity by removing blight or encouraging regeneration;

- Legal, financial and commercial context within which the site is being handled including the specific legal requirements that remediation has to comply with, and the views of stakeholders on how unacceptable risks should be managed.

Table 4. Sustainable Remediation Indicators – Economic Indicators (Smith et al. 2010)

Element	Category	Issues that indicators might need considered
Economic 1	Direct economic costs and benefits	Direct financial costs and benefits of remediation for organization, consequences of capital and operation costs, and sensitivity to alteration (e.g. uplift in site value to facilitate future development, minimization of risk or threat of legal action).
Economic 2	Indirect economic costs and benefits	Long term or indirect impacts and benefits, such as financing debt, allocation of financial resources internally, changes in site-local land-property values, and fines and punitive damages (e.g. following legal action, so includes solicitor and technical costs during defence). Consequences of an area's economic performance. Tax implications. Financial consequences of impact on corporate reputation.
Economic 3	Employment and employment capital	Job creation, employment levels (short and long term), skill levels before and after, opportunities for education and training, innovation and new skills.
Economic 4	Gearing	Creating opportunities for investment, use of funding schemes, ability to affect other projects in the area to enhance economic value.
Economic 5	Life span and project risks	Duration of the risk management (remediation) benefit (e.g. fixed in time for a containment system), factors that might impact the chances of success of the remediation works and issues that may affect works, including community, contractual, environmental, procurement and technological risks.
Economic 6	Project flexibility	Ability of project to respond to changing circumstances, including discovery of additional contamination, different soil materials, or timescales. Robustness of solution to climate change effects. Robustness of solution to altering economic circumstances. Requirements for ongoing institutional controls. Ability to respond to changing regulation or its implementation.

Table 5. Sustainable Remediation Indicators – Social Indicators (Smith et al. 2010).

Element	Category	Issues that indicators might need considered
Social 1	Human health and safety	Risk management performance of the project in terms of delivery of mitigation of unacceptable human health risks. Risk management performance in the short term, including risks to site workers, site neighbours and the public from remediation works and their ancillary operations (includes hazardous process emissions such as bioaerosols, allergens, as well as impacts from operating machinery and traffic movements, excavations, etc.).
Social 2	Ethical and equity considerations	How are social justice and/or equality addressed? Is the spirit of the "polluter pays principle" upheld with regard to the distribution of impacts and benefits? Are the effects of works disproportionate to, or more beneficial towards particular groups? What is the duration of remedial works and are there issues of intergenerational equity (e.g. avoidable transfer of contamination impacts to future generations?). Are there businesses involved operating ethically (e.g. open procurement processes)? Does the treatment approach raise any ethical concerns for stakeholders (e.g. use of genetically modified organisms)?
Social 3	Impacts on neighbourhoods or regions	Impacts to local community, including dust, light, noise, odour and vibrations during works and associated with traffic, including both working-day and night-time/weekend operations. Effect of antisocial use of site, and its impact of other regeneration activities. Impacts on the built environment, architectural conservation, conservation of archaeological resources. Effect of the project on local culture and vitality.
Social 4	Community involvement and satisfaction	Impacts of works on public access to services (all sectors-commercial, residential, educational, leisure, amenity). Inclusivity and engagement in the decision-making process. Transparency and involvement of local community, directly or through representative bodies.
Social 5	Compliance with policy objectives and strategies	Compliance of the works with policies, regulatory standards and good practice as set out nationally, by local authority, at the request of community and/or in line with industry working practices and expectations.
Social 6	Uncertainty and evidence	How has sustainability assessment been carried out and what has it considered? Quality of investigations, assessments (including sustainability) and plans, and their ability to cope with variation. Accuracy of record taking and storage. Requirements for validation/verification.

Remediation objectives relate directly to the need to address pollutant linkages by one or more means. This may be achieved by decreasing contaminant mass, concentration, mobility or toxicity; by effective containment of the contaminant; or through the management of the receptor or pathway.

Remediation criteria provide a measure (usually, but not necessarily, expressed in quantitative terms) against which compliance with remediation objectives can be measured. Examples of quantitative measures include:

- Guideline values (e.g., soil guideline values, drinking water standards);
- Site-specific assessment criteria developed from detailed quantitative risk assessment;
- Engineering-based criteria (e.g., the thickness and permeability of a cover system).

1.7.3. Assessment of remediation actions

Having deciding on the objectives of the remedial action, the following steps for the assessment of the remedial actions are (R&D Technical Report "Cost-Benefit Analysis for Remediation of Land Contamination" produced by Risk & Policy Analysts Ltd. in association with WS Atkins):

- Step I: Screening stage
- Step II: Qualitative analysis
- Step III: Combined Cost-Effectiveness Analysis (CEA) and Multi-Criteria Analysis (MCA)
- Step IV: Cost-Benefit Analysis (CBA)

Step I

The initial screening stage is used to examine the characteristics of the contamination problem and associated solutions to determine what might be appropriate for a particular site and hence further assessment requirements.

Step II

Qualitative analysis involves recording the potential impacts of the remedial options without the need to estimate their significance.

The appraisal consists of the identification of impacts with respect to four categories:

- Human health and safety
- Environment
- Land use
- Third party or stakeholder concern

For this step, it is necessary to determine the ***before remediation*** impacts (i.e. the baseline relating to the contamination and the risks it poses taken from the risk assessment), the ***during remediation*** impacts (i.e. those resulting directly from the remedial methods used) and the ***after remediation*** impacts (i.e. those remaining when remediation has been completed).

Step III

From the work carried out in Step II, the impacts, which are likely to arise before, during and after remediation, will be identified for each of the options. However, the Step II assessment provides no identification of how significant those impacts are likely to be, nor how the significance varies between remedial options.

Thus, Step III provides further information on:

- The relative performance of the alternative options across the various impacts categories of concern
- The significance of these to the choice between remedial options

The first stage of this appraisal involves assigning scores across all of the impact categories based on the relative size of the impacts associated with each of the alternative remedial options for both the ***during*** and ***after remediation*** scenarios.

The aim is to give each remedial option a score, which reflects the relative impact it has on each of the categories (human health and safety, environment, land use and third party or stakeholders concern). Thus, the actual magnitude of the impacts which occur is of less importance than whether they are three times as great under one option than under another. Within this context, there are two different approaches which could be adopted towards impact scoring:

- Comparing remedial options directly in terms of proportional effect: for example, one option may give rise to twice the level of volatile organic emissions than a second option, with emissions under a third option being zero. In such a case, the first option would be assigned a score of -100, the second a score of -50 and the third a score of zero; or
- Developing a scale which reflects the relative significance of different levels of effect. An example of such a scale might be scoring no emissions zero, some emissions -25 and lots of emissions -100.

The use of a relative scoring system also needs a definition of ***significant***, since it is differences in the significance of impacts that will determine the scores. A significant impact is one which marks a noticeable difference between the remedial options. The magnitude of a ***significant*** impact will vary between sites due to differences between the remedial options, site-specific conditions and the level of contamination. Hence, deciding which impacts are ***significant*** is a subjective decision, and must be documented in the same way as for all other decisions taken.

Step IV

Finally, the remedial options should be compared each other in the basis of a Cost-Benefit Analysis (CBA) which will allow the comparison of the total expected cost of each option against the total expected benefits, to assess if the benefits outweigh the costs, and by how much. Generally speaking, there is a concern regarding the

potential of the economics to decide if a remedial action will or will not be performed. However, as CBA has become integral to large projects, the limitations to its methodology have come under greater scrutiny and it is true that CBAs struggle to put monetary values on things like environmental quality. Crafty economists try to get around this problem by calculating "willingness to pay": working out how much money someone would spend to clean the air, the soil or purify water.

1.7.4. Remedial actions impacts

Conducting investigation and remediation work causes both direct and indirect environmental impacts. The direct impacts relate to the performance of the work itself and include the consumption of water and fuel and the release of solid waste, wastewater, and air emissions. The indirect impacts relate to the manufacture and transportation of materials used in the environmental work. This includes the manufacture of PVC and stainless steel well materials, the manufacture of drilling and remediation equipment (prorated for the duration of the project or site use), the manufacture of disposable materials (gloves, drums, sampling supplies, etc.) and the impact from accidental fuel spills. Fuel loses usually occur during project work such loses should include both the on-site releases and also the reported national or regional fuel loses prorated based on the total fuel consumed by the site work. An example of another indirect impact to the environment is the amount of paper consumed by reporting requirements.

Similar to the direct impacts caused by conducting environmental work, the indirect impacts include the consumption of natural resources and the production of waste products. The indirect impacts may appear insignificant as compared to those caused from other activities. However, they are significant when one is attempting to justify an environmental project on the bases of its benefit to human health and the environment. Accurately quantifying the indirect impacts requires considerable time, specific industry knowledge, and the ability to filter politically or marketing derived figures but this work should be performed. Just as the analysis of soil and water samples is required, the total impact of the work performed should also be determined.

The environmental impact associated with an undisturbed or inactive site is limited to the potential exposure of hazardous substances. In comparison, the impact associated with a site in which investigation or remediation work is in progress, relates not only to potential exposure but also to the consumption of resources and production of waste streams caused by the work itself. To assist with the quantification of work related impacts, specific activities have been reduced to the amount of water and fuel consumed and the amount of waste produced,

primarily the amount of CO_2 emitted. Carbon dioxide emissions vary based on combustion efficiency and on the exact formulation of the fuel.

Investigation causes also environmental impacts (e.g. drillings). Using direct push for soil and groundwater sampling, for example, has a relatively low environmental impact as compared with rotary wash (mud rotary), which has a higher effect. But it is important to understand that the different drilling methods are also dependent on the required depths of the investigation. Direct push and hollow stem auger are limited to relatively shallow work, mud rotary can go deeper, and rotosonic is the better method for the deepest work. Many sites require less work and many require more. The amount of wastes generated also varies widely between projects depending on policies, work practices, and site conditions. The best practice is to limit wastes whenever possible. Soil and water generated from the investigation work should be returned to the subsurface when it is possible to do so without causing an additional or new exposure concern.

Wastes are generated also during the remediation stage. For example, a single excavator and front-end loader are capable of loading out close to 1,000 tons per day under ideal conditions. Rarely are those conditions met. The availability of the trucks to transport the material is usually the limiting factor. The soil type, presence of debris, staging area, weather, sampling, documentation, and hauling distance to the landfill all tend to limit the amount of work that can be accomplished in a day. Most remedial actions greater than 20,000 tons will utilize two excavators, two front-end loaders, one bulldozer, and other miscellaneous equipment such as power screens, street sweepers, dewatering pumps, water treatment, and other support equipment such as smaller excavators, loaders, and a backhoe. None of these pieces of equipment are operated continuously during the course of a project. Depending on the available personnel and logistics, the excavation, staging, and load out are often alternated. A respectable throughput (requiring experience, planning and resources) can average a load out of 750 tons per day, not including non-working days of which there are many. The load out of this amount of soil will require diesel fuel and this will result in CO_2 emissions.

The amount of fuel required to transport the soil to the disposal facility is of course strictly dependent on the travel distance and number of loads. The air emissions from diesel exhaust represent one of the larger impacts associated with site work (Egeghy et al. 2000). The construction of diesel engines and composition of diesel fuels and associated exhaust products differ based on type and use. These include on-road vehicles (both light-duty and heavy-duty trucks) and non-road (drilling rigs, tractors, construction equipment, and locomotives including line-haul and switch). Diesel fuel is a mixture of many different hydrocarbon molecules. The combustion, both complete and incomplete, of diesel fuel forms a complex mixture

of hundreds of organic and inorganic compounds in the gas and particulate phases. The gaseous constituents include carbon dioxide, oxygen, nitrogen, water vapor, carbon monoxide, nitrogen compounds, sulfur compounds, and low-molecular-weight hydrocarbons. The toxicologically relevant gaseous compounds include aldehydes (formaldehyde, acetaldehyde, and acrolein), benzene, 1,3-butadiene, PAHs, and nitro-PAHs (Egeghy et al. 2000). Of all of these compounds, the most environmentally significant emission, from a global perspective, is CO_2. Although this greenhouse gas is not a toxicological concern, it is the major contributor to global warming.

The particulate phase of diesel exhaust is termed 'diesel particulate matter' and it includes elemental carbon, adsorbed organic compounds, and small amounts of sulfate, nitrate, metals, and other trace elements. The toxicologically relevant compounds associated with diesel particulate matter are the PAHs, including nitro-PAHs, and oxidized PAH derivatives. Although PAHs comprise less than 1% of the particulate matter, diesel emissions have been observed to have elevated concentrations of certain low molecular weight PAHs compared to other combustion aerosols. Enrichment of high molecular weight PAHs such as benzo(a)anthracene and benzo(a)pyrene has also been observed under some conditions. Regardless of the studies referencing specific PAH species, it appears that fuel chemistry ultimately dictates the emission compounds released into the environment. This is because PAH molecules are relatively refractory in nature and this results in a significant fraction surviving the combustion process. Therefore, emissions of PAHs are more a function of the PAH content of the parent diesel fuel than of engine technology or combustion. It is interesting to note that changes in the fuel production processes over time would indicate that diesel PAH content has increased over the past 40 years. While diesel exhaust represents an environmental concern, the more obvious impact associated with site work is from the exposure of COCs (Egeghy et al. 2000).

1.8. Concern in Europe: What the EU is doing?

Worrying trends emerged from research findings and monitoring programmes about the status of European soils. This made the EU decide to analyse and describe the threats being faced by the soils of Europe and suggest a foundation for their protection.

Different community policies contribute to soil protection, particularly environment (e.g. air and water) and agricultural (agri-environment and cross-compliance) policy. However, even if exploited to the full, existing policies are far from covering all soils and all soil threats identified (EC 2006). For these reasons, the Commission

adopted a **Soil Thematic Strategy** (COM (2006) 231) and a proposal for a **Soil Framework Directive** on 22 September 2006 with the objective to protect soils across the EU. But this directive has not been endorsed yet by the European Council. There remains opposition to the proposals in several Member States who say that soil protection solely should be up to Member States, with an emphasis on sharing best practice examples and further development of (voluntary) guidelines.

The Communication (COM (2006) 231) sets the frame and the proposal for a framework Directive (COM (2006) 232) sets out common principles for protecting soils across the EU (EC 2006; EC 2006b). Within this common framework, the EU Member States will be in a position to decide how best to protect soil and how use it in a sustainable way on their own territory. The overall objective is protection and sustainable use of soil, based on the following guiding principles:

- Preventing further soil degradation and preserving its functions:
  - when soil is used and its functions are exploited, action has to be taken on soil use and management patterns, and
  - when soil acts as a sink/receptor of the effects of human activities or environmental phenomena, action has to be taken at source.
- Restoring degraded soils to a level of functionality consistent at least with current and intended use, thus also considering the cost implications of the restoration of soil.

The main aspect of the Soil Thematic Strategy was the proposal, by the European Commission, for a Soil Framework Directive. This would require Member States to systematically identify damaged soils, combat soil degradation and to identify areas where there is a risk of erosion, landslides, loss of organic matter in soils, or compaction or salinisation of soils. Member States would then adopt risk reduction and remediation plans for affected areas, within national remediation strategies (LIFE Focus, 2010).

In 2012, EC released a new communication COM (2012) 46, which provides an overview of the implementation of the Thematic Strategy for Soil Protection1 since its adoption in September 2006 (EC 2012). According to this report, the European Parliament adopted its first reading on the proposal for the Soil Framework Directive in November 2007 by a majority of about two thirds. At the March 2010 Environment Council, a minority of Member States blocked further progress on grounds of subsidiarity, excessive cost and administrative burden and up to date no further progress has since been made by the Council (EC 2012). Nevertheless, some countries are already adopting aspects of the EU Soil Thematic Strategy in their national legislation (JRC 2012).

Finally, the recent Directive on industrial emissions 2010/75/EU (IED) was adopted on 24 November 2010 and replaces the IPPC Directive as of 7 January

2014. This new Directive has introduced additional provisions to ensure that the operation of an installation does not lead to deterioration in the quality of soil (EC 2012).

The 'Roadmap to a Resource Efficient Europe,' proposes that "by 2020 EU policies take into account their direct and indirect impact on land use in the EU and globally, and the rate of land take is on track with an aim to achieve no net land take by 2050; soil erosion is reduced and the soil organic matter increased, with remedial work on contaminated sites well underway." Within the Thematic Strategy for Soil Protection (COM (2006) 231) proposals have been prepared for a dedicated "Soil Framework Directive."

The threats considered in the "Soil Thematic Strategy" were erosion, organic matter, contamination, sealing, compaction, biodiversity, salinisation, flooding and landslides. What the European policy makers needed to know was; how to deal with these threats. What actions and policies would work in the light of both scientific knowledge and past experience?

Finding answers to these questions is challenging for several different reasons. Firstly, the threats themselves are complex and sometimes involve slow processes that are hard to demonstrate. Another problem is that the claims made about the soil are often political where it is hard to draw a line between concerns that are reasonable or speculative. There is in general surprisingly little information or data about some of the threats to support far-reaching actions.

Much of the published data and information about the nature of European soils is based on surveys that were made more than half a century ago. Those who were responsible for this work have mostly retired. Much of what is known about soils is biased towards the needs of agriculture and crop production. Emphasis was given in old soil surveys to recording information that could be reliably recorded and which enabled the agricultural quality of the soil to be assessed. The soil threats often involve dynamic soil properties that show seasonal variations or demonstrate gradual trends. Thus, the challenges of establishing a coherent framework for soil protection in Europe are big.

The European Commission has founded numerous of soil related projects which have produced very useful results for soil threats as they are defined in the Soil Thematic Strategy, for soil quality monitoring, remediation/rehabilitation, protection against natural hazards and people use. For example, LIFE programme has funded about 147 soil-related projects since its launch in 1992, and there has been an increasing focus on soil protection since the publication of the Thematic Strategy in 2006. In specific, since 2014, LIFE has co-financed 21 projects related to soil sealing, 13 projects related to soil biodiversity, 24 projects related to soil carbon capture, 11 projects related to soil monitoring, 12 projects related to water

and soil, 43 projects related to sustainable agriculture and 23 projects related to land contamination. Similarly, other EU funding instruments have funded many soil related projects (CASCADE, DIGISOIL, Geoland2, iSoil, LUCAS, ENVASSO, ESVA, Ramsoil, SOTER, and many others).

Thus, technologies/methodologies/practices have been developed for urban and rural areas, for agricultural areas, for industrial and brownfields areas, soils that accept different types of wastes, recycling of wastes/nutrients/water on land, etc. In the framework of these projects, many web applications (e.g. SoilPro, Prosodol, sigAGROasesor, Agrolca Manager, AgroStrat, AgriClimateChange, and others), databases and platforms (iSOIL, PanGeoe-SOTER, Soilection, EUGRIS, and others), and networks (EURODEMO, NICOLE, GS Soil, agriXchange, EUGRIS and others) have been developed as outcomes.

However, despite the very useful results of these projects and the well-designed and demonstrated actions, there is a big gap between the projects' outcomes and their applicability/adoption by the target end users (i.e. authorities, policy makers, land owners), which, in turn, does not enhance the implementation of the European soil policy at local, regional, national and European level. One of the reasons for this is that the available soil data and projects' data are not translated into problem solving technology and the language of delivery of soil information and technologies is complex so that Local and Regional Authorities (LRAs) and other non-experts (land users, other stakeholders), who need it, find it difficult to avail themselves of the information.

However, bridging the gap between the already produced results and the adoption by the stakeholders is not the only issue of concern when trying to identify the reasons of the low applicability of the EU projects' results. Another one is the limited success of the awareness raising campaigns implemented by the projects. Awareness raising has been carried out for environmental issues around water and air, but less so for soil. Some projects (e.g. SOILCONS-WEB, VOLANTE) began making an effort in this direction, but much more needs to be done considering that much effort has gone into awareness raising amongst key stakeholder groups, such as farmers. However, awareness-raising targeted to activities of the LRAs, which is a significant gap with regards to soil conservation, are limited. More information campaigns and decision-support tools, designed especially for LRAs, will help bridge the gap between lessons learnt and those implementing land use policy.

Low applicability is owed also to the fact that the projects focus mainly on one subject (e.g. remediation of metals contaminated land) and develop a technology/methodology for this specific problem without providing to the end users the technologies/methodologies that should be applied before and after the proposed technology. Therefore, another important aspect that has been not considered

when considering projects applicability, is that results from different projects could be combined and applied in sequential steps in many different cases, which, however, requires a decision making tool. For example, considering the two LIFE projects BioReGen and PROSODOL:

1. By using BioReGen, an end user may apply remediation of metals contaminated land by growing high productivity plants that act as bio-accumulators of certain metals in soil, and thus offering cost-effective options for remediation.
2. By using the monitoring system of PROSODOL, the user could implement an initial characterization of the contaminated area, set up a list of appropriate soil quality indicators, evaluate the risk level of the area, and, finally, develop a periodical monitoring system of the soil quality after the implementation of BioReGen results and by using the web GIS application developed during PROSODOL (http://www.prosodol.gr).

Many such combinations could be done between the results of the EU funded projects to provide a holistic approach of soil protection that will assist the implementation of EU soil policy at local/regional level.

One more reason, apart from those mentioned, is the fact that this knowledge is dispersed on the Internet, meaning that there is a lack of an overall tool, which will assist, not the knowledge searching but it will provide the information to implement the knowledge.

It is obvious therefore that although many of the EU projects have produced positive results that could feed into soil policy, in practice this has rarely happened. The Athens Soil Platform Meeting (in 2013) – a thematic seminar for LIFE projects from across the EU – identified the need for projects to develop strategies for building contacts and fruitful working relationships with legislators at regional, national or EU level. Another proposal (made by the author, who also led the discussion of the 1st working group of the Soil Platform Meeting, http://www.bpi.gr/files/SOIL/SOILPLATFORMMEETINGWG-1Minutes.pdf) suggested establishing a Common European Platform to transfer knowledge from the scientific community to public authorities and policy-makers, by making a range of decision-support tools widely available to members of such a pan-European network (source: LIFE Publication 2014: "LIFE and Soil protection" – page 8), in other words, a Pan European Soil Platform in which all available tools/technologies/methodologies developed so far by the EU soil-related projects will be included in a multi-language web platform which will target, not primarily the scientists or the researchers, but the LRAs, the policy-makers as well as the land owners, the farmers and the public, in general.

1.9. Societal challenges

There has become a consensus that the soil is one of the great challenges that need to be addressed, if Europe is to meet its aim of achieving sustainable development.

Ecosystem health is an emerging trans-disciplinary concept useful in bridging the natural, social, and health sciences and to integrate the human values and perceptions that are part of management. In this view, a healthy ecosystem is a socio-ecological unit that is "stable and sustainable," maintaining its organization and autonomy over time and its resilience to stress, while capable of remaining economically viable and able to sustain human communities (Rapport 1995).

Soil, in its broadest sense, is part of our human habitat; we depend ultimately on it for almost everything. Our dependence is not reflected in the way we organize or manage it. Inadvertently, it is all too easy to focus on one thing that the soil is doing and then to neglect the others, especially those things that are long-term. In order to achieve a land use that is in all senses sustainable, it is necessary for people to have a better, more holistic understanding of what is going on in the soil.

Why are seemingly ignorant decisions often made?

If the soil is so critical to life and human well-being why is it neglected? Why is it threatened? Many people may be ignorant about the long-term consequences of land use. Soil might be perceived as a limitless resource. Land is often owned by people with legal rights that entitle the owners to manage the land as they see fit. Soil degradation is often slow and complex and it is not always easy to demonstrate. Fortunately, neglect is not always a disaster and the soil does have a great capacity to survive and recover from ill treatment (soil resilience). The problem is often that if the soil is used exclusively for one thing then often it cannot adequately do all of the other functions that are vital for the maintenance of fertile soils or ecological processes such as regulating the water cycle. The problem then is an organisational and institutional one.

As a first step for the adoption of soil protective measures, the society should realize what ecosystem health is, how an ecosystem's components interact each other, and that people are also an ecosystem component. Then, scientists, politicians, policy makers and other relevant stakeholders should provide to the members of the society clear and understandable answers to the following questions:

- What are the key functions or services provided by the soil and how should these be measured and monitored?
- How can sustainable soil conservation and protection be achieved?
- What is known about protecting and conserving soil functions from good practice and from case studies?

- How can strategies be identified for conserving and protecting soils, within the context of current environmental and agricultural policies?
- How can combating soil degradation be incorporated into soil conservation and protection strategies?

During the last decade, many people expressed concern about the way land use and pollution were reducing the resilience of the soil and its ability to withstand all of the threats that it is facing. There is no doubt that soil degradation has resulted in soils becoming both less fertile and less able to regulate water and cycle nutrients. On the other hand, it is clear that not all areas are affected and that there are many places that serve as examples of good practice.

The majority of European citizens, except from people working on the land, are completely detached from the soil. Nevertheless, there is an enormously enthusiastic minority passionate about gardening and horticulture and there is a great interest in nature and landscape. Still, preoccupations with air and water are incorporated to the daily lives of the urban population, while soils are generally considered as completely irrelevant. This makes air and water protection easy to justify to the general public, who might not understand the need for soil protection.

Raising consciousness about the importance of soil conservation and protection for the welfare of our modern societies has to be a major policy goal.

Given the legal framework developed by the EU, Local and Regional Authorities (LRAs) have a crucial role to play in the protection of European soils. Everything should be done in order to alert LRAs to the importance of their role and to help community members and LRAs officials take a leadership role in ensuring that future development reflects environmental protection as well as social, and economic community goals.

In today's European Union of 27 Member States, nearly 300 regions and 91,000 municipalities have major powers in key sectors such as education, the environment, transport and economic development, and they account for 2/3 of the total public investment expenditure. Local and regional authorities are vital to the democratic life of the European Union and are key actors in the conception and implementation of common European policies. The current financial, economic and social crisis affecting most of Europe's national governments means that the future of Europe lies, more so than ever, in the hands of local and regional authorities. Indeed, these units of self-government have the capacity to support development projects directly in their territories and on the ground, and to establish a full cooperation with national governments and European institutions in order to create optimal conditions for sustainable and inclusive growth. Over the years, local and regional governments have proven and continue to prove that by

interacting, working together and exchanging best practices, local and regional leaders are better able to tackle challenges and pave the way to a better future.

The EU has determined that protecting soil requires a holistic approach to soil management. The EU Soil Thematic Strategy includes: a proposed legislative framework for the protection and sustainable use of soil, in order to integrate soil protection into national and EU policies; measures to improve knowledge of soil functions; and measures to increase public awareness. It seeks to establish rational land use planning practices at all levels of government to ensure the sustainability of soils, consistent with a "precautionary principle" used by the EU in establishing environmental policy. The proposed EU soil framework directive, designed so that Member States may adopt measures tailored to local needs, establishes common principles, objectives, and actions to guide land use planning and management and requires that Member States adopt a systematic approach to identifying and combating soil degradation. Member States also must integrate soil protection into other policies – especially with respect to agriculture, regional development, transport, and research.

Soil is an integral part of our environmental, social and economic systems, providing food, biomass and raw materials, serving as a habitat and gene pool, controlling the quality and quantity of water flow, climate change mitigation and adaptation, and biodiversity, soil also performs storing, filtering and transformation, as well as social cultural and religious, functions. In this way, soil plays an integral part in the regulation of natural and socio-economic processes that are necessary for human survival, such as the water cycle and the climate system. Because soil forms the basis of many different human activities, it has a significant economic value, which, however, is barely recognised. Ensuring that soil is in a good state to deliver its essential functions is vital for the sustainability of Europe's environment and economy. Therefore, all initiatives and actions that aim to soil conservation and sustainable management bear economic benefits for local population.

Thus, the European LRAs, as key players for soil sustainability, should be provided with the appropriate tools to mitigate soil threats as well as to improve soil quality in a sustainable way. In this respect, the economic benefits that are anticipated concern each one of the Member States separately and also Europe as a whole. The LRAs should adopt soil conservation measures and integrate soil conservation into regional and town planning policies as well as in other public policies (agriculture, energy, waste disposal, transport, energy, infrastructure, etc.). This, in turn, will bring significant economic benefits to local communities, as local authorities will be able to plan and develop targeted actions to protect soil and to

implement innovative ideas/technologies in all production or other sectors (e.g. cultural, aesthetic), where soil is involved.

However, the LRAs rarely know what exactly to implement and which could be the most appropriate practices, methodologies, technologies, strategies that are most suitable for each case of soil degradation, that are, of course, affected by local conditions and peculiarities. There is also a lack of knowledge on how to set targets for soil properties and how to monitor them in the short and in the long term. This is why it is crucial for the scientific community to provide the LRAs with simple and easy understandable tools that will include all the until now produced knowledge, as well as specific implementation instructions.

The LRAs should be urgently provided with and trained in such decision-making tools. It is true, however, that there are many European soil- and environmental-platforms and portals. However, none of them targets the immediate involved stakeholders (e.g. the LRAs), since these platforms/portals target mainly the scientific community. Therefore, they are basically little understandable by the key-holders, i.e. those who can adopt and implement specific measures and finally solve the problems, namely the RLAs and the policy-makers.

It has to be well understood that the local authorities and the decision makers require functional summaries of the environmental problems highlighting major issues (e.g. straightforward identification of sensitive areas irrespective of source; ability to identify remedial/protective actions, to determine the effect of remedial actions; and appropriate monitoring actions) and not long and non-understandable scientific reports. Thus, the development of practical and simple decision-making tools that will encourage local policy-makers, authorities and individuals to take a more holistic approach to soil conservation and improvement and, at the same time, will provide rapid and reliable data/information and web monitoring tools will be very useful for the stakeholders.

Knowing exactly what to implement and how, which benefits to expect and also the cost of these actions, LRAs will have significant economic benefits, since

1. they could perform proper financial planning actions to seek the necessary funds as well as rational use of available funds and achieve best value for money,
2. they could identify those practices which will lead to the desired result, depending on the goals they have set, so that national or EU funds to be utilized in the best possible way. It is thus crucial for the authorities to be able to identify the most fit-for-purpose and cost effective solutions,
3. addressing degraded soils' impacts would economically benefit the citizens and through them the community as a whole. For example, addressing loss of soil productivity, degradation of the plant cover, land

contamination, soil loss/sealing/compaction, intensive and mainly non-sustainable agriculture, desertification risk, and also remediating brownfields and waste disposal areas, improving urban areas by introducing greening practices, etc., would bring net economical benefits to the agricultural sector, improve food quality and safety, increase products competitiveness, increase available clean areas, decrease inputs like water, fertilizers, pesticides, reduce health risks for human and animals, aesthetically improve degraded areas with subsequent increase in human well-being and tourism and many others,

4. instead of using expensive technologies (e.g. dig-and-dump) they can identify alternative methodologies/technologies derived from many EU projects that are of low cost and have proven environmental benefits, however, still unknown to the wider public (LRAs included) due to the limited dissemination and awareness raising campaigns.

The anticipated social impacts are also significant considering that regional and local authorities are those authorities which are closest to the citizens and through many participatory processes the voice of citizens can be heard while they can express their views on issues that are concerned with the local community and influence its socio-economic development. The undertaking of initiatives and the design of projects/activities for soil protection and improvement with immediate effect on the quality of local environmental and the prosperity of the civil society will strengthen the relationship of trust between citizens and LRAs and allow their smooth and effective cooperation. This, in turn, will bring substantial benefits for the progress and the success of the actions planned and undertaken and also for the society due to the strengthening of the relationships between its members, leading to an overall improvement of citizens' social life.

Furthermore, the awareness raising and also the knowledge on the actual scientific possibilities/solutions for soil protection and improvement given to the LRAs and to the citizens in a way that they can read and understand will make them active actors in all activities and will significantly increase the acceptance of the designed plans by the civil society.

As far as citizens are concerned, an overall improvement of their social life may be seen due to improvement of their economical status and also of the local environment.

It should be also mentioned that the impacts of soil degradation are more severe for small and poor farmers who are marginalized form lack of credit, spirit of initiative or know-how. For them the loss of marginal production, but vital for their survival, is extremely penalising. The improvement if this situation by adopting low-cost but effective practices as derived from many EU projects (however,

unknown to the farmers or other potential users) will narrow societal disparities and will further assist the development of the society.

Considering the growing social demand regarding the quality of the everyday environment and of the productive sectors, the establishment (or the consolidation) of such a participatory (in other words, democratic) circle at territorial level would help to improve the environment, will boost development and strengthen the social network.

2. Sustainable Agriculture

2.1. Historical review

Agriculture is the production of food and goods through farming. Agriculture was the key development that led to the rise of human civilization, with the husbandry of domesticated animals and plants (i.e. crops) creating food surpluses that enabled the development of more densely populated and stratified societies. It provides the basis of subsistence for human populations (EU 2011).

While the first large agricultural civilizations developed on alluvial materials of large river basins (Egypt, Mesopotamia, Huang-ho), much of Europe was first extensively farmed. From the late Neolithic times until the Roman period, large areas of Europe remained forested. The phenomena of soil degradation generated by human activities is a very ancient feature of Europe. Historic soil erosion was known to occur in cycles during which periods of erosion were followed by periods of stability or soil formation. Soil loss was not only experienced as negative and in many cases it may have deliberately been induced by the local communities to produce fertile sediments. Soil erosion has been at the basis of the creation of large alluvial plains that were extensively cultivated in ancient times. Ancient societies adapted to the redistribution of resources (soil and water) and exploited the environment as how it had become.

Historic erosion had many different complex causes ranging from the destruction of forests for fuel or timber to the neglect of common lands and extremes in climate. However, large efforts had been made at the end of the nineteenth century to re-establish forests in France, Italy and Spain and there had been considerable success in reducing soil degradation.

Soil erosion rates over much of Europe were very low under the mixed farming that occurred before and just after the Second World War. In the 1960s and 1970s, several scientists who had worked on soil conservation schemes in Africa and Asia returned to Europe where they could see that erosion rates were becoming high

as well. They began to measure the long-term impacts of slow processes; not only erosion by rain-wash but also those caused by ploughing, grazing and the loss of soil with root crops.

In most of Europe, soil erosion and soil contamination began to be serious issues with the advent of modern agriculture after the Second World War. At that time, agricultural policy focused on increasing agricultural production to sustain food security (Bullock 1999). To make farming more effective and raise farm income, mechanization and intensification took place. Pesticides were developed to control plant diseases. Small fields got consolidated to enlarge fields. Furthermore, fields were levelled to make tillage, plant treatment, and harvesting operations more effective. Soil quality was gradually becoming less important as a deciding factor for the agricultural system. As a consequence, organic matter and soil biodiversity decreased and soils that were susceptible became more compact and sensitive to erosion.

One hundred years ago, agriculture could be seen to be having a great impact on land degradation and erosion in the United States of America (Photo 2.1). This impact resulted in the abandonment and afforestation of huge areas in New England and the Appalachians.

Tens of thousands of farmers suffered hardship and left the land. Bennett, in 1930, (http://www.soil.ncsu.edu/about/century/hugh.html) and others documented the magnitude and impact of erosion and warned about the consequences if no actions were taken. They were able to set up research stations to quantify the soil loss, both in tons of soil and loss of agricultural production.

Photo 2.1. Dust storm approaching Stratford, Texas. Dust bowl surveying in Texas. Image ID: theb1365, Historic C&GS Collection. Location: Stratford, Texas. Photo Date: April 18,1935. Credit: NOAA George E. Marsh Album.

2.2. Agriculture in the EU

Farming is the most dominant and dynamic type of land use, covering around 40% of the land area in the EU-27 (EUROSTAT 2010). The agricultural area is commonly divided into four main classes: arable land, permanent grassland, permanent crops and kitchen gardens. In 2007, they respectively represented 104, 57, 11 and 0.4 million hectares in the EU-27. Within the arable land class, cereals were the dominant crop (55.4 million ha), followed by fodder crops, i.e. crops that are cultivated primarily for animal feed (18.2 million ha) and industrial crops, i.e. crops grown to produce materials for industrial processes and products (12.9 million ha). The main permanent crops were olive trees (4.27 million ha), vineyards (3.28 million ha) and fruit, berries and citrus (2.88 million ha).

According to EUROSTAT (2010) and in absolute terms, total trade in agricultural products amounted to almost EUR 153 billion in 2007, split between EU imports from third countries of EUR 77.4 billion and exports of EUR 75.1 billion. The EU is currently the largest global importer and exporter of agricultural products. It is also the primary importer from developing countries. For many years, the EU has been a net food importer. Even if today the EU's overall trade is in fairly close balance, the EU still remains a substantial importer for many product groups.

As regards cropping patterns. Cropping patterns provide insight into environmentally important trends in farming in the European Union. The utilised agricultural area can be divided into three main types of agricultural land use: arable area, permanent grassland and permanent crops. Kitchen gardens are also included by convention in the total utilised agricultural area, even if they only represent small areas. In the EU-27 in 2007, arable land represented 104 million hectares, whereas permanent grasslands represented 57 million ha and permanent crops only 11 million ha (EUROSTAT 2010).

Cropping pattern is defined as the spatial representation of crop rotations, or as the list of crops that are being produced in an area and their sequence in time (Casasnovas and Montero 2004).

Regarding Organic Farming (EUROSTAT 2010), in 2008, just over 4.5% of the utilised agricultural area (UAA) in the EU-27 was classified as total organic areas (including both fully converted areas and areas under conversion), ranging from 15.9% in Austria and 10.8% in Sweden to below 2% in Ireland, Romania and Bulgaria. The overall percentage of UAA occupied by organic farming has increased from 2007 to 2008 in the EU-27 and in all Member States, except Italy and France (decrease in percentage points of –15.3 and –2.3%). This increase is greatest for Greece, Slovakia, Bulgaria and Spain (changes of +12.0, +16.2, +22.6 and +23.3%, respectively).

Organic farming can be defined as a method of production which places the highest emphasis on environmental protection and animal welfare considerations. Organic farming involves holistic production management systems for crops and livestock, emphasising the use of on-farm management practices in preference to the use of off-farm inputs. This is accomplished by using cultural, biological and mechanical methods in preference to synthetic chemical inputs such as fertilisers, pesticides (fungicides, herbicides and insecticides), additives and medicinal products.

In the EU, farming is only considered to be **organic** if it complies with Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products.

Environmental concerns about sustainability coupled with growing consumer interest in food safety have resulted in many agricultural holdings converting to certified organic production methods (source: Organic Farming in the EUhttp://ec.europa.eu/agriculture/organic).

Agriculture exerts pressures on the environment that are both beneficial and harmful and can result in positive and negative environmental impacts. The positive or negative nature of these interactions changes according to the agricultural practices that prevail in given geographic areas. In the last few decades, these practices have changed quite significantly, contributing to increased yields (e.g. quantities of cereals per hectare or milk per cow) and therefore, stressing the food production role of farming. These changes can be classified into two main categories: the specialization and intensification of certain production methods (e.g. with the use of more chemicals and heavy machinery) and the marginalisation or abandonment of traditional land management (e.g. where agriculture is less profitable).

Therefore, in order to reduce the pressure of intensive farming systems on biodiversity, sound agricultural management practices (e.g. efficient use of inputs and slurry, prevention of negative effects, management of low-intensity pasture systems, integrated farm management, preservation of hedgerows and woods) should be promoted as they tend to have a substantial and positive impact on the conservation of the EU's wild flora and fauna.

Agricultural practices have a direct impact on soil, air, water, biodiversity and landscapes, as well as an indirect impact on climate change and waste production and accumulation. For instance, agriculture emits greenhouse gases and consumes fossil fuels for farm operations, thus having an impact on air quality. The run-off from agricultural land contributes to 50–80% of the total nitrogen load in water and has remained constant over the last 30 years (EEA 2005). Globally, agriculture accounts for 70% of the consumption of fresh water resources. On average, 42% of total water abstraction in Europe is used for agriculture, and agriculture accounts

for 50–70% of total water abstraction in south-west European countries (UNEP 2004). Intensification and land abandonment have led to the destruction of valuable semi-natural habitats that are essential both for biodiversity and landscape preservation.

Greenhouse gas (GHG) emissions

Climate change represents one of the greatest environmental, social and economic threats facing the planet. The European Union is actively working towards a global agreement to control climate change. This process is attributed to a build-up of greenhouse gases (GHG) emitted by human activities, which trap the Sun's heat in the atmosphere in the same way as the glass of a greenhouse. Six main greenhouse gases are monitored: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and three fluorinated gases: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

As already discussed, globally, soil is the biggest terrestrial carbon pool. The decay of SOM results in the release of greenhouse gases, mainly CO_2, into the atmosphere. Thus, preserving existing carbon stocks in the soil and fighting the depletion of humus (the most stable share of SOM) are of utmost importance for the environment.

According to UNFCCC (United Nations Framework Convention on Climate Change – United Nations 1992) emissions reporting, the sources of greenhouse gases from agriculture are: enteric fermentation (fermentation that takes place in the digestive systems of ruminant animals, i.e. cattle, buffalo, sheep); anaerobic decomposition of manure; rice cultivation; agricultural soil management; prescribed burning of savannahs; and field burning of agricultural residues that produce CO_2, but mainly CH_4 and N_2O.

Agriculture is therefore a major source of non-CO_2 greenhouse gases, which are many times more powerful than CO_2. Several farm management practices can potentially reduce GHG emissions. They include, for instance, the decrease in fertiliser use and the application of organic matter to stabilise and increase the SOM content, control of manure management systems to reduce the extent of anaerobic decomposition, improved animal productivity and rumen efficiency or a control of the anaerobic digestion by capturing the methane produced and using it for heating purposes. The drainage of peatlands and the conversion of grasslands to croplands result in large emissions of GHG. These emissions, together with an overall depletion of soil organic content in agricultural lands, are a serious threat to soil fertility and a further boost to climate change (Doran 2002).

In absolute amounts (EUROSTAT 2010), the EU-27 agricultural sector produced 462,217 thousand tonnes of CO_2 equivalents of greenhouse gases in 2007, which represented 9% of the total GHG emissions of the EU-27. However, a reduction of 20.2% can be observed compared to 1990. It should be noted that these numbers only take into account emissions from animal enteric fermentation, manure management, rice cultivation, agricultural soils and burning of agricultural residues. They do not take into account emissions coming from land use and land use changes (drainage of peatlands and conversion of grassland to cropland), neither do they account for emissions from agricultural machinery or fertiliser production.

The largest decrease in emissions occurred between 1990 and 1993 (EUROSTAT 2010). This decreasing trend can mainly be attributed to reductions in livestock numbers in the new Member States after the strong political and economic changes that occurred in the early 1990s and to changes in manure management.

2.2.1. Farm management practices

Farm management practices (H. P. Piorr and U. Eppler, University of Eberswalde) in the framework of the PAIS project (Proposal on Agri-Environmental Indicators), financed by Eurostat (from 2000 to 2004) are decisions and practical measures defining the management of farms. They include input use and production technologies such as crop rotation, soil treatment methods and coverage of soil with vegetation, as well as types and capacities of storage facilities for organic fertilisers. Farm management practices, therefore, have a direct impact on various soil degradation processes, such as erosion, reduced organic matter content in soil, soil compaction and different types of pollution.

For instance, the best farm management practices enable the preservation and improvement of permanent soil fertility, prevent soil erosion and compaction, increase efficiency in the use of plant nutrients, decrease the risk of environmental pollution by plant protection products and fertilisers and are economically advantageous.

In livestock manure, the best practices ensure sufficient storage capacities, to decrease the risk of soil and water pollution. Very small dung pits, dunghills and other storage facilities are indeed forcing farmers to apply manure in an excessive and unplanned manner, regardless of the needs of the plants and environmental conditions.

In the Report of EUROSTAT of 2010, a set of seven indicators which characterise the management practices in the different Member States, with the aim of pointing out progress towards the sustainability of farming are described. The indicators help show whether sustainable production methods are applied in the field.

Farmers' training level and use of environmental farm advisory services: The indicator presents educational levels of holders and managers of agricultural holdings based on completed formal education and agricultural training. Their favourable age and educational structure is one of the biggest factors contributing to more efficient management of agricultural holdings, because well-educated, innovative and aware farmers find it easier to adapt to the modern economic circumstances (cost analysis, assimilation of technical progress, etc.), environmental considerations (water use, pesticide and fertiliser management) and social conditions (consideration of the rural context, new direct markets, etc.).

Mineral fertiliser consumption: Fertile soils are rich in nutrients, essential components which play a key role in plant metabolism and growth. Crops take the nutrients they need from the soil, and these nutrients need to be replaced in order for plants to continue their development. Traditional farm management practices replaced the nutrient stocks by practicing crop rotations and regular fallow periods, together with the spreading of animal manure. Today, inorganic fertilisers are, together with manure, the main sources used to restore nutrients to the soil and to increase crop yields. Excessive application of nutrients can, however, pose a threat to the environment.

Consumption of pesticides: A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. Therefore, depending on the pest in question, the term pesticide refers to insecticides (if the pest is an insect), herbicides (if the pest is another plant), fungicides (if the pest is a fungus) and various other substances used to control pests. The use of pesticides plays an important role in agricultural production by ensuring less weed and pest damage to crops and a consistent yield. Their use, however, can have several negative impacts on human health (through pesticide residues in food) and the environment. The main environmental impacts of pesticides are water quality degradation and terrestrial and aquatic biodiversity reduction through toxic effects on non-target species. The contamination of the environment by pesticides may result from spray drift, volatilisation, surface run-off and subsurface loss.

Energy use: Total energy use comprises the direct use of gas oil, petrol and electric energy related to heating and the use of machinery, and the indirect use of energy for the production of mineral fertilisers, farm machinery and buildings. A reduction in total energy use at farm level reduces the environmental impacts of farming.

Soil cover: The indicator presents the share of the year when the arable area is covered by plants or plant residues. The longer an arable area is left without plant or plant residues, the more vulnerable it is to nutrient leaching and to wind and water erosion.

Tillage practices: Proper tillage practices, employed separately or in combination with crop rotation, can be very effective in reducing soil losses. Zero tillage is a way of growing crops from year to year without disturbing the soil through tillage. This can increase the amount of water in the soil and decrease erosion. It may also increase the amount and variety of life in and on the soil. This indicator measures the share of arable areas under zero or conservation tillage.

Manure storage: Manure is organic matter (from both animal and plants) used as organic fertilizer in agriculture. Animal dung has been used for centuries as a fertiliser for farming, as it improves the soil structure so that it holds more nutrients and water and becomes more fertile. Animal manure also encourages microbial soil activity which promotes the soil's trace mineral supply, improving plant nutrition. It also contains some nitrogen and other nutrients which assist the growth of plants. Responsible storage is necessary to protect the local environment from the harmful effects that 'run off' from manure can have if it is allowed to enter watercourses.

2.2.2. Indicators of pressures and risks to the environment

The magnitude of interactions between agriculture and the environment is partially defined by the farm management practices and agricultural production systems. Agriculture has a significant impact on soil, air, water, biodiversity and landscapes.

To assess this magnitude, nine indicators have been proposed (EUROSTAT 2010). This set of indicators aims at tracking the threats posed to the environment by farming. These threats can be linked to land use, input use including nutrients (e.g. fertilisers, manure), pesticides and emissions in water and air.

Land use change: Conversion of agricultural land to artificial surfaces (i.e. soil sealing) can have several environmental impacts on soil, water and biodiversity resources. The sealing may increase the risks of soil erosion and water pollution. It also disturbs agricultural habitats, impacts on animal migration patterns due to habitat fragmentation and affects the hydrological cycle, leading to an increased risk of floods. In addition, it affects the aesthetic value of agricultural landscapes and increases their fragmentation, which can result in more noise and emissions due to increased traffic levels. This indicator measures the share of agricultural area that has been sealed compared to a reference period.

Risk of land abandonment: Land abandonment is traditionally defined as the abandonment of exploited agricultural landscapes, which are left to their own spontaneous dynamics. This abandonment leads to a loss of landscape diversity and related loss in biodiversity and to an increasing vulnerability to fires and, in some cases, soil erosion. This arises from a re-growth of various shrubs and

eventually woodland vegetation on abandoned agricultural land, which suppresses biodiversity-rich grasslands and leads to an increased fire risk in Mediterranean areas. The reasons for and consequences of land abandonment are very diverse across the EU, ranging from difficult economic conditions to demographic factors.

Gross nitrogen balance: Gross nitrogen balance relates to the potential surplus of nitrogen on agricultural land. This is estimated by calculating the balance between nitrogen added to an agricultural system and nitrogen removed from the system per hectare of agricultural land. A persistent surplus indicates potential environmental problems; a persistent deficit indicates potential risk of decline in soil nutrient status.

Risk of pollution by phosphorus: This indicator relates to the potential surplus of phosphorus on agricultural land. This is estimated by calculating the balance between phosphorus added to an agricultural system and phosphorus removed from the system. A persistent surplus indicates potential environmental problems.

Pesticide risk: The term 'pesticides' is a generic name that encompasses all substances or products that kill pests. Plant protection products (PPPs), the pesticides used in agriculture, are part of the modern agricultural production system and are used to control occurrence of weeds, insects and diseases prejudicial to crop production, and to minimise labour requirements. They are also used for regulating vegetative crop growth. The risk linked to the use of PPPs is highly dependent on their inherent properties (degradation pathways), on environmental conditions including soil temperature and moisture content and on farm management practices (e.g. application rates). This indicator measures the index of risk of damage linked to PPPs from pesticide toxicity and exposure.

Ammonia emissions: Ammonia (NH_3) is naturally found in trace quantities in the atmosphere. It is produced by the decay of animal excrement and vegetable matter. When deposited in water and soils, ammonia can potentially cause two major types of environmental damage, acidification and eutrophication, both of which have negative impacts on sensitive vegetation systems and water quality. In Europe, ammonia emissions mainly occur as a result of volatilisation from livestock excretions (more particularly from cattle, buffalo and swine). A smaller fraction of ammonia emission is due to the volatilisation of ammonia from nitrogenous fertilisers. The agricultural sector remains responsible for the vast majority of ammonia emissions within the EU, as agriculture contributes to over 90% of the total ammonia emissions in most EU countries

Greenhouse gas emissions: As discussed in section 2.2.

Water abstraction: Irrigation represents the primary use of water in agriculture. Trends in water abstraction rates depend on different factors: crop selection, irrigation area, irrigation technology, water prices, water restrictions, pumping

costs and climate. The environmental impact of increasing water demand can result in declining groundwater levels and the need to build more and larger water reservoirs. In some instances, major water diversion structures are necessary to supply water to irrigation schemes. The diversion or retention of water for irrigation can have serious downstream effects on the environment, especially the drying up of wetland areas. This indicator evaluates the contribution of agriculture to water abstraction by measuring the share of agriculture in water use.

Soil erosion: Due to the loss of topsoil, the soil becomes less fertile and the aquatic ecosystem contaminated. Erosion in agricultural areas could result in undercut slopes, which remove the slope base, causing landslides. Wind erosion, involving a removal of predominantly the finest soil particles, results in an ongoing decrease in soil fertility, so that the effects of wind erosion on agricultural productivity are detectable only after years or decades. The highest number of erosive days on bare soil per year (calculated over the last 30 years) is found across the sand belt covering southeast England, the Netherlands, northern Germany and Poland (SOCO 2009).

2.3. Sustainable Agriculture

The world's population is poised to reach 9 billion by the middle of this century and over the next 40 years, 70% more food will be needed to sustain all these people. Most of this additional food will have to be produced where it is needed, namely in developing countries. These countries will have to double their production to achieve this goal, with implications also for the natural resources that farming depends on and especially water, land for cultivation and mineral fertilisers. All of these are available in only limited amounts. In many places, the soil has already suffered long-term damage, and water resources are often overused or polluted by fertilizers and pesticides. Agricultural biodiversity has decreased as farming has become industrialised. These negative effects have heightened global awareness of the fact that agriculture does more than simply produce food, animal feed and energy; it also impacts on the climate and the health of global ecosystems (Wörner and Krall 2012).

Against this backdrop, *how do we make sure that future agricultural production guarantees food security for the world's population without destroying its own resource base*? The answer is that we need productive, yet sustainable agriculture. Growth must not be detrimental to resources and must not rely on consuming resources (USDA 1999).

The debate about sustainable agriculture typically focuses on whether farming should be conventional or organic, on an industrial scale or small scale. However,

the issue is rather more complex, as sustainability hinges on many factors (Wörner and Krall 2012).

Sustainable agriculture (ATTRA 2005):

- puts the emphasis on methods and processes that improve soil productivity while minimising harmful effects on the climate, soil, water, air, biodiversity and human health
- aims to minimise the use of inputs from nonrenewable sources and petroleum-based products and replace them with those from renewable resources
- focuses on local people and their knowledge, skills, socio-cultural values and institutional structures
- ensures that the basic nutritional requirements of current and future generations are met in both quantity and quality terms and that agriculture can also generate additional products
- provides long-term jobs, adequate income and dignified and equal working and living conditions for everybody involved in agricultural value chains
- reduces the agricultural sector's vulnerability to adverse natural conditions (e. g. climatic) and socio-economic factors (e. g. strong price fluctuations) and to other risks.

Therefore, sustainable agriculture integrates three main goals (Photo 2.2)

- environmental health,
- economic profitability, and
- social and economic equity.

A variety of philosophies, policies and practices have contributed to these goals. People in many different capacities, from farmers to consumers, have shared this vision and contributed to it (USDA 1999, ATTRA 2003).

Photo 2.2. The Components of Sustainable Agriculture

Sustainable agriculture can be broken into three components: economic, environmental, and social, that they are overlapping, impacting and influencing each other. For example, economic decisions will also impact the environmental and the social components.

Economic Profitability

To be truly sustainable, a farm must be economically viable. The environmental and social benefits of sustainable production methods do not always translate into immediate economic gains. That said, sustainable agriculture practices can have a positive economic impact on a farm. For example, diversifying the farm with several crops and markets helps to reduce financial risk. Over time, improved soil and water quality, as well as other environmental benefits from sustainable practices, may raise the value of the farm. Selling products directly to local markets in the community reduces shipping and fuel costs and can potentially decrease transportation costs. While sustainably grown produce may not bring the full price premiums sometimes paid for certified organic products, growers selling directly to individuals and specialty markets can still capture added value (SARE 2003).

Production costs can be variously affected by sustainable methods. Fertilizer and pesticide costs are generally reduced on a sustainably managed farm because, for example, legumes and crop rotations tend to be less expensive than their synthetic alternatives. Labor costs are often higher than conventional systems. The higher labor costs are most often attributed to the increased time required for monitoring and managing pests on sustainable farms. Planting material costs can be lower for growers saving their own seed or producing their own stock. However, those using organic planting material often pay more for seed or other planting material.

Machinery costs (purchase, fuel, and repairs) will vary depending on the specific type of sustainable production system. Conservation tillage systems and reduced pesticide applications can cut costs related to machinery use and fuel costs. On the other hand, certain systems, such as ridge tillage, can require specialized equipment. Fuel and machinery costs can increase as a result of moving bulky materials, such as organic matter, for soil improvement purposes. The result is that some farms that utilize sustainable agriculture practices may be more profitable than their conventional farming counterparts, although the reverse can also be true. In addition to crop production methods, many other factors can affect the bottom line, including management, marketing skills, and experience.

ATTRA (2003, 2005) lists the following indicators that a farm is achieving economic sustainability:

- The family savings or net worth is consistently going up.

- The family debt is consistently going down.
- The farm enterprise is consistently profitable from year to year.
- Purchase of off-farm feed and fertilizer is decreasing.
- Reliance on government payments is decreasing.

Environmental Stewardship

Environmental concerns are central to sustainable agriculture. Sustainable agriculture is frequently described as: ecologically sound practices that have little to no adverse effect on natural ecosystems. However, more than that, sustainable agriculture also seeks to have a positive impact on natural resources and wildlife. This can often mean taking measures to reverse the damage (e.g. soil erosion or draining of wetlands) that have already occurred through harmful agricultural practices. Renewable natural resources are protected, recycled, and even replaced in sustainable systems. Also inherent to sustainable agriculture environmental concerns is the stewardship of non-renewable resources, such as fossil fuels (SARE 2003b).

A key to successful sustainable production is healthy soil, with a central tenet that management practices "feed the soil and the soil feeds the crop." Ecologically, this means that soil fertility is provided by adequate soil organic matter and biologically based inputs that feed soil organisms, which release nutrients to plants. Sustainable methods of enhancing soil fertility and improving soil health include: using nitrogen-fixing legumes, green manure, and animal manure; minimizing or eliminating tillage; and maintaining year round soil cover. However, depending on the condition of the soil, establishing healthy soils may take several years. This approach does not preclude the use of synthetic fertilizer that can be used to supplement natural inputs. However, fertilizer decisions are based upon soil test results.

Other sustainable concepts include: maximizing diversity through planned crop rotations, intercropping, and companion planting; protecting water quality; composting; year round soil cover; integrating crop and animal production; soil conservation practices; and attracting beneficial wildlife. Some traditional agricultural practices, such as moldboard plowing, are in conflict with sustainability since they can result in damage to soil structure. Rather, tillage practices should be appropriately timed, using implements that minimize damage to soil structure to the greatest extent possible (SARE 2003b, 2005).

Insects, diseases, and weeds are managed, rather than controlled, in sustainable systems. The goal is not necessarily the complete elimination of a pest, but rather to manage pests and diseases to keep crop damage within acceptable economic levels. Sustainable pest management practices emphasize prevention through good production and cultural methods. Some strategies include: using crop rotations that

will disrupt the pest life cycle, improving soil quality, practicing good sanitation, using optimum planting densities, timing planting and transplanting operations to avoid high pest populations, employing biological control, and growing resistant varieties. Monitoring pests through frequent crop inspections and accurate identification are essential to keeping ahead of potential problems. Integrated Pest Management techniques can be incorporated into a sustainable program. These may include scouting, targeting pesticide applications, and the use of biological pest controls. Pesticides are seen as a last resort when using IPM methods, and are chosen for their low toxicity, specificity to the pest, and lack of persistence in the soil (ATTRA 2001).

Achieving a healthy, balanced ecosystem takes time. Making the transition to sustainable farming is a process that generally requires moving forward step-by-step. While there are common goals that are critical to sustainable agriculture, there is no single approach that will guarantee sustainable success on every farm. The methods for accomplishing those goals must be tailored to the individual farm.

ATTRA (2005) lists the following indicators that a farm is achieving environmental sustainability:

- There is no bare ground.
- Clean water flows in the farm's ditches and streams.
- Wildlife is abundant.
- Fish are prolific in streams that flow through the farm.
- The farm landscape is diverse in vegetation.

Social Responsibility

Social sustainability relates to the quality of life for those who work and live on the farm, as well as those in the local community. Fair treatment of workers, positive farm family relationships, personal interactions with consumers, and choosing to purchase supplies locally (rather than from a more distant market) are just some of the aspects considered in social sustainability. Community supported agriculture (CSA), farmers markets, U-pick, cooperatives, and on-farm events are just some of the ways a sustainable farm can have a positive impact on the local community. In essence, the farm supports the community and the community supports the farm.

ATTRA (2005) lists the following indicators that a farm is achieving social sustainability:

- The farm supports other businesses and families in community.
- Money circulates within the local economy.
- The number of rural families is going up or holding steady.
- Young people take over their parents' farms and continue farming.
- College graduates return to the community after graduation.

Definitions (Doran 2002, Wörner and Krall 2012)

Organic farming does not use synthetic pesticides and mineral fertilizers and attempts to work with natural methods and cycles. A number of associations and certification systems exist, but organic production does not have to be certified.

Conventional farming is not a clearly defined concept but the term is generally used in the literature to refer to farming with synthetic pesticides and fertilizers. Therefore 'conventional farming' frequently denotes non-sustainable farming practices.

Industrial agriculture is typically considered to be a highly mechanised form of plant and animal production using high-yield seeds or breeds. It is often also used to mean non-sustainable production, although this does not have to be the case.

Good agricultural practices (GAP) are production methods governed by laws, regulations and guidelines. These practices set minimum standards for sustainable farming. One such example is GLOBALG.A.P., a voluntary standard set by the food industry.

Integrated plant protection is a production method adapted to the location that is environmentally sound. It uses all suitable and reasonable crop cultivation, nutrition and protection processes in the best possible combination. Integrated plant protection also harnesses both bio-technical progress and the natural constraints of harmful organisms (integrated pest management). This approach aims to guarantee long-term dependable yields and commercial success.

In the following, some key questions regarding sustainable agriculture that mainly set by or concern society, are discussed.

1. Soil management – is it possible without ploughing?

'Conservation agriculture' has been a focus of attention in recent years as a farming method that involves no tillage, permanent organic mulch cover and extended crop rotation. These methods make the soil much less susceptible to wind and water erosion. Its structure improves, it can absorb and store water better, fewer nutrients are washed away and the number of soil-dwelling organisms increases. All in all, crops can draw on more nutrients. In a best-case scenario, the soil releases fewer greenhouse gases and may even store more carbon. Over the past ten years, an average of 6 million hectares of conservation agriculture has been brought into cultivation each year (Wörner and Krall 2012).The main drawback of conservation agriculture is that the use of herbicides has been virtually inescapable up until now. Soil tillage operations modify the soil's architecture (soil structure, porosity, bulk density, and water-holding capacity), the distribution of crop residues and organic carbon content. The lack of ploughing, however, requires changes to weed management if wheat, soy, maize and other agricultural crops are to grow successfully (Doran 2002).

Special machines are also needed, for instance, for direct sowing, as well as a great deal of expertise.

Smallholders in developing countries typically have neither, making it a challenge to introduce conservation agriculture.

2. Organic agriculture – can it feed the world?

Organic farming is one type of sustainable farming. It has potential, especially for farms that still rely on traditional and extensive agricultural methods.

Changing over to organic cultivation could significantly boost yields, even though the boost always depends on the baseline. Other types of sustainable farming would also deliver much higher yields if better-quality seed and fertilizers were used, if soil were better cultivated or if rainwater were used more. Switching to organic farming typically leads to a sharp drop in yields compared with intensive farming at prime locations with healthy soil and decent rainfall. Yet, we need the high yields that intensive farming brings to feed the world's population.

Therefore, organic farming cannot feed the world alone in its present form but will instead have to be combined with other sustainable production methods.

3. Mineral fertilizer – a blessing or a curse?

The past decade's increases in agricultural yields would have been impossible without mineral fertilizer. Subsidy schemes have made mineral fertilizer much cheaper in many developing countries and have thus helped to boost food production and improve food security.

Until now, insufficient attention has been paid to the adverse effects on the soil and the environment of improper use of mineral fertilizer with the exception of nitrous oxide emissions and their impact on climate change and nitrate leaching. Many tropical soils are acidic by nature, and mineral fertilizer speeds up the acidification process. Consequently, soil productivity deteriorates rather than improves in the long term and the fertilizer cannot have its full effects. Most soils do not have enough phosphorus, with the result that in the industrialized countries, soil is often over-fertilized, while in Africa a shortage of fertilizer results in under-fertilization of the soil.

Synthetic nitrogen, which today makes up approximately 72% of the nutrients applied through mineral fertilizer worldwide, takes a significant amount of energy to produce. Potassium (15%) and phosphorus (13%), which are exploited from natural deposits, account for the remainder. These resources are finite, so new strategies are needed for providing the soil with nutrients to make the use of mineral fertilizer sustainable. Wherever possible, organic fertilizer (manure, compost and green manure) should meet the need for basic nutrients, with mineral

fertilizers used only to cover any shortfall. Sewage sludge can also play a role, although contamination, for instance from heavy metals, is a problem. Tailored fertilizer strategies are crucial to guaranteeing that cultivated plants absorb the maximum amount of nutrients. Nitrogen produced as a result of the symbiosis between fungus and roots is a key factor in soil nitrogen supply.

4. Seeds –from commercial or farm-based production?

Most farmers in developing countries use their own seeds and propagating material. These items are adapted to local conditions, cultural needs and families' nutritional habits, but typically do not produce very high yields. These farm varieties compete with modern seeds and propagating material, which feature enhanced properties, such as higher drought tolerance, better resistance to certain pests or very high yields. High-productivity seeds have revolutionized farming yields and paved the way for global cereal production to almost triple between 1950 and 2000.

Modern varieties all share very similar properties. In order to prepare farmers for climate change and other future challenges, diverse characteristics such as resistance to new diseases, pests and drought are becoming increasingly important. Traditional varieties often have these characteristics. In addition to cultivation techniques, plant breeding provides another opportunity to significantly improve yields from smallholder farming. Modern varieties can be combined with local regional varieties or their characteristics, and farmers and professional seed growers can work hand in hand. National and international agricultural research institutes and non-governmental organizations are the main actors involved in participatory seed cultivation. The outcome may be better local seeds that are not protected by patents and are freely available for further breeding. However, commercial high-yield hybrid seeds are also essential to enhance productivity. Hybrid seeds lose their beneficial properties in subsequent generations but are still worth buying annually if yields are high enough.

Hybrid seeds are widespread and exceptionally successful worldwide in both conventional and organic farming. However, seed firms and local availability of these seeds, together with advice on how to use them, are required for the use of high-quality seeds to become more wide-spread (USDA 1999, SARE 2003b).

Genetically modified seed
The use of genetically modified plants in farming remains controversial. The main criticisms relate to environmental risks, the level of concentration on the seed market, the expansion of patent protection for seeds, which increases farmers' dependency, and the adverse effect on organic farming. However, the challenge of significantly increasing global production of food and agricultural raw materials supports the use of all available technical innovations. What is needed is transparent research, preferably publicly funded, into the risks of gene technology. Any risks ascertained must be set against the benefits to assess the benefit of using genetically modified plants. Genetically modified varieties are mostly supplied by a small number of multinational seed companies, but this could change if national and international agricultural researchers made seeds available as global public goods – in other words, without licence fees. These varieties might, for instance, tolerate salt or drought, which would help smallholders in regions hit especially hard by resource degradation and climate change.

Monsanto Co., was among the first to genetically modify a plant cell, along with three academic teams, which was announced in 1983 (Plant Biotechnology News 2013), and was among the first to conduct field trials of genetically modified crops, which it did in 1987. Monsanto was a pioneer in applying the biotechnology industry business model to agriculture, using techniques developed by Genentech and other biotech drug companies in the late 1970s in California (Leonard-Barton and Pisano 1990). In this business model, companies invest heavily in research and development, and recoup the expenses through the use and enforcement of biological patents (Schneider 1990, USDA 2004, Burrone 2006). Monsanto's application of this model to agriculture, along with a growing movement to create a global, uniform system of plant breeders' rights in the 1980s, came into direct conflict with customary practices of farmers to save, reuse, share and develop plant varieties. Its seed-patenting model has been criticized.

However there are contradictory examples of achievements and consequences of GM seeds use while in a wider point of view, the public opinions regarding Genetically Modified (GM) seeds are also contradictory.

Negative Example. GM seeds have been used in India for the last decade. In a country of more than 550 million farmers who are largely poor and uneducated and the agriculture market rife with inefficient business practices, the Indian government sought to reform the market by eliminating subsidies and loans to the farmers. However, the government reform did not help the farmers since the Indian government has "forced market liberalization on India which means the elimination of government subsidies and government-backed loans to farmers." At that crucial period, the GM seeds entered Indian market by promising higher yield and net income for the poor farmers. However, GM seeds in India did not produce what it had been promised and farmers hoped. The expensive seeds (100 grams of GM cost $15 to the farmers compared with $15 for 1,000 grams of traditional seeds) piled up debts and destroyed farming fields. In many instances, the crops simply failed to materialize. The farmers were not aware that the GM seeds

required more water than the traditional seeds. And lack of rain in many parts of India exacerbated the crop failure. With no harvest, the farmers could not pay back the lenders, while by a contractual clause, the farmers could not save GM seeds for reuse after the first season. Burdened with debts and humiliation, the farmers simply took their own lives, some by swallowing poisonous pesticides in front of their families. To date, an estimated 200,000 farmers have committed suicide all over India (Source: http://www.globalresearch.ca/killer-seeds-the-devastating-impacts-of-monsanto-s-genetically-modified-seeds-in-india/28629).

Photo 2.3. Genetically modified cotton seeds. The blue seeds belong to a new variety of cotton seeds, namely Praja. Praja is developed as an insect-resistant genetically modified seed having good tolerance towards major sucking pests. What is more, it promises high yields in rain-fed areas because of its deep root system and desired drought tolerance, noted the report.

Positive Example. Another example published by K. Kaplan (2013) and mentioned a study published in the journal PLOS ONE, tracked the fortunes of 533 cotton farms in India over eight years. These farming families were poor – on average, family members consumed no more than $500 worth of goods each year. The typical farm was about 12 acres, with about half the area used to grow cotton, while wheat, millet, sorghum, rice and other crops were grown on the rest of the land.

In 2002, 38% of the farms planted cotton that was genetically modified with *Bacillus thuringiensis* (Bt), making it able to ward off insect pests like cotton bollworms without needing extra pesticides. Researchers checked in with farmers every other year. By 2008, 99% of the farms were planting Bt cotton. Previous studies have found that farms using Bt crops earned more money – they get higher yields while spending less money on chemical pesticides. The authors of the study found the same thing in India – farming families that planted Bt cotton were able to grow or buy more food, and they were less likely to be classified as "food insecure," consuming fewer calories per day than the World Health Organization deems safe. (The researchers estimated that threshold to be 2,300 calories per day for an adult male farmer in India).

5. Agricultural biodiversity – will it save us?

Agricultural biodiversity encompasses the species, varieties and breeds that are used or available in agriculture. It is essential for productive, efficient and sustainable farming. The loss of diversity in agricultural crops was and remains attributable to increasing agricultural intensification and industrialisation. A similar trend has emerged in animal husbandry. Around four fifths of the world's 925 million starving people live in rural areas. Most of them are farmers and livestock owners. Their survival relies on a wide range of local crop varieties and locally adapted animal breeds in at times challenging environmental conditions. Hunger and poverty can be combated only if farmers are put in a position to farm successfully under these conditions and manage the scant resources available to them better and more sustainably (Wörner and Krall 2012).

Three quarters of the world's cultivated plants and 690 livestock breeds have been irretrievably lost since the middle of the 19th century and 20% of our agricultural livestock breeds are at risk of extinction.

It is therefore needed to preserve and unlock the significant potential of agricultural biodiversity. Places that no longer traditionally preserve varieties by using them, as is the case today for millet in the Sahel region or potatoes in Peru, always pay the price. Approaches to tackling the problem exist, but there are still no long-term solutions aside from storing seeds and material for propagation in gene banks. It is also important to recognise that in helping farmers to adapt to climate change, agricultural biodiversity is an important new genetic reserve and insurance policy for the future, increasing its significance.

6. Smallholders – better farmers?

Environmentally harmful farming methods are not only characteristic of many industrial or intensive agricultural businesses; smallholders practicing extensive farming frequently also destroy the soil and the environment. Many live and farm on land that is more environmentally susceptible than prime agricultural locations. Poverty is generally the cause, but

Who are smallholders?
The term 'smallholder' encompasses a very diverse group. The spectrum ranges from medium-sized agricultural enterprises that are fully integrated into the market economy – a group that is very common in many Asian countries – to micro-enterprises that overwhelmingly practice subsistence farming and include three quarters of the world's poor. The common denominator is frequently having two hectares of land or less. Approximately 85% of all agricultural businesses worldwide are smallholder operations, and in many developing countries, more than 90% of farmers are smallholders.

a lack of knowledge can also lead to improper resource management. Smallholders frequently do not use pesticides as prescribed and spread them without wearing protective clothing. People suffer poisoning time and again, and food is contaminated. Alternatively, farmers put too much fertiliser on the soil, with the consequences already described. However, even where fertiliser and pesticides are not used, soil can degrade through improper management or be lost through erosion. On the other hand, many smallholders embracing traditional practices make a significant contribution to preserving the existing diversity of agricultural crops and livestock and indigenous farming knowledge. The conclusion is that the better farmers are not smallholders per se but all those who use sustainable farming practices at all levels of production. Nonetheless, smallholders are, by far, the largest and, hence, the most important group in the transformation of agriculture in developing countries.

7. How sustainable agriculture can be promoted?

Education, knowledge and agricultural advice are essential for sustainable farming, especially by smallholders in developing countries. Access to resources is equally important. Besides water and land, these resources mainly comprise fertiliser, seeds, pesticides, machinery and draught animals, but also credit and, often, workers. Small-scale farmers are still often excluded from the formal credit market in many places because they cannot offer banks any collateral. In particular, growth-oriented sustainable farming needs development infrastructure and access to functioning markets. Modern communication technologies play an increasingly vital role: it is now hard to image daily life without mobile phones and Internet access, even in remote rural areas.

Agripreneurs are farmers who think and act entrepreneurially, will be critical for sustainable farming in the future. Agripreneurs use resources optimally and sustainably. They not only provide food but their products also serve energy, raw materials and animal feed markets.

2.4. The European Common Agricultural Policy (CAP)

(Source: 'The common agricultural policy explained' (European Commission, Agriculture and Rural Development DG, http://ec.europa.eu/agriculture/envir/).

The common agricultural policy (CAP) finds its roots in 1950s western Europe, whose societies had been pressured by years of war. The emphasis of the early CAP was on encouraging higher agricultural productivity to ensure that consumers had a stable supply of affordable food and that the EU had a viable agricultural sector.

The high budgetary costs, the distortion of some world markets and the increasing concerns about the environmental sustainability of agriculture called for a strong reform of the CAP. For instance, production limits were set to help reduce surpluses and agri-environment measures (AEM) were introduced. AEM are designed to encourage farmers to protect and enhance the environment on their farmland. Farmers commit themselves, for a five-year minimum period, to adopting environmentally friendly farming techniques. AEM are currently the main instrument for the integration of environmental goals into the CAP.

Rural development regulation is quite flexible and allows agri-environmental programmes to be designed at national, regional or local levels. Thus they can be adapted to local or regional farming and environmental conditions, which are very diverse throughout the EU. As a consequence, there is a wide range of AEM in different Member States.

Farmers are no longer paid just to produce food. They have to respect environmental, food safety, phytosanitary and animal welfare standards. The latest CAP reforms confirmed this shift towards increasing environmental concerns. For instance, three priority areas are identified in the CAP:

- biodiversity and the preservation and development of 'natural' farming and forestry systems and traditional agricultural landscapes;
- water management and use;
- dealing with climate change.

This is achieved by:

- targeting aid at rural development measures promoting environmentally sustainable farming practices, like agri-environment schemes;
- enhancing compliance with environmental laws by sanctioning the non-respect of these laws by farmers through a reduction in support payments from the CAP.

2.5. Societal challenges

Having recognized the environmental challenges of agricultural land use, in 2007, the European Parliament requested the European Commission to carry out a pilot project on "Sustainable Agriculture and Soil Conservation through simplified cultivation techniques" (SoCo). The SoCo report (JRC 2009) concluded that there is a wide range of farming practices available to farmers throughout the EU for mitigating or even reversing soil degradation processes. In addition, there is a range of measures within the current rural development policy that are appropriate for supporting sustainable soil management. These include national agri-environment measures and the provision of advice and training to farmers. Given the

appropriateness of existing instruments, rural development policy should continue to address soil conservation needs. More work is needed to improve policymakers' and stakeholders' understanding of the appropriate reference levels that determine which agricultural practices produce public benefits beyond mandatory requirements and for which farmers should be remunerated. The development of reliable, comprehensive and operational indicators on (i) the state of soils (soil degradation); (ii) the social impact (cost) of soil degradation; and (iii) the impacts of soil protection, conservation and improvement practices, as encouraged in the proposed Soil Framework Directive, should be prioritized in order to produce a more accurate baseline estimate of the condition of European soils (Louwagie et al. 2011).

Another issue of concern that should be always kept on mind when designing dissemination, training or educational strategies for the farmers and the society is the extent of adoption of the proposed practices and by which factors is this affected. The wide adoption of a sustainable way of thinking is depended on well understanding of these factors and in developing the appropriate strategies to reach and convince the target audience.

Social networks and social participation which are important components of social capital enable individuals to engage infrequent interactions with others and facilitate the access to information and sharing of knowledge and better access to markets through collective bargaining. Therefore, social networks should be very well exploited and specific activities should designed in order to disseminate information through them. Reciprocity based on trust and trustworthiness is also an important feature that facilitates collective action since individuals within a social group may engage in informal exchanges with each other in the hope that the counterparts will reciprocate (Pretty and Ward 2001).

The factors that are mainly affect the adoption of new, alternative sustainable practices in agriculture, are:

Age: Younger farmers were more likely to perceive that soil erosion was a problem, that conservation measures are profitable, and that the risk associated with adopting new practices is therefore justified. In addition, younger farmers were more likely to adopt conservation tillage than older ones (Carlson and Dillman 1986) and to recognize nonpoint source pollution problems (Christensen and Norris1983).

Education: Similar to age, educational level has a positive relationship on the use of soil conservation practices. Higher educational level was associated with stronger intentions to adopt soil conservation in general (Bultena and Hoiberg 1983). Lack of education is a reason for indifferent or negative farmer attitudes toward soil conservation. Lack of education limited farmer's knowledge and

awareness of the concepts of soil conservation, thus they were unable to recognize soil erosion problems when they existed (Sadler Richards 1983).

Management Skills: More skilled farmers had stronger intentions to adopt soil conservation while innovators had, in generally, significantly higher farm management skills (Zimmerman 1988).

Farm Size: Larger farm size is associated with stronger intentions to adopt soil conservation. Farmers with larger farms were more likely to adopt conservation tillage (Bultena and Hoiberg 1983), and early adopters of no-till farmed more land than nonusers (Carlson and Dillman 1986).

Farm Type: Farm type is an important factor affecting the adoption of soil conservation practices because the ease with which the necessary practices can be integrated into an existing operation will depend on the type of farm operation in place. For instance, less adoption of best management practices may be expected for cash grain farms than other farm types due to the inherent short-run profit goal of these operations (Culver and Seecharan 1986).

Farm Income or Financial Situation: Higher gross incomes have been shown to be significantly related to the adoption of conservation tillage (Bultena and Hoiberg 1983, Smithers and Smit 1989). Gross farm income has been positively correlated with the adoption of no-till, the perception of soil erosion problems, the perceived extent of the problems, and the adoption of soil conservation practices (Carlson and Dillman 1986, Green and Heffernan 1987).

Farm Organizational Structure: The type of organizational structure in place could, in part, influence land management practices, farm planning strategies, and goals of an operation. For example, a very different view of the land and the farming business is likely to occur between a family and a commercial farm where there are often differential priorities regarding the intensity with which the land is farmed. Early adopters were more likely to be a family corporation as opposed to a family farm (Carlson and Dillman 1986).

Risk: Considering that there is, in general, a considerable uncertainty associated with the costs and benefits of soil conservation measures, it is anticipated that this uncertainty could affect the adoption of best management practices. The amount of risk or uncertainty associated with a farmer's immediate decision-making environment, affects the length of the planning horizon. When uncertainty is low, planning horizons lengthen (Culver and Seecharan 1986). However, not only the attitude to risk in general but also the perceived riskiness of the practice itself in terms of yield and/or income is important (Christensen and Norris 1983).

Awareness or Perception of Erosion Problems: Farmers are generally aware of existing and potential soil erosion, soil compaction and soil structure problems on their farms. However, their perception of the extent and magnitude of erosion's

effects are questionable. There appears, therefore, to be only a general awareness of land degradation problems among farmers. This is nonetheless an important observation, since awareness of a problem is hypothesized by many to be the first step in the process of adopting practices to mitigate against the problem. There is a general perception that problems existed, but there is hesitancy among farmers to admit that there is any relationship between pollution in general and the situation on their own farm in particular. However, the absence of soil conservation practices on a farm does not necessarily imply that farmers are unaware or unconcerned about land degradation problems (Swanson et al. 1986).

Awareness or Perception of Soil Conservation Measures: As noted above, individuals make decisions about changing farming practices based on their perceptions of the situation or the innovation at hand. The benefits of soil conservation practices are not always clearly evident. Where clear assessments of costs and benefits are not readily available, it is more difficult for individual decision-makers to develop accurate perceptions of an innovation and its potential impact on their operation (Dickinson et al. 1987).

Farmer's perceptions of a practice can differ widely from its actual characteristics Perceived characteristics of an innovation that affect adoption are:

1. socio-technical: degree of newness, perceived complexity, degrees of discomfort, divisibility, visibility, compatibility with existing methods, and;
2. socio-economic: costs and returns are not always perceived similarly by farmers and social factors may modify the importance of economic considerations or perceptions of the advantages of adoption.

Attitude Towards Soil Erosion and Soil Conservation: Attitudes toward something are different than awareness about, or perceptions of the item in question. Knowledge about something is necessary prior to having an attitude towards it, but questions (in a survey, for example) which assess awareness or perceptions do not necessarily provide information vis-a-vis an individual's attitude toward the item in question. A person might perceive that a soil erosion control practice is not economically justifiable, but this does not necessarily mean that he/she will have a negative attitude towards the practice; as it may be the best solution available.

Similarly, a person may have a positive attitude towards soil conservation and conservation practices

in general, but may not perceive the problems or solutions accurately. Conversely, it is possible for an individual to accurately perceive the extent of soil erosion problems and not care about them enough to do anything about them (in other words, to have a negative attitude toward soil conservation). There are many instances where attitudes follow from perceptions. For example, indifferent or negative attitudes toward conservation tillage (which would affect adoption

rates) were found related to lack of education about the problem, misconceptions about the economics of potential solutions, or negative past experiences with conservation tillage (Sadler Richards 1983).

Therefore, while attitudes may influence some behaviours, attitudes and behaviour do not necessarily correlate well. When this is true, measurement of attitudes and subsequent attempts to change them may be largely irrelevant exercises and it may be more rewarding to focus on behaviourial change and constraints directly.

Community Attitudes About Soil Conservation: Bultena and Hoiberg (1983) found that those who perceived a high degree of local acceptance of reduced tillage were more likely to adopt conservation tillage practices. The importance of local community involvement in promoting and implementing measures to control nonpoint source pollution should be noted. Community participation undoubtedly fosters positive attitudes on the part of individuals and reinforces an adopter's self-image.

Land Tenure: Land tenure has a negative effect on soil conservation. Soil conservation practices are not employed as extensively on rented land (Christensen and Norris 1983) since farmers managed their owned land differently than their rented land. Rented land tended to be of lower quality and more in need of ameliorative practices, yet less likely to receive upgrading practices.

Orientation to Agriculture and Farming: Orientation to farming could be also a possible explanation of adoptive behavior."Orientation to farming" could be "business orientation" or a "way-of-life orientation" and is more significantly related to the adoption of different types of conservation practices than either "psychological innovativeness" or "profitability orientation" (Ervin and Ervin 1982).

Availability of and Access to Assistance: Assistance to farmers can take many forms; financial, technical information and advice. The availability of technical and financial assistance has an impact on the ability of farmers to do something about the problems they face (Christensen and Norris 1983). Farmers considering the adoption of soil conservation practices reported that lack of available knowledge, assistance and/or equipment was an important reason that they would not adopt such practices (Wall et al. 1985).Good technical advice can be an important stimulus to adoption of soil conservation practices. A key factor in many programs designed to promote the adoption and diffusion of agricultural (and more specifically, soil conservation related) innovations is the provision of information to farmers. This information is designed to educate farmers about soil erosion problems and possible solutions, which are available via the adoption of particular practices. Little has been done to investigate the communication channels, by which such information is distributed and decisions made. It is true that the type and form of information is relevant to adoption rates whereas, lack of available

knowledge (Culver and Seecharan 1986) and access to knowledge (Christensen and Norris 1983) have been shown to reduce adoption of conservation practices.

The most important information channels to reach farmers should be governmental and not only farmers personal experiences, media (newspapers and journals).

The type of information access which a farmer has, depends upon his/her personal characteristics and connectivity to communication channels. These communications are different for different categories of adopters. While awareness may come through the mass media, decisive positive or negative influences to change behaviour often arise through inter-personal communications. Role leadership is often diffuse in the farming community, and subsequently hard to measure.

Profitability of a Practice: It is clear that the use (or non-use) of some practices is economically motivated since the presence of a favourable cost/benefit ratio favours adoption (Culver and Seecharan 1986). Zimmerman (1988) stated that the cost of equipment, and therefore, the profitability of the practice, was one reason given by a randomly selected group of farmers for not adopting conservation tillage.

For practices which are profitable locally, then their adoption could be more related to diffusion-type variables. The same is not true for unprofitable practices. Similarly, in an area where conservation tillage is potentially a profitable practice, adoption is not constrained by the same factors as for conservation expenditures in general (Norris and Batie 1987). Since conservation tillage is profitable, such variables as erosion potential and perception of the problem are not correlated with the adoption of the practice (Norris and Batie1987). It appears that the relative importance of the various factors which affect adoption and the appropriate type of model to use may differ according to profitability. The perception of the profitability of soil conservation practices affects the perception of the problem as well as the adoption of soil conservation practices (Green and Heffernan 1987).

Characteristics of Innovations: Innovations possess characteristics that make them more or less likely to be widely adopted. These include, for example, the ease with which they may be integrated into the existing farming system or the degree of individual effort (mental and physical) required to master the item (White 1985, Webster 1986). Jolly et al. (1985) have provided some helpful suggestions for distinguishing among the key characteristics of a technology which may affect adoption. By classifying them as either (1) direct superior, (2) direct inferior, or (3) indirect, one is readily able to predict the likelihood of adoption. Inferior and superior are defined on the basis of whether or not net economic benefits of the new technology are greater than the existing technology, while direct and indirect are defined by where benefits occur (i.e. on-farm or off-farm). They concluded that, "when direct economic benefits are absent, the economic and sociological models

of adoption appear to breakdown" (Jolly et al. 1985). Dickinson et al. (1987) note that the managerial complexity of the technology or set of practices is an important factor in determining whether or not a practice or set of practices will be adopted. It is also true that the importance of this managerial complexity factor varies with education, ability, and experience of the user. Therefore, there is a need to relate the characteristics of the innovation under consideration to the socio-economic characteristics of the potential adopter. The perceived characteristics of the innovation are as important as the actual characteristics of it.

The Larger Economic and Social Environment: The microeconomic situation on the farm is affected to a large degree by the general macroeconomic climate of the agriculture sector and the national and world economies as a whole. The larger economic environment, therefore, affects the adoption of soil conservation practices indirectly through its effect on the farm's specific economic situation. The same macroeconomic environment will affect different farmers in different ways depending on specific personal and situational factors which are exogenous to the larger economic and social environment. The organization and structure of the agricultural industry dictates the behaviour of farmers to some extent (Swanson et al. 1986). Tax policy, farm support programs and the agricultural treadmill are barriers to soil conservation. Constraints of one kind or another can prevent farmers from behaving consistently with their attitudes (Lovejoy and Napier 1986). During periods of uncertainty in the industry, farming decisions are often made for the purpose of maximizing short-run profits (Swanson et al. 1986). Therefore, when the agricultural economy or the economy as a whole is in flux, especially on the downward side, the adoption of practices which affect the long-term sustainability of the farm is not as critical as is achieving short-run survival.

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Accountability and Information Systems*

Introduction

Organizations are responsible for the social effects of their behaviour. In order to hold them accountable, the public must know what happened. Organizations must therefore provide evidence of performance in the form of various kinds of annual statements, compliance reports, or risk assessments. To make sure such reports are reliable, certain internal controls must be built into the procedures, processes and information systems that are used to gather evidence. Information systems are designed. Therefore, it makes sense to take the core value of accountability into account during the design and implementation of information systems.

So what is accountability? "Accountability can be defined as a social relationship in which an actor feels an obligation to explain and to justify his or her conduct to some significant other" (Day & Klein 1987). In other words, an actor provides motivations of his or her conduct towards stakeholders, i.e. other parties that care about this conduct. Accountability is a social value, like other values that shape modern commerce and government, such as security, reliability, profitability, usability or efficiency. The attitude of an organization towards such values, as ingrained in the organizational culture, affects the way in which the mechanisms are designed that structure the functioning of an organization. This may be called value sensitive design (Friedman et al. 1992; Friedman et al. 2008; Van Den Hoven & Weckert

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2008) (Van Den Hoven et al. 2015). For example, a manufacturing plant reflects the value of quality, when there are specific roles for people who are responsible for checking quality and initiating improvements.

In a similar way, the attitude of an organization towards the value of accountability is reflected by the way the organization is set up (Burgemeestre & Hulstijn 2015). In particular, when actors want to explain or justify their conduct to others, they need evidence. Such evidence is collected by means of information systems. An information system is a set of interrelated components (people and artefacts) that collect, process, store, retrieve, and disseminate information, to support decision making and control in an organization (Laudon & Laudon 2014). Here we look, in particular, at the control function of information systems: to support feedback over organizational behaviour. Information only counts as evidence when it is reliable: it must be accurate (correspond to reality) and complete (all relevant aspects are recorded). Moreover, the party being held accountable may have legitimate or illegitimate reasons to adjust the information. For example, in a tax declaration, management may want to report as little revenues as possible, as taxes are deducted as a percentage of revenues. In the annual financial statements, on the other hand, management may want to report as much revenues as possible, to attract investors. For these reasons, external stakeholders expect certain precautions in the evidence collection and reporting process that should guarantee reliable reporting. These are called internal controls. Consider for example segregation of duties, reliable cash registers, automated checks, access control, or logging and monitoring.

Crucially, such internal control measures are being designed. An adequate design of the internal controls is a prerequisite for this kind of accountability. But it is not enough. Evidence is being generated in a corporate environment. People are often in the position to circumvent the controls or manipulate their outcomes (Merchant 1998). Whether they choose to do so depends on their values and beliefs, which are partly determined by the corporate culture (Hofstede et al. 1990). Corporate culture cannot be designed; it can only be stimulated. For instance, a culture of accountability can be facilitated by systems that make it easier rather than harder to access and share information.

That suggests the following research question:

> Under what conditions does the design of the information systems in an organization reflect the value of accountability?

In this paper, we would like to argue that the information systems in an organization support the value of accountability when (1) they produce reliable evidence,

i.e. they record the organizational behaviour accurately (as it occurred) and completely (nothing missing), and (2) that relevant evidence is indeed revealed to stakeholders.

Concerning the research method, note that we made a step from the philosophical notion of accountability to a deliberate design choice. We approach the question by means of design science (Hevner et al. 2004; Peffers et al. 2008). Design science studies the way in which artefacts, here information systems, are being designed, according to a requirements specification, the context of use, theory and methods.

Relevant design principles can be derived by comparing various cases of information systems reflecting – to a certain extend – the value of accountability. In particular, we will look at cases that have to do with evidence and compliance reporting, as a specific case of being accountable. These cases are triggered by new forms of regulatory supervision, such as responsible regulation (Ayres & Braithwaite 1992). This means that policies of the regulator towards a company depend on the company's compliance record. Companies must explain to the regulator how they have interpreted the rules, what measures they have taken, and that they can demonstrate to be compliant. In these reporting cases two other notions also play an important role. Risk plays a role, because many regulations are meant reduce the risk for society (Beck 1992; Power 2007). Trust plays a role, because the regulator depends on the company for reliable reporting, and hence, is forced to trust them (Gambetta 1988; Zucker 1986).

The remainder of this paper is structured as follows. In Section 2, we discuss the idea that accountability can in fact be designed, and is not a property that grows or develops. We describe the idea of a dialogue with stakeholders, in which design choices are motivated. We propose a particular technique, value-based argumentation, to structure such dialogues about design. Second, we will discuss the crucial notions of risk and trust, in the context of information systems and reliability of evidence. Third, we discuss the relationship between the notion of accountability on the one hand, and new forms of regulatory supervision on the other hand. In Section 3, we discuss a number of cases, both to illustrate the approach and evaluate its application. Section 4 derives conclusions and substantiates the claim made above, that accountability depends on reliable evidence and the willingness to challenge.

2. Theory

We use several theoretical approaches to discuss accountability. A large part of the discussion is based on (Burgemeestre & Hulstijn 2015), in particular, at the beginning.

2.1. Accountability

Accountability is a property of a person or organization. When used to describe a system, its meaning is derived. Accountability is an iconic notion, with positive connotations. For example, accountability is used as a kind of synonym to good governance (Dubnick 2003). Clearly the meaning depends on a relationship with others: "Accountability can be defined as a social relationship in which an actor feels an obligation to explain and to justify his or her conduct to some significant other" (Day & Klein 1987). According to Bovens (2007), an accountability relationship contains a number of components: the actor can be a person or agency. Then there is some significant other, who can be a person or agency, but can also be a more abstract entity, such as God or 'the general public.' Bovens calls this the forum. The relationship develops in three stages. First, the actor must feel obliged to inform the forum about its conduct, including justifications in case of failure. The obligation may be both formal, i.e., required by law or by contract, or informal and self-imposed, for instance because the actor is dependent on the forum. Second, the forum may interrogate the actor, ask for explanations and debate the adequacy of the conduct. Third, the forum passes judgement on the actor's conduct. A negative judgement often leads to some kind of sanction; again this can be both formal and informal. The crucial role of the forum means that an accountability relation should provide room for discussion; it is not a one-way stream of reports, but rather a dialogue. Moreover, accountability is not without consequences; a judgement depends on it.

We can also analyse accountability as the counterpart of responsibility (Van De Poel 2011). When I am responsible for my actions now, I may be held accountable later. I need to collect evidence, so that I can justify my decisions. One could say that this focus on evidence collecting has turned a moral topic into a rather more administrative or technical one.

Based on the philosophical and legal literature (Duff 2007; Hart 1968) it is possible to identify a number of necessary conditions for accountability. Accountability can be set apart from blame and from liability, which are all related to the umbrella notion of responsibility. Blame is the stronger notion. Accountability involves the obligation to justify one's actions, but does not necessarily imply blame. Ignorance or coercion can be valid excuses. Liability narrows the notion to a legal perspective. One can be blamed but not liable, for instance when a contract explicitly excludes liability. Conversely, one can be liable, but not blamed, for instance when everything was done to prevent disaster. To summarize, according to Van De Poel (2011), agents are only accountable for their actions, in case each of the following conditions are met:

a. Capacity. The agent must be able to act responsibly. This includes the difficult issue of 'free will.' Conversely, when the agent is under pressure or coerced into doing something, or when he or she is mentally or physically disabled, he or she is no longer held accountable.
b. Wrongdoing. Something must be going wrong. This means that the agent fails to live up to its responsibilities to avoid some undesired condition *X*. Or, under a different account, it means that the agent transgressed some duty *D*.
c. Causality. The agent is instrumental in causing some undesired condition *X*. Either this means that the agent is generally able to influence occurrence of *X*, or, that some transgression of duty *D* causes *X* to occur.

2.2. Accountability and auditing

As we stated in the introduction, we focus on accountability in the context of regulatory compliance. Companies collect evidence of behaviour and produce reports. To verify these reports, auditors or inspectors are called in. Therefore, auditing theory is relevant here, see textbooks like Knechel et al. (2007). "Auditing is the systematic process of objectively obtaining and evaluating evidence regarding assertions about economic activities and events to ascertain the degree of correspondence between the assertions and established criteria, and communicate the results to interested users" (American Accounting Association 1972). Roughly, auditing is testing to a norm (Figure 1). What is being tested is a statement or assertion made by management about some object, for instance the accuracy and completeness of financial results, the reliability of a computer system, or the compliance of a process. The statement is tested against evidence, which must be independently collected. The testing takes place according to norms or standards.

Much recent thinking about accountability and compliance monitoring has come to be dominated by a rather mechanical logic of auditability (Power 2009). This way of thinking is characterised by a bureaucratic demand for evidence, and by reference models like COSO and COBIT that try to put reality into a rational mould of control objectives and measures to mitigate risks. The plan-do-check-act loop (Deming 1986) that was originally developed for improving quality in the automobile industry, is widely adopted to make organizations learn and improve their risk management efforts (Power 2007). This Deming cycle is essentially a feedback-control loop, which presupposes that an organization is run as a machine, with levers and dials. Although corporate reality rarely fits these moulds, accountability has sometimes degenerated into a box-ticking affair.

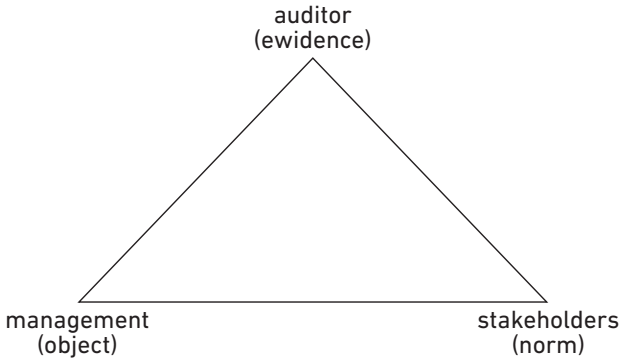

Figure 1. Typical audit setting

In the typical audit relation, we identify three actors: management, stakeholders, and auditors (Figure 1). Management is accountable for its actions to the owners or shareholders of a company, who want to see a return on investment. It is also accountable to other members of society, like employees, suppliers or others who are dependent on the company. Every year management prepares financial statements about the results of the company: profit and loss, assets and expectations, and compliance. Auditors verify these statements, and provide assurance as to their reliability. In this case, the accountability derives from a delegation of tasks: shareholders have delegated executive tasks to management. The resulting loss of control is remedied by accountability reporting.

This type of accountability relationship is typically addressed by agency theory (Eisenhardt 1989). One party, the principal, delegates work to another party, the agent. The agent must give an account of his or her actions, because the principal is distant and unable to verify or control the agent's actions directly (Flint 1988). In addition, the agent's incentives may conflict with those of the principal, so the agent may withhold evidence of executing the task. The resulting information asymmetry is one of the focal points of agency theory. The principal runs a risk, for two reasons: (i) she is dependent on the agent for executing the action, but does not have a way of directly controlling the agent, and (ii) she is dependent on the agent for providing evidence of execution. To overcome these risks, the principal will typically demand guarantees in the way information is being generated: internal controls.

2.3. Accountability is not traceability

Even though accountability has become a main issue in today's audit society (Power 1997) and information systems are crucial for the collection of evidence, the topic has received limited attention in computer science. An exception is (Friedman et al.

2008). They define accountability as the set of properties of an information system that ensure that the actions of a person, group of people, or institution may be traced uniquely to the person, people, or institution. So, under this view, accountability is ensured by an audit trail. In the context of regulatory compliance, also Breaux and Anton (2008) consider a software system to be accountable if "for every permissible and non-permissible behaviour, there is a clear line of traceability from the exhibited behaviour to the software artefacts that contribute to this behaviour and the regulations that govern this behaviour" (p 12). However, Chopra and Singh (2014) argue that although such traceability is an important mechanism for holding someone accountable, it is neither necessary nor sufficient. First, traceability of actions is not always necessary. One can also use the outcomes of a process, rather than the way it was carried out, to hold someone accountable. Compare the difference between outcome control and behavioural control (Eisenhardt 1985). Second, traceability is not enough. What is needed is a mechanism of holding the agent accountable: someone must evaluate the audit trail and confront the agent with possible deviations. This is the role of the forum (Bovens 2007).

Who plays the role of the forum? That is a matter of governance (see below). In trade relationships, we often find actors with countervailing interests (e.g. buyer and seller) who can hold each other accountable. This is also why segregation of duties is considered so important: it creates independent sources of evidence, which can be used for cross-verification. In bureaucracies, often an artificial opposition is created, for instance between the front office (help client) and the back office (assess conformance to policies). Also the installation of a dedicated risk management function, separated from the business, can be seen in this respect. When effective, such a risk function should provide a counter force against the tendency of the business to take on too many risks (Coso 2004; Power 2007). The resulting critical dialogue between the business and risk function, should lead to lower risks, and motivated controls. For a computer system, the human user or system administrator is asked to take up the accountability function. He or she should regularly evaluate the log files and report deviant behaviour.

In the cases discussed in this paper, companies are accountable for their conduct to the general public. The interests of the public are protected by a regulator (e.g. environmental inspection agency; customs administration). So in these cases the regulator plays the role of the forum.

2.4. Governance mechanisms

Before we can talk about designing for accountability, we must specify what it is we are designing. Internal controls involve processes and procedures, information

systems, but also mechanisms of governance. After all, to ensure reliability, the people collecting evidence and reporting must be independent from those who possibly made mistakes, or who have in interest in hiding mistakes. In particular, they must be are independent of management.

What is governance? Governance roughly means the act of governing, both in government and businesses. Governing is often explained by the metaphor of steering a vessel. For instance, governance is defined as the "means to steer the process that influences decisions and actions within the private, public, and civic sectors." (O'Leary et al. 2006). In the steering metaphor, these means are a map (where you are), a compass (where you are heading) and a rudder (to change course). So we are monitoring the current situation in relation to some set of objectives. Moreover, when a group consisting of several people collaborate to reach a common goal, their individual efforts need to be coordinated. This group perspective suggests the following definition. Governance is "a set of coordinating and monitoring activities that enables the survival of the collaborative partnership or institution" (Bryson et al. 2006).

Consider a case of collective action (Ostrom 1990). Suppose we have a group *G*, consisting of individual actors who must work together to achieve or maintain a joint goal *P*, as in Figure 2. Now what kinds of governance mechanisms are necessary in such case? We need a mechanism to regulate entering and exiting the group, so members can be recognized. We need a way to assign tasks to actors, for instance by means of roles and responsibilities. We need ways to make actors do their task, for instance by physical or institutional power. We need all kinds of means to coordinate and communicate between actors. We need mechanisms to monitor behaviour, so that performance can be improved, and later the group can be held accountable for what was done. Finally, we need ways of adjusting behaviour when necessary. In this way, the group can learn and improve. Summarizing, we can say that governance concerns jointly determined norms and rules designed to regulate both individual and group behaviour.

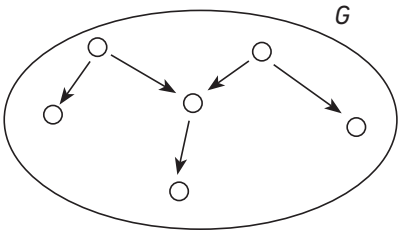

Figure 2. Collaborative action: coordination between actors to achieve or maintain a joint goal

The notion of governance becomes more specific when we know what it is we are governing. For instance, we know what it means to govern data. Essentially, data governance is an "overarching methodology that defines who is responsible for what data at which point in the process. There is more to it though, such as internal controls, information systems architecture, standardization of data formats, corporate culture and use of technology, such as monitoring tools" (Martijn 2014). We also know what is expected of the way corporations are governed. Corporate governance refers to "the mechanisms, processes and relations by which corporations are controlled and directed" (Cadbury 1992). See also the famous Sarbanes-Oxley act (Sarbanes & Oxley 2002), that was introduced in response to a number of corporate scandals, such as the Enron case (Satava et al. 2006). Corporate governance involves such aspects as (a) rights and equitable treatment of shareholders, (b) interests of other stakeholders such as employees, suppliers, customers, and governments, in particular in the Rheinland model, (c) role and responsibilities of the board, (d) the importance of integrity and ethical behaviour, and (e) disclosure and transparency.

From this list, it becomes immediately clear that governance touches accountability: (a) and (b) are about the interests of stakeholders, who most holds the company accountable. Aspect (c) is about responsibility, which is the forward looking counterpart of accountability (Van De Poel 2011). And (d) and (e) are about corporate culture and the values that constitute it.

2.5. Self regulation and regulatory supervision

Interestingly, governance can also be understood in a more narrow sense, as a shift from 'government' to 'governance:' a diffusion and fragmentation of governmental arrangements with a de-centering of the state (Maher 2008). This specific sense of governance often involves public-private partnerships. A modern government is no longer in a position to get things done by itself: it must often collaborate with private parties to accomplish its public goals. This may concern both funding and expertise. For instance, a municipality may only allow development of a shopping mall, when the project developers also build public housing in the same area.

As we have seen, various forms of public-private partnerships can also be found in the area of regulatory supervision (Ayres & Braithwaite 1992; Black & Baldwin 2010; Van Der Voort 2013). Increasingly, companies themselves are expected to decide on policies and control objectives, implement them, and monitor operating effectiveness. They have to demonstrate to the regulator that they are 'in control.' The regulator will respond to this compliance behaviour accordingly, hence the name responsive regulation (Ayres & Braithwaite 1992). Which approach the regulator must choose, is often shown by means of a regulatory pyramid (Figure 3). Initially,

a regulator may respond to deficiencies with advice on how to improve compliance, or with a warning. In case of repeated violations, the regulator will issue sanctions. Only in case of a flagrant breach of trust, a license may be suspended or withdrawn.

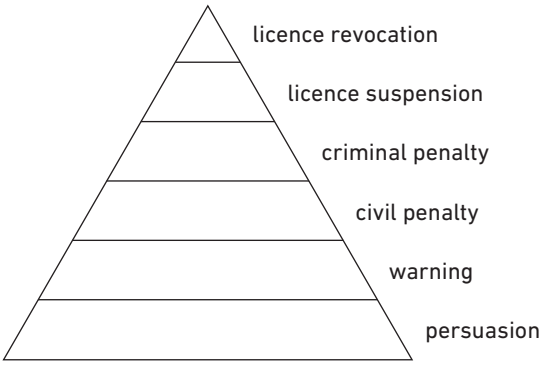

Figure 3. Enforcement Pyramid (Ayres & Braithwaite 1992: 35)

These new forms of supervision essentially delegate part of the tasks that are traditionally associated with supervision and enforcement: setting the norm, monitoring, and intervention. In a sense, they are forms of self-regulation (Rees 1988): the company controls itself. The regulator checks the internal controls. Depending on how much of the regulatory tasks are delegated, we get the different kinds of regulatory approaches (Table 1). In traditional command and control, the regulator performs all regulatory tasks. In the case of enforced self-regulation, companies have a lot of freedom in how to set up their control framework, but they must have one. The regulator may still issue sanctions, in case of repeated and grave violations.

So what are the regulatory tasks? The company performs activities that are being regulated (S0). These are governed by legislation. However, legislation is generic: it often involves open norms (see below). These must first be interpreted to be applicable (R1). However, different norms apply to different companies, so in case of enforced self-regulation, the interpretation of the norms is delegated to the company: it must set its own control objectives (S1).

How do you measure compliance to an open norm? This is discussed by Westerman (2009). Typically, a control framework contains a set of control indicators to demonstrate whether the objectives are being met. Traditionally the regulator determines the indicators (R2). Consider for example emission targets in environmental regulation. But in a self-regulation scheme, the company sets the indicators. Traditional inspections by the regulator (R3) are being replaced by monitoring efforts of the company (S3). Internal monitoring can be more frequent, and more reliable, when the system is set-up properly. In case there are deviations,

management has to intervene (S4). The regulator is only monitoring the effectiveness of the control system as a whole (R3). When the company's interventions are successful, the regulator need not do anything. The company is 'in control' when it is able to handle incidents. However, in case of repeated and grave violations. The regulator may still apply sanctions (R4).

Table 1. Redistribution of regulatory tasks from regulator to subject

Command and Control	Enforced Self-regulation
S0. Perform activities	S0. Perform activities
R1. Interpret open norms	S1. Interpret open norms
R2. Set control indicators	S2. Set control indicators
	S3. Monitor activities
	S4. Control activities
R3. Monitor activities	R3. Monitor subject's internal control (S1-S4)
R4. If necessary, apply sanctions.	R4. If necessary, apply sanctions.

Self-regulation and system-based forms of regulatory supervision are not suitable to all companies and domains. Clearly, there is a large risk of misuse and corruption. In general, self-regulation makes sense, when the interests of the public are aligned with those of the company. For example, quality control, or safety and security are generally in the interest of the company. Helderman and Honingh (2009) discuss several domains and sectors. For example, self-regulation is not a good idea for restaurants (food safety), or for fishing (fish quota), because the stakes are too high and the chances of detection are too low.

2.6. Dealing with open norms

The law should be universally applicable: it should apply to different locations, at different times and to different people. For that reason, the law is generally quite abstract and generic. The law is said to have open texture (Dworkin 1977). That means that both companies and regulators have to deal with open norms. Open norms are norms that first have to be interpreted and adjusted to the specific situation (Burgemeestre et al. 2009). In general, there are two kinds of open norms: principle-based and goal-based norms. They are often opposed to rules.

Principle-based regulation is often presented as being opposed to rule-based regulation (Cunningham 2007; Korobkin 2000). Principles leave discretionary space to the regulator, but also to the subject, to interpret what the principle means. This is a matter of professional judgment, associated with competent professionals such as judges, accountants, engineers, etc. Unlike a rule, which tells us precisely what to do, a principle only guides us in behaviour. There may be several principles applicable at the same time, leading to different outcomes. So, principles must be prioritized. By contrast, rules must be consistent. However, in practice, the difference between principle-based regulatory systems and rule-based regulatory systems is not so large. Principles are often followed up by guidelines and best practices, about how to fill out the details. These have the same function rule: they provide certainty about where the borderline is between right and wrong. Rules, on the other hand, often have exceptions. Dealing with exceptions in a systematic way leads to policies, which are often based on basic underlying principles. So, in practice, rule-based and principle-based systems often form a continuum.

Goal-based regulations are based on the objectives or goals, that motivate them (Westerman 2007, 2009). Unlike rules, such regulations do not specify how to comply, but they specify what needs to be achieved. Consider, for example, environmental regulations, which set a certain target: by 2015, carbon emissions must be reduced by 20%. How companies much reach that goal, is left up to them. In addition, companies must also agree on ways to measure and monitor progress, and on possible disciplinary measures. Clearly, these open norms create a lot of uncertainty. In a competitive commercial environment they affect the 'level playing field' among businesses. After all, differences in legal interpretation may lead to competition advantages. Crucially, the interpretation and adjustment process required for both principle- and goal-based regulation involves a dialogue among the main stakeholders. Black calls such dialogues regulatory conversations (Black 2002). They help to demarcate the boundary between what is allowed and what is not allowed.

A similar discussion also applies to norms that are not legal, but are for instance common in a particular domain or profession. For instance, accounting principles can also be rule-based or principle-based (Satava et al. 2006). The same applies to technical standards and norms, such as those employed in information security. For instance, the NIST standards or the COBIT framework are relatively principle-based, with generic control objectives, whereas best practices such as the ISO 27002 provide more detailed guidance. Note that open norms are particularly challenging when we are dealing with technology (Aldewereld et al. 2007). Technical specifications are always 'hard:' they must be made specific for a situation.

2.7. Audit as a dialogue

The regulatory setting sketched above, of new forms of regulatory supervision and self-regulation, also affects the auditing or inspection process of the regulator (Burgemeestre et al. 2011). Instead of auditing behaviour directly, now the company's internal control system must be audited. This is sometimes called the system-based approach to regulatory supervision (Helderman & Honingh 2009), because it assesses the system of processes and procedures that produce behaviour, instead of the behaviour itself. The notion is based on an older notion of system-based auditing, as used in accounting (Knechel et al. 2007).

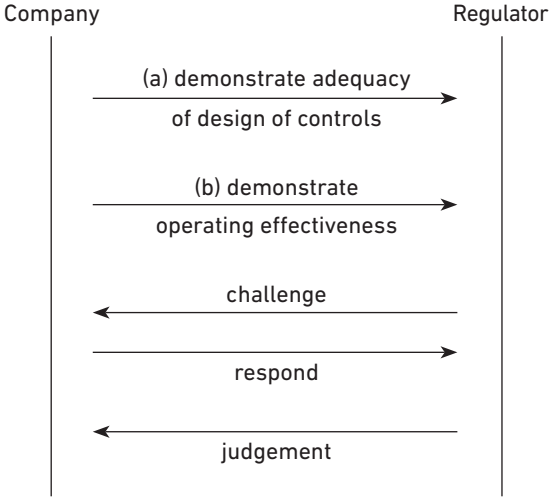

Figure 4. Audit as a dialogue: (1) demonstrate, (2) challenge and respond, (3) judgement

Now crucially, we believe that such an auditing process can be fruitfully modelled as a dialogue (Figure 3). First, the company must demonstrate to the regulator (a) that its system of controls is designed adequately to meet the control objectives, and counter the risks that are inherent in the business, and (b) that these control measures are in fact implemented and have been effective for the duration of the period being discussed. Second, the regulator may then challenge certain claims or assumption made by the company, we will subsequently respond, until finally, all issues are resolved. In that case, the regulator can pass judgement, whether the system of controls is indeed adequate for meeting the risks, and effectively implemented (Burgemeestre et al. 2011; Burgemeestre et al. 2013).

Note in this respect, that the role of regulator can be played by auditors or inspectors on behalf of the government, but also by internal risk managers or

security officers: any kind of official that is responsible for long term risks management. That people in such 'quality roles' exist to challenge existing ideas is part of a good governance structure.

2.8. Value based Argumentation

How should such a dialogue be conducted? How can we make sure that hidden assumption and attitudes of stakeholders are revealed? In previous work, we propose to make trade-offs concerning core values explicit in a dialogue with stakeholders, using an approach called value-based argumentation (Atkinson & Bench-Capon 2007; Atkinson et al. 2006; Burgemeestre et al. 2011, 2013). Recently similar techniques have also been used for policy evaluation

Walton (1996) analyses dialogues in terms of argument schemes and critical questions. An argument scheme presents an initial claim. The opponent can challenge the claims of the proponent, by asking so called critical questions. Originally, the argumentation scheme uses means-end reasoning: what kinds of actions should we perform in order to reach our goals? This captures debates about effectiveness and about alternatives. But how are goals justified? The answer is: by social values. Perelman (1980) indicates that social values can account for the fact that people may disagree upon an issue even though it would seem to be rational. In the business world, consider values like profit, safety, or quality. Such values are embedded in the corporate culture (Hofstede et al. 1990) For example, a culture which values short term profits over security – as apparent from payment and incentive schemes – will be more likely to lead to behaviour which violates a security norm, than a culture which values security over profits.

Atkinson and Bench-Capon (2007) adapted Walton's argument scheme and added social values. We have in turn adapted Atkinson et al 's argument scheme to the design of controls and auditing (Burgemeestre et al. 2011, 2013). This leads to the following argumentation scheme:

(AS) In the current system $S1$,
we should implement system component C,
resulting in a new system $S2$ which meets requirements R,
which will realize objective O,
and will promote value V.

An argument scheme like AS asserts an initial claim. Opponents may then ask critical questions (CQ), trying to undermine the assumptions underlying the argumentation. Atkinson et al. (2007) provide an extensive list of critical questions,

challenging the description *S1*, the effectiveness of the choice of component *C*, or the legitimacy of the social value *V*. We have adapted this list of questions (Burgemeestre et al. 2013). In our exposition here we use a simplified version. Note that a further simplification would be possible if we would connect values to controls directly, without the additional layer of objectives. However, in practice the additional layer is needed to deal with those objectives that are not values, for example regulatory objectives.

> CQ1. Is the current system *S1* well described?
> CQ2. Will implementing components *C1* … *Cn* in *S1* create a system *S2* that meets objective *O*?
> (a) Are system components *C1* … *Cn* sufficient to achieve objective *O*?
> (b) Are each of the system components *C1* … *Cn* necessary to achieve *O*?
> CQ3. Does new system *S2* promote the value *V*?
> CQ4. Are there alternative systems *S'* that meet requirements *R*, are there alternative sets of
> requirements *R'* that achieve objective *O*, and promote value *V*?
> CQ5. Does control *C* have a negative side-effect *N*, which demotes a value *W*?
> CQ6. Is it feasible to implement control *C*, requirement *R*, and objective *O* at all?
> CQ7. Is value *V* a justifiable value?

Critical question CQ1 is about an accurate system description. CQ2 is about effectiveness. This involves two questions: adequacy refers to the question whether *C1*… *Cn* are good enough to achieve *O* (CQ2a). Necessity refers to the question whether no components can be left out (CQ2b). Note that there may be several ways of achieving the same objective. CQ3 considers whether the resulting system as a whole will promote the value. CQ4 considers alternative solutions. CQ5 considers negative side effects. Typically, the costs of an investment are listed here. CQ6 considers feasibility of the solution. In other words: are the assumptions on which the reasoning is based warranted? Finally, CQ7 considers the relative worth of the value itself.

During the dialogue, a shared understanding is established of why certain controls are necessary. This knowledge can be depicted in the form of a dependency graph, which shows the dependencies between values, objectives and components. We say that value, objective or component *Q* depends on *P*, written $P \rightarrow Q$, whenever *P* is required for achieving *Q*. We say that *P* negatively affects *Q*, written $P \not\rightarrow Q$, whenever *P* precludes achieving *Q*.

For example, Figure 4 depicts the outcome of a dialogue about security. It is agreed among participants that a system with a *weak password* policy contributes to the value *usability,* whereas a *strong password* policy promotes *security.* A *strong password* policy has the property of being *hard to remember* for users. This negatively affects *usability*. In each situation, different choices will be made. In a school, usability outweighs security, but not in a bank.

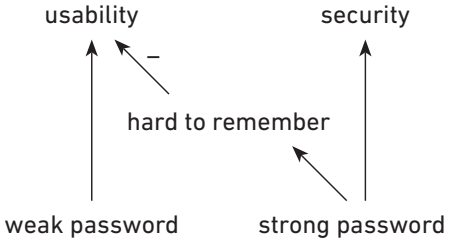

Figure 5. Dependency graphs for passwords

These critical questions quite naturally combine with the design science approach that we have chosen (Hevner et al. 2004). Such dialogues with stakeholders make it possible to deal with philosophical issues and values, as part of the design of a system.

There is a clear relationship between accountability situations and audit as a dialogue, in particular value-based argumentation. Crucial is that both stress a critical dialogue, between parties who may not agree, but at least agree to respect the rules of conduct. According to (Bovens 2007), accountability is characterized by a relationship between an actor and a forum. In such accountability relations, we find three phases. (1) The actor has an obligation to explain and justify his or her conduct to the forum. (2) The forum can pose questions, and challenge assumptions, to which the actor can respond. Finally, (3) the forum may pass judgment, so the actor may face consequences. The analogy between these three steps, and the three phases of the dialogue (Figure 3) shows that 'audit as a dialogue' is a particular way to implement accountability relations. The specific approach of value-based argumentation may then provide clear rules of conduct. As we have seen, dependency trees can be used to depict the motivations, of selecting certain values, objectives and controls in a system. That means that such accountability relations extend beyond the mere presentation of evidence of which behaviour took place, as we have seen in the audit trail or traceability approach, but also provides motivations for actions, in terms of objectives and ultimately values.

2.9. Management in Networks

When we read the literature about management and internal control, such as textbooks like (Romney & Steinbart 2006), we often get the impression that decisions are clear. Business process models or organizational charts look square and edgy: these kinds of models pretend that distinctions are clear and that responsibilities are nicely demarcated. They represent a world of rationality and civil debate. The following cartoon wants to illustrate that this is an illusion (Haiko van der Voort). Distinctions are blurred, responsibilities are subject to constant discussion and preferences, politics, emotions and laziness affect the outcomes. How can we deal with these challenges? How can we deal with the fact that such models don't fit?

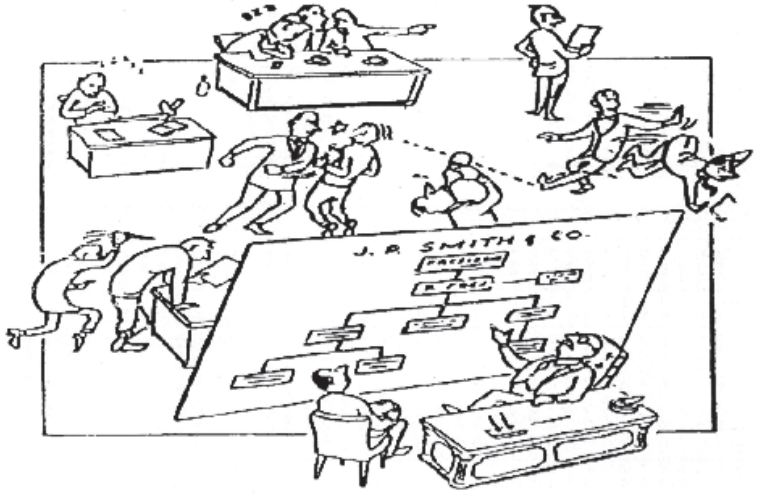

Figure 6. Management of organizations is not square and edgy, but messy and chaotic

One way to deal with the fact that such models do not fit is to use the models with care: to verify their predictions. One can organize a critical counterforce of people who are willing and able to generate feedback. This is a function of the accountability forum, in the sense of Bovens: to challenge conventional wisdom. For example, to improve data quality (accuracy, completeness, timeliness an relevance of data), feedback is crucial (Orr 1988). The slogan is 'use it or lose it!' This means that the quality of data which is not used, will deteriorate. By contrast, data that is being used will generate feedback for improvement. This should be fostered.

The field of public administration studies how to manage complex networks of organizations. This is not so much a science, but rather an art. Consider the

metaphor of a wheelbarrow full of frogs, which should be kept in the wheelbarrow. You have to change course to keep them from jumping out. I learned a lot from the books by De Bruin and Ten Heuvelhof on process management and management in networks (De Bruijn & Ten Heuvelhof 2007; De Bruijn et al. 2002). Typically, they operate in a situation in which there is no rational solution; parties have different interests. All these interests have to be balanced. Consider a large infrastructural project, like building a high way through a nature reserve. Some parties want to achieve a success, and are willing to 'trade' some of their objectives. Others do not want to achieve anything, but are in a position to obstruct the development. For example, an environmental action group could start legal procedures, which could delay development. The environmentalists can for example be 'bought' by promising to develop a nature reserve elsewhere. For this reason, for a network manager the process by which decisions are taken is crucial. If we manage to design a decision making process, that makes sure that all stakeholders with power and influence over the project can have their say, and that decisions are being reached at some point in time, then whatever comes out of the process is acceptable.

Again, we see the importance of a governance structure: tasks, roles and responsibilities, communication rules, entry and exit of members, distribution of revenues, and power. These have to be arranged beforehand. Often such factors are more important for the success of an ICT project for the government, then purely rational design issues or requirements.

We also see an important role for accountability. This process approach to management of networks can be very obscure. Decisions are negotiated rather than motivated rationally. But afterwards the public may demand to know how and why certain decisions were taken. That means that accountability should be built into the decision making process from the beginning. Transparency is an important virtue too in this respect. Organizing a critical counterforce will improve decisions, as they are being scrutinized from the beginning.

2.9. Risk

Of some things in life we never have enough: security, reliability or love. However, it takes effort to maintain these. How much effort can be justified? Often these decisions to implement controls concern a trade-off. Such trade-offs are made by means of risk assessment. The controls should be proportional to the risk.

What is risk? Roughly, risk is a 'bad chance.' It is an uncertain event that will have detrimental consequences in case it occurs. In some definitions (e.g. COSO ERM), not meeting objectives already counts as a risk. Usually, risk is calculated according the following formula:

$$\text{risk}(e) = \text{likelihood}(e) * \text{impact}(e)$$

The risk of an event *e* is the likelihood of that event occurring, multiplied with the impact in case that event would occur. Typically likelihood is measured as the frequency of occurrences (for instance twice a year) or as a probability, on a scale of 0 to 1. The impact is measured in monetary value, as the estimated losses. For instance, the costs of repair after an incident, the costs of lost productivity and the costs of lost customers. Aspects such as reputation are much harder to calculate. Also safety and security risks are difficult to measure quantitatively. For that reason, one often uses a qualitative scale of high, middle, low, to estimate risks.

Risks must be reduced by control measures. Depending on the type of risk, different kinds of measures are proposed. When the likelihood of a risk is high, it makes sense to improve the preventative measures. After all, these will reduce the likelihood. However, when the likelihood of a risk is low, but it has a high impact when it does occur, it makes sense to have detective and corrective measures in place. Detective measures make sure that a risk is detected whenever it occurs. Corrective measures try to reduce the impact. Consider for instance a fire extinguisher or a 'social media response team' to reduce the impact on reputation, in case of an incident becoming debated on social media.

Consider again the example of Figure 5. A long password is more effective in ensuring security, but it negatively affects usability. A short password may be insufficient. Depending on the circumstances the trade-off will be made differently. In a school usability takes priority over security; in a bank security takes priority.

How much controls are necessary and sufficient to reduce a risk? Which kinds of risks are acceptable? Risks are countered by implementing controls. For every implemented control something has to be given up. It is a trade-off. For example, controls have direct costs: investment in software for example. They also have indirect costs, of lost flexibility and opportunities to collaborate, or lost usability to consumers. Therefore, there is always a point at which further investment in controls is no longer justified (Figure 7). The risk reduction is not enough, compared to the costs of the control. That point is called the risk appetite of an organization. Beyond this point, risks must be accepted.

However, it is often a subjective judgment where this risk appetite lies. Different people perceive the severity of a risk differently. Consider again the diagram in Figure 7. People like A (auditors, risk managers, security officers) have a more pessimistic outlook: for a given set of controls, they perceive the remaining risks as higher. People like B (business manager; project leader), on the other hand, have a more optimistic outlook. They do not want to obstruct a project or dedicate budget to risk reduction. They want to succeed.

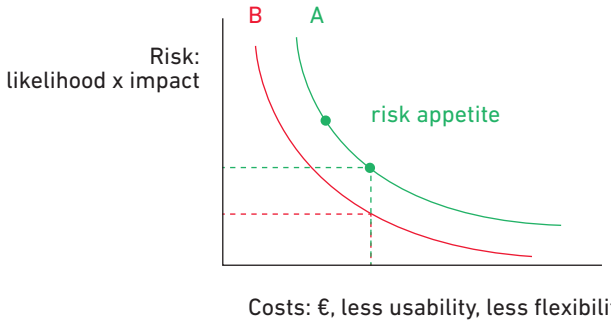

Figure 7. Decision making about risk and controls. Role A is played by an auditor, risk manager or security officer. Role B is played by a business or project manager. Both roles must be present

The point of the diagram is to show that both kinds of people should be present during risk assessment sessions. Whenever an 'A-person' wants to implement a control, he or she should be able to argue why this control is necessary, and why alternative solutions are not sufficient. By contrast, B-persons are challenged to at least accept the remaining risks, when a control is not implemented. This prevents that risks are taken unknowingly.

So once again, we see a governance structure with at least two opposed forces that stimulate critical discussion. Such internal critical opposition can also be institutionalized. An example of such a governance structure is shown in Case C on the Three Lines of Defense Model.

2.10. Trust

The last notion we need is trust. Suppose parties collaborate in a network. Parties depend on each other; they run a risk that the others will not do as expected. Parties must therefore trust each other. Trust is needed, whenever someone depends on another person, but has no means of controlling that other person. Trust is a personal attitude or characteristic. Trustworthiness depends on competence, reliability, and sincerity. We can also look at trust from an economic perspective. In that case, we get the following definition. Trust is "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer et al. 1995).

In the auditing field, many people like the phrase, attributed to Stalin, that "trust is good, but control is better." This seems to suggest that trust and control are opposites: by introducing additional controls we reduce trust. This is not necessarily

true. Such a statement may be true in case of a contract between business partners who already trust each other. In that case, the lengthier the contract, the more trust is harmed. But now, consider a contract between business partners who do not yet know each other. In that case adding controls may help to create trust. For example, using an Escrow service or reputation management, when trading on E-bay (Tan & Thoen 2000). Such controls foster what has been called transaction trust. The trader will trust that the transaction will go through as agreed, even though he or she may not trust the other business partner. The reason is that the trader understands the control mechanisms, and believes they will indeed be applied.

This is an example of what has been called institutional trust, which is based on formal measures, by contrast with personal trust, which is based on knowing someone by experience. Zucker (1986) has convincingly shown that in modern society in many cases personal trust has been replaced by institutional trust. For example, a bank no longer employs an account manager who knows us; instead we use Internet banking, and we have to trust that it works.

Trust is also related to auditing and accountability. In a sense, the demand for accountability and the call for audits, show that trust is eroding. A third party audit should provide additional assurance, as it is called, that a company will behave as expected. However, unfortunately, also auditors have been questioned. Many of the large accounting firms have been involved in scandals. The profession is under pressure, and rightly so.

I believe that the solution does not lie with auditors, but rather with the parties on behalf of whom they conduct the auditors: shareholders, regulators and the general public. They should be more demanding in the type and quality of audits. Do not take the current audit standards for granted, but be creative: use technology to dare answer different and more profound questions. Challenge the motivations behind a decision, rather than then operational details. Audit a business model, instead of the privacy violations that follow from it. Challenge a strategy, before it is implemented.

3. Cases

The following cases are used to illustrate the notions discussed above.

Case A. AEO self-assessment

This case illustrates the general set-up that we discussed, of a company that has to justify its decision to the regulator. The case is described in (Burgemeestre et al.

2011), see also (Commission 2007). Under the AEO initiative, companies which can demonstrate to the customs authorities to be "in control" regarding customs compliance, administration of the flow of goods, financial solvency, and safety and security (if appropriate), can obtain a certificate. Certified companies are called Authorized Economic Operator. This status is recognized throughout the EU. AEOs receive benefits, in the form of less physical inspections and advance warnings in case of inspections. The application procedure for an AEO certificate involves a self-assessment. Crucially, this involves a risk assessment of which risks the company is phasing. It also contains a list of the controls that the company has taken to mitigate those risks. This corresponds to our phase (1): demonstrate effectiveness of control measures. After that, the customs officers can challenge the self-assessment findings. They can demand more information or question lack of expected controls. The company can then respond to these challenges.

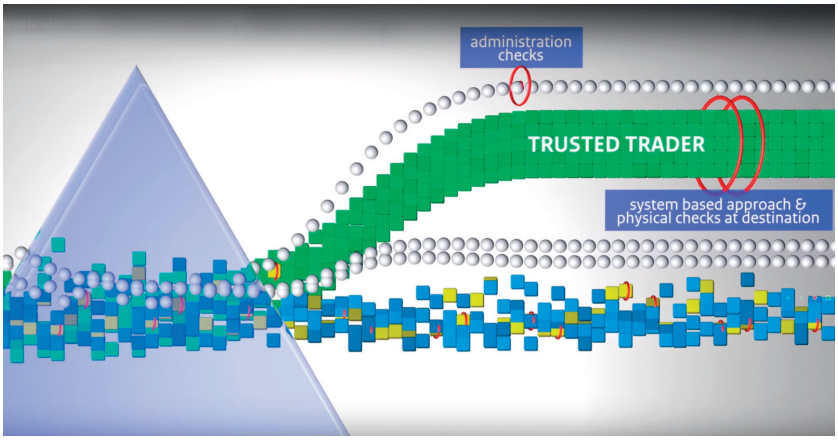

Figure 9. Vision on regulatory supervision of Netherlands Customs Administration (https://www.youtube.com/watch?v=0AB31WPW4Xs)

The introduction of the AEO scheme, or in general 'trusted traders,' is part of long-term vision of the customs authorities on how to conduct regulatory supervision. We find similar strategies also in other regulators (Mertens 2011). The vision is illustrated in Figure 9. On the left we see a mixed flow of traders (blue, yellow and green boxes) and information about them (white dots). The idea is to separate these flows. Trusted traders are green. They experience mainly administrative checks. That means that the inspection efforts can be directed towards the blue unknown traders. Administrative checks can happen before arrival of the goods, based on a customs declaration, or afterwards. In that case the customs authorities verify the reliability of the trader's administration. This is called the

system-based approach: it relies on the system of controls built into the warehouse and administration. Every once in a while, inspections must also take the physical flow of goods into account, to verify accuracy and completeness of reporting. Do the records correspond to the goods? Are all goods reported?

We can also see some yellow boxes. These represent traders that together form a trusted trade-lane. A trade-lane is a network of traders who collaborate on a stable basis. For trusted trade-lanes, which carry a large part of the volume of trade, further simplifications and reductions in physical inspections are proposed. The concept is currently being debated: when can a trade lane be trusted? What kind of audits and assurance are required to establish that a trade-lane is reliable? Many expect something like a risk control framework that applies to the entire trade-lane. Since risks are usually not caused by those actors who experience the impact, controls will have to be redistributed. That also means we need some authority to enforce them.

Case B. SBR Programme

This case illustrates the management of networks discussion. It is described in (Bharosa et al. 2013). It is about a large IT project for the Dutch national government. The purpose of the project was and is to make companies and government ministries adopt a new standard for the representation of financial reporting: XBRL. The abbreviation XBRL stands for eXtensible Business Reporting Language. It is XML variant, and is used for financial reporting (accounting; tax; banks). New application domains (education; agriculture) are envisioned. The idea is that compliance reporting of businesses to government can be made more reliable, and less inefficient. The purpose is to reduce the administrative burden that companies face. After all, businesses must file many official reports, which largely overlap. In particular, the financial accounts largely overlap with tax declarations, although they are filed for a different purpose. Also the monthly reports to the Central Bureau of Statistics contain similar data. XBRL makes it possible to store the same data once, but re-use it to report to various stakeholders many times. The slogan is "store once, report to many." Standard Business Reporting (SBR) is a set of agreements about the use of XBRL, about the Netherlands Taxonomy (NT) that contains the official legal definitions of the concepts used in electronic format, software interfaces, governance policies, security measures, and a schedule for taxonomy updates.

Figure 10 gives an overview of the general idea. In the middle we see a company, which needs to file reports. These reports are produced with software, provided by a software provider, and with the help of an intermediary, for instance an accountant or a tax advisor. The software providers have been convinced to make

their software compatible with the XBRL reporting standard. Different types of reports can now be generated on the basis of the same financial data: tax declarations, financial reports, statistics reports. SBR provides agreements on information security measures: all intermediaries must be able to digitally sign the reports, using a public-key infrastructure (PKI). Reports are sent to Digiport: a government web portal, that redirects the reports to the various stakeholders involved: the tax administration, the chamber of commerce, the statistics bureau. The portal is maintained by Logius, a large government bureau responsible for information service provision. Logius also runs the SBR programme.

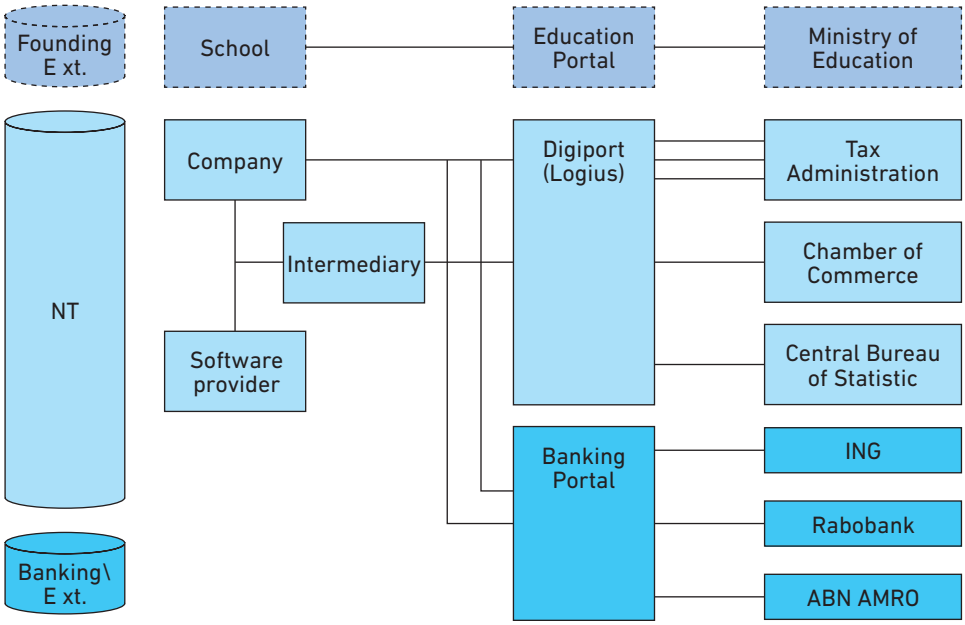

Figure 10. General set-up of the SBR programme

On the left, we see the Netherlands Taxonomy (NT). This is a large repository of official definitions of concepts used in financial laws and regulations, in such a way that they can be used to calculate with. For instance, the concept of income as used by the tax office, but also as used by the statistics bureau. Where XBRL provides the syntax (form) of the reports, the NT provides the semantics (meaning). On the bottom we see that several banks have also joined the programme. Banks need frequent reports from creditors about their creditworthiness and the status of the loans. For this, they can partly re-use the NT. The banks have made an extension of the NT taxonomy, specific to credit reporting. Although banks

are no government institutions, the banks promised to follow the updates of the NT. On the top we see an example of a new domain: financial reporting of schools and universities to the ministry of education. Here too, a large part of the reports are about finances, and again the NT can be re-used to cover those. The education specific part can be put again in a separate extension.

Case C. Three Lines of Defense

Consider the so-called Three Lines of Defense Model (IIA 2013), shown in Figure 8. It is a governance model of how to organize the risk function of a large organization. The model is used by many banks and insurance companies. The model is based on a military metaphor of consecutive lines of defence. The first line consists of controls that are built into the business function, on the left. They must make sure that mistakes are being prevented. They also have the budget for implementing controls, and they are ultimately the 'owner' of the risk. Together with senior management, they are responsible for residual risks. The second line consists of dedicated professionals, who are experts in risk management, financial controls, security or compliance. They provide advice to the business on how to manage the risks, and improve the controls. They also determine risk policies and set the risk appetite. The third line consists of the internal audit department. They must assess the risks, and test if they conform to the policies and do not exceed the risk appetite.

It is interesting to study the flow of information between these lines of defence. There are various loops of reports that are regularly filed. First, there is periodic reporting on the preparation of the audit file (1^{st} to 2^{nd}). This is the normal way of communicating small risks and incidents. Second, there are yearly audits of both the adequacy of design and operating effectiveness, of the current system of controls (3^{rd} to 1^{st}). This audit shows whether the company is 'in control' of its control objectives. Third, the risks are periodically being re-assessed (all lines). This facilitates a learning cycle. The company can adjust the controls to internal changes (e.g. new product) or external changes (new legislation; new threats). Fourth, in case these adjustments are major, this is typically done by means of long-term projects. These project related changes in systems call for re-assessment and updates too. In addition, there are also two management control loops. There is periodic reporting to and direction from management, involving all three lines of defence. Moreover, there is less frequent reporting to the supervisory board (audit committee, or the board itself). This should ensure independence of each of the three lines, so they can scrutinize the other two.

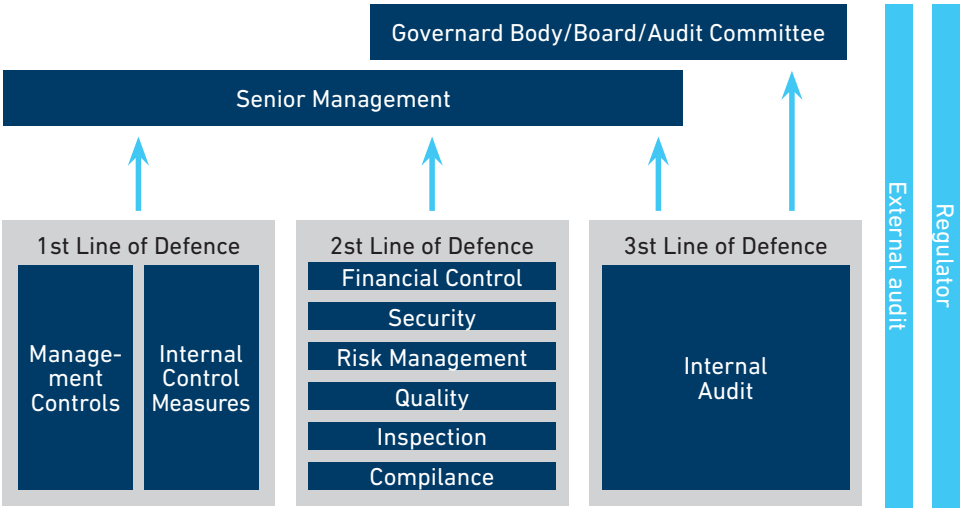

Figure 8. Three Lines of Defense Model (IIA 2013)

Why three lines? Suppose there is only one line: the business (1st). In that case, we need an independent assessment of the effectiveness of controls. Hence, we develop an independent internal audit department (3rd). But who should then manage the implementation of and who should set the risk policies and risk appetite? The first line is too busy and lacks expertise. Often, people from the third line specialize in giving such advice. However, they are not allowed to audit their own advice. Audit must be independent and unbiased. Therefore, after a while, a second line will develop, in between the first and the second.

This discussion shows, that the outcomes of the risk management process need to be shared with parties that are independent. Managing risks by itself is not enough; someone needs to have the institutional power and authority to take action. That is the role of the supervisory board. It must provide checks and balances against the senior management.

Case D. Lehman Brothers

On September 15, 2008, the Lehman Brothers investment bank had to file for bankruptcy at the height of the financial crisis. What caused the crisis? And did the sophisticated risk management function that we discussed, not prevent such a disaster?

The case of Lehman Brothers shows that having an independent risk function is no guarantee. After the Lehman Brothers bank collapsed, an investigation was started (Valukas 2010). The examiner showed that Lehman Brothers did have

a state of the art risk management function. The risk officers did send repeated warnings to management about the large financial risks they were taking, in excess of the previously decided risk appetite. Nevertheless, management repeatedly overruled these warnings. "We found that Lehman was significantly and persistently in excess of its own risk limits. Lehman management decided to disregard the guidance provided by Lehman's risk management systems. Rather than adjust business decisions to adapt to risk limit excesses, management decided to adjust the risk limits to adapt to business goals." (Examiner Valukas, in a hearing to the U.S. House Committee).

The example also shows that we can be critical of risk management, in particular of the 'promise' of enterprise risk management that is displayed by risk frameworks like the COSO ERM framework (Coso 2004). That promise is that risk can always be controlled, and that this can be done in a universal way, irrespective of the different characteristics of specific business departments and types of risks (e.g. financial, operational, or security risks). For instance, Power (2009) states that: "(…) an impoverished conception of 'risk appetite' is part of the 'intellectual failure' at the heart of the financial crisis. Regulators, senior management and boards must understand risk appetite more as the consequence of a dynamic organizational process involving values as much as metrics. In addition, ERM has operated as a boundary preserving model of risk management subject to the 'logic of the audit trail,' rather than a boundary challenging practice which confronts and addresses the complex realities of interconnectedness. The security provided by ERM is at best limited to certain states of the world and, at worst, it is illusory – the risk management of nothing" (Power 2009).

The Lehman Brothers case shows that risk detection and warning are not enough; someone needs to have the power to stand up and do something about it. The problem of Lehman Bothers was that a corporate culture had developed in which risk taking and making profits, was valued over risk reduction and being cautious. A similar observation is made by Joris Luijendijk, who made an anthropological study of bankers in the City of London (Luijendijk 2015). Once again this shows that the notion of social values, as we discussed above, helps to understand these developments. Also, a recent report on risk management in banks from the UK puts a lot of emphasis on the notion of corporate culture (Power et al. 2013).

4. Conclusions

Based on the literature review and the cases, we can draw a number of interesting conclusions.

First, a discussion of accountability in relation to information systems does make sense. Accountability touches upon notions like evidence, both in auditing and in law. To guarantee reliable evidence requires certain prerequisites to be built in: internal controls.

Second, the focus on reliability of evidence does not mean that accountability is the same as traceability, as in computer science approaches. In addition to tracing decisions, requires the ability to confront actors with their behaviour and demand explanations. This may involve the motivation for why certain decisions were taken. Decisions can be motivated by reference to objectives, and when those conflict, ultimately with reference to social or ethical values. Values are part of corporate culture. They are relatively stable.

That means that accountability can be maintained, when two conditions have been met.

1. Reliable evidence of behaviour and of the motivation of decisions is collected. It must be an accurate and complete representation of what happened.
2. A critical discussion with a forum: an independent party, which is willing and able to challenge the evidence, and question the motivations.

This critical discussion starts with a claim or statement by the actor being held accountable. The statement is based on reliable evidence of conduct. It can also involve a motivation of decisions, such as why a set of components is necessary to reach a certain objective. The statement can then be challenged, and challenges are responded to. Finally, when all arguments have been exchanged, the forum passes judgement. Holding someone accountable has consequences. Such a critical discussion can be structured using the value-based argumentation approach.

Third, a critical discussion also requires a governance structure in which some party, called the forum, is both competent and powerful enough to be able to challenge the statements by management. We could say that we need to 'institutionalize' opposition. An example of such a governance structure is the Three Lines of Defense Model.

The purpose of such critical discussions is not to create uncertainty, but rather to challenge assumptions and conventional wisdom, and derive information, which can be used to learn and improve. In the end, this will also improve decision making.

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Innovative Approaches to Social Aspects of Climate Change and Water Management. Use of Geographical Information Systems (GIS) as an innovative approach to our lives

Introduction Geographical Information Systems (GIS)

Some 35,000 years ago, Cro-Magnon hunters drew pictures of the animals they hunted on the walls of caves near Lascaux, France. Associated with the animal drawings are track lines and tallies thought to depict migration routes. These early records followed the two-element structure of modern geographic information systems (GIS): a graphic file linked to an attribute database. If we look back to the first observations made by Galileo in 1610 when he turned a telescope to the heavens and caught a glimpse of the surface complexities exhibited on our nearest neighbour, the Moon, and then later confirmed the Copernican Revolution with his discoveries of moons around Jupiter.

Since then, first with telescopes and, after the opening of the Space Age, with orbiting spacecraft, flyby, probe, and lander missions to the Moon and the planets, most of the same instruments that survey the electromagnetic spectrum interacting with the Earth have been the principal tools used in exploring our planetary

associates and beyond – searching well into outer space to look at stars and other members of the Universe.

The science of 'remote sensing' in its broadest sense has been developing since the 19th century with the invention of photography and the first aerial photographs taken from captive balloons. Throughout the 20th century, technological advances in a number of areas – the development of colour and infrared sensitive films, 5 aircraft and satellite platforms – enlarged the sphere of remote sensing with the development of applications such as mapping, geological exploration and meteorology making use of remotely sensed images.

Remote sensing as it is currently practised, however, began with two major advances in technology – the launch of high resolution digital imaging systems (starting with Landsat-1 in 1972) and the development of minicomputers and image-display terminals in the 1970s.

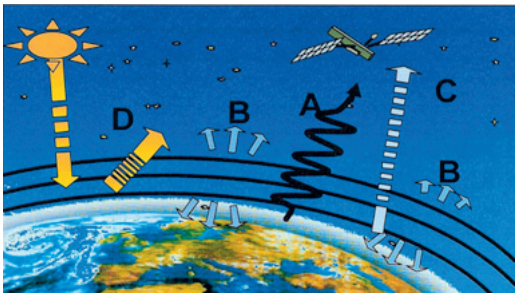


Figure: Principles of remote sensing system

With these advances, image processing systems rapidly evolved. By the early 1980s, a typical system would have functionality for image input, geometric correction, classification (supervised and unsupervised), image enhancement, convolution, arithmetic functions (e.g. band rationing) and principal components analysis. These would be performed as batch or interactive operations, with special frame-store hardware used for image display.

The evolution continued throughout the 1980s, with an increased range of processing functions, data from new sensors (Landsat TM, SPOT, radar, airborne multispectral scanners), faster processors, higher resolution displays and user-friendly menu interfaces. Interfaces to vector data are provided by most systems, although functionality is largely limited to overlay of the data over imagery. As the computer spreadsheet changed the way people organized and used information in the 1980s, so is GIS doing the same thing today, in an even more powerful way. GIS facilitates wise use of limited resources by clarifying characteristics and patterns over space. It's especially useful for problem-solving situations.

GIS has found great application in geologic science and especially in the sector of earthquakes. It is an important tool in order to collect muchinformation and have a better overview and better conclusions over the features and the seismicity of a seismic area that interests us.

Though most of the data, like geologic features, seismic features etc, is not new and has been available to the public for nearly a decade, most of it has never been presented in an easy-to-understand format using GIS technology and made available to public.

What is GIS?

GIS is a rapidly growing technological field that incorporates graphical features with tabular data in order to assess real-world problems. The GIS field began around 1960, with the discovery that maps could be programmed using simple code and then stored in a computer allowing for future modification when necessary. This was a welcome change from the era of hand cartography when maps had to be painstakingly created by hand; even small changes required the creation of a new map. The earliest version of a GIS was known as computer cartography and involved simple line work to represent land features. From that evolved the concept of overlaying different mapped features on top of each other to determine patterns and causes of spatial phenomenon.

Definition of GIS

Like the field of geography, the term Geographic Information System (GIS) is hard to define. It represents the integration of many subject areas. Accordingly there is no absolutely agreed upon definition of a GIS (deMers 1997). A broadly accepted definition of GIS is the one provided by the National Centre of Geographic Information and Analysis: a GIS is a system of hardware, software and procedures to facilitate the management, manipulation, analysis, modelling, representation and display of georeferenced data to solve complex problems regarding planning and management of resources (NCGIA 1990). Geographic information systems have emerged in the last decade as an essential tool for urban and resource planning and management. Their capacity to store, retrieve, analyse, model and map large areas with huge volumes of spatial data has led to an extraordinary proliferation of applications.

A Geographic Information System (GIS) is a tool that uses the power of the computer to pose and answer geographic questions. The user guides the program to arrange and display data about places on the planet in a variety of ways – including

maps, charts and tables. The hardware and software allows the users to see and interact with data in new ways by blending electronic maps and databases to generate colour-coded displays. Users can zoom in and out of maps freely, add layers of new data, and study detail and relationships.

The key word to this technology is Geography – this usually means that the data (or at least some proportion of the data) is spatial, in other words, data that is in some way referenced to locations on the Earth. Coupled with this data is usually data known as attribute data. Attribute data generally defined as additional information, which can then be tied to spatial data. An example of this would be schools. The actual location of the schools is the spatial data. Additional data such as the school name, level of education taught, school capacity would make up the attribute data. It is the partnership of these two data types that enables GIS to be such an effective problem solving tool.

A Geographical Information System generally is a collection of spatially referenced data (i.e. data that have locations attached to them) and the tools required to work with the data. Nowadays, we normally associate the term with computers, but a (properly organized) set of file cabinets, a calculator (when available), pens, pencils, drafting table, etc., was the GIS available to people before computers.

The capabilities of GIS are a far cry from the simple beginnings of computer cartography. At the simplest level, GIS can be thought of as a high-tech equivalent of a map. However, not only can paper maps be produced far quicker and more efficiently, the storage of data in an easily accessible digital format enables complex analysis and modelling not previously possible. The reach of GIS expands into all disciplines and has been used for such widely ranged problems as prioritizing sensitive species habitat to determining optimal real estate locations for new businesses.

GIS operates on many levels. On the most basic level, GIS is used as computer cartography, i.e. mapping. The real power in GIS is through using spatial and statistical methods to analyse attribute and geographic information. The end result of the analysis can be derivative information, interpolated information or prioritized information.

GIS has been defined by the Association for Geographic Information as: A system for capturing, storing, checking, integrating, manipulating, analyzing, and displaying data which are spatially referenced to the Earth.

Other quotes to answer "What is GIS?":

"In the strictest sense, a GIS is a computer system capable of assembling, storing, manipulating, and displaying geographically referenced information, i.e. data identified according to their locations. Practitioners also regard the total GIS as including operating personnel and the data that go into the system." **USGS**

"A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on earth. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps." **ESRI**

"GIS is an integrated system of computer hardware, software, and trained personnel linking topographic, demographic, utility, facility, image and other resource data that is geographically referenced." **NASA**

GIS has already affected most of us in some way without us even realizing it. If youhave ever using an Internet mapping program to find directions, you have personally used GIS. The new supermarket chain on the corner was probably located using GIS to determine the most effective place to meet customer demand.

Components of GIS

Above we have briefly explained what GIS is. The next step in understanding GIS is to look at each component of GIS and how they work together. These components are:

Hardware

Hardware comprises the equipment needed to support the many activities of GIS ranging from data collection to data analysis. The central piece of equipment is the workstation, which runs the GIS software and is the attachment point for ancillary equipment. Data collection efforts can also require the use of a digitizer for conversion of hard copy data to digital data and a GPS data logger to collect data in the field. The use of handheld field technology is also becoming an important data collection tool in GIS. With the advent of web-enabled GIS, web servers have also become an important piece of equipment for GIS.

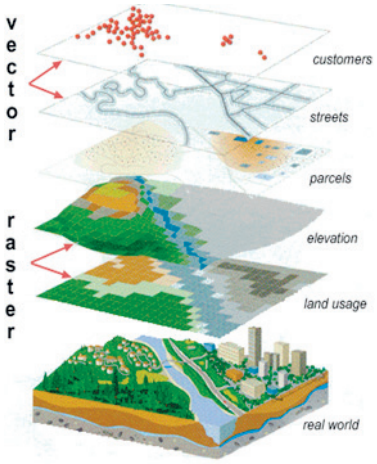


Figure: Vector & raster datasets nature

Software

Different software packages are important for GIS. Central to this is the GIS application package. Such software is essential for creating, editing and analyzing spatial and attribute data, therefore these packages contain a myriad of GIS functions inherent to them. Extensions or add-ons are software that extends the capabilities of the GIS software package. Component GIS software is the opposite of application software. Component GIS seeks to build software applications that meet a specific purpose and thus are limited in their spatial analysis capabilities. Utilities are stand-alone programs that perform a specific function. For example, a file format utility that converts from on type of GIS file to another. There is also webGIS software that helps serve data through Internet browsers.

Data

Data is the core of any GIS. There are two primary types of data that are used in GIS. A geodatabase is a database that is in some way referenced to locations on the Earth. Geodatabases are grouped into two different types: vector and raster. Coupled with this data is usually data known as attribute data. Attribute data generally defined as additional information, which can then be tied to spatial data. Documentation of GIS datasets is known as metadata.

People

Well-trained people knowledgeable in spatial analysis and skilled in using GIS software are essential to the GIS process. There are three factors to the people component: education, career path, and networking. The right education is key; taking the right combination of classes. Selecting the right type of GIS job is important. A person highly skilled in GIS analysis should not seek a job as a GIS developer if they have not taken the necessary programming classes. Finally, continuous networking with other GIS professionals is essential for the exchange of ideas as well as a support community.

What is satellite remote sensing?

Satellite remote sensing involves gathering information about features on the Earth's surface from orbiting satellites. These satellites carry two types of sensor systems known as "active" and "passive." A "passive" system generally consists of an array of small sensors or detectors which record (as digital numbers) the amount of electro-magnetic radiation reflected and/or emitted from the Earth's surface. A multispectral scanner is an example of a passive system. An "active" system propagates its own electro-magnetic radiation and measures (as digital numbers) the intensity of the return signal. Synthetic Aperture Radar (SAR) is an example of an active system.

The digital data acquired by the satellites is transmitted to ground stations and can be used to reconstitute an image of the Earth's surface not too dissimilar to an aerial photograph.

Applications of GIS and remote sensing

Geography Matters Everywhere

Geography matters in every business and every discipline. Wherever you turn, geography helps people do a better job and make a difference. GIS is helping thousands of organizations around the world. GIS is utilized in every discipline, everywhere. Beautiful and interesting maps are providing better decisions making tools and analysis and making a difference in our world.

Some of these applications can be found in: 1) Natural Resources; 2) Archaeology; 3) Meteorology and Climatology; 4) Hydrology; 5) Forest resource inventory; 6) Geology, Lithology and mineral resource inventory; 7) Urban and land use; 8) Oceanography; 9) Natural disaster monitoring (volcano); 10) Global change study and Climatological processes; 11) Forest Fire Monitoring; 12) Vegetation and Agriculture monitoring; 13) Drought Monitoring; 14) Landslide and earthquake monitoring; 15) Flood monitoring; 16) Sand-storm monitoring; 17) Water resources and wastewater monitoring; 18) Thermal pollution; 19) Soil moisture variation; 20) Heat and moisture fluxes (exchanges); 21) Evapotranspiration; 22) Biomass distribution; 23) Transportation and infrastructure planning.

Global positioning systems (GPS)

A Global Positioning System (GPS) is a set of hardware and software designed to determine accurate locations on the earth using signals received from selected satellites. Location data and associated attribute data can be transferred to mapping and Geographical Information Systems (GIS). GPS will collect individual points, lines and areas in any combination necessary for a mapping or GIS project. More importantly, with GPS you can create complex data dictionaries to accurately and efficiently collect attribute data. This makes GPS is a very effective tool for simultaneously collecting spatial and attribute data for use with GIS. GPS is also an effective tool for collecting control points for use in registering base maps when known points are not available. GPS operate by measuring the distances from multiple satellites orbiting the Earth to compute the x, y and z coordinates of the location of a GPS receiver.

Uses of GPS

GPS can be used for georeferencing, positioning, navigation, and for time and frequency control. GPS is increasingly used as an input for Geographic Information

Systems particularly for precise positioning of geospatial data and the collection of data in the field.

Remote Sensing

Remote sensing includes all information collected from sensors which are physically separate from the object. Remote sensing is concerned with deriving information about the Earth's surface using an elevated platform, to produce such information as satellite data or aerial photography.

Figure: A sample site as shown from a satellite image

Remote sensing instruments rely upon the detection of energy emitted from, or reflected by, the object under consideration. Remote sensing allows the measurement and monitoring of surface electromagnetic variation, and as such this data provides a unique way of viewing the landscape. Satellite remote sensing is the only source of data with which we can view the entire planet and monitor the change in the nature of the surface of the planet through time, in a consistent, integrated, synoptic and numerical manner.

Satellite remote sensing has the ability to provide complete, cost-effective, repetitive spatial and temporal data coverage, which means that various phenomena can be analysed synoptically, and such tasks as the assessment and monitoring of land condition can be carried out over large regions. As well as being of use by itself, remote sensing can be also be used as an important data source for the development and refinement of models, and can be used to validate models.

Why use GIS?

Maps have traditionally been used to explore the Earth. GIS technology has enhanced the efficiency and analytical power of traditional cartography. As the scientific community recognizes the environmental consequences of human activity, GIS technology is becoming an essential tool in the effort to understand the

process of global change. Map and satellite information sources can be combined in models that simulate the interactions of complex natural systems. Functions of GIS include: data entry, data display, data management, information retrieval and analysis.

Advantages of GIS

Geographic Information Systems (GIS) provide an ideal vehicle for teaching topics in the Earth and environmental sciences. A GIS has a number of advantages over traditional materials when used as an instructional tool. These advantages include the following elements:

Improve Organizational Integration

One of the main benefits of GIS is improved management of your organization and resources. A GIS can link data sets together by common locational data, which helps departments and agencies share their data. By creating a shared database, one department can benefit from the work of another – data can be collected once and used many times.

Make Better Decisions

The old adage "better information leads to better decisions" is true for GIS. A GIS is not just an automated decision making system but a tool to query, analyze, and map data in support of the decision making process. Because GIS products can be produced quickly, multiple scenarios can be evaluated efficiently and effectively.

Make Maps

For simplicity's sake we often call GIS "mapping software." We most often associate maps with physical geography, but the map to the right demonstrates that GIS is flexible enough to map any kind of terrain, even the human body. GIS can map any data you wish.

Making maps with GIS is much more flexible than traditional manual or automated cartography approaches. A GIS creates maps from data pulled from databases. Existing paper maps can be digitized and translated into the GIS as well. The GIS-based cartographic database can be both continuous and scale free. Map products can then be created centred on any location, at any scale, and showing selected information symbolized effectively to highlight specific characteristics.

A map can be created anytime to any scale for anyone, as long as you have the data. This is important because often we say "I see" to mean "I understand." Pattern recognition is something human beings excel at. There is a vast difference between seeing data in a table of rows and columns and seeing it presented in the form of a map. The difference is not simply aesthetic, it is conceptual – it turns out that the way you see your data has a profound effect on the connections you make and the conclusions you draw from it. GIS gives you the layout and drawing tools that help present facts with clear, compelling documents.

Visualization

Through a process known as visualization, a GIS can be used to produce images not just maps, but also dynamic and customisable maps, drawings, tables, charts, animations, and other cartographic products. These images allow researchers to view their subjects in ways that they never could before and to identify and characterize relationships by manipulating multiple visual representations of data. The images often are helpful in conveying the technical concepts of a GIS to non scientists.

Data output

A critical component of a GIS is its ability to produce graphics on the screen or on paper to convey the results of analyses to the people who make decisions about resources. Wall maps, Internet-ready maps, interactive maps, and other graphics can be generated, allowing the decision makers to visualize and thereby understand the results of analyses or simulations of potential events.

Data analysis

The analytical tools of a GIS enable us to quantify relationships both within and among spatial data sets using database functions, statistical analyses and spatial overlay operations

Mapping and monitoring change

GIS can be used to map the change in an area to anticipate future conditions, decide on a course of action, or to evaluate the results of an action or policy.

Mapping locations

GIS can be used to map locations. GIS allows the creation of maps through automated mapping, data capture, and surveying analysis tools.

Mapping quantities

People map quantities, like where the most and least are, to find places that meet their criteria and take action, or to see the relationships between places. This gives an additional level of information beyond simply mapping the locations of features.

Mapping densities

While you can see concentrations by simply mapping the locations of features, in areas with many features it may be difficult to see which areas have a higher concentration than others. A density map lets you measure the number of features using a uniform areal unit, such as acres or square miles, so you can clearly see the distribution.

Climate change

Introduction

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events). Climate change is caused by factors such as biotic processes, variations in solar radiation received by the Earth, plate tectonics, and volcanic eruptions. Certain human activities have also been identified as significant causes of recent climate change, often referred to as "global warming."

What is climate change?

The Earth's climate is driven by a continuous flow of energy from the sun. Energy in the form of heat, from the sun, passes through the Earth's atmosphere and warms the Earth's surface. As the temperature increases, the Earth sends heat energy (infrared radiation) back into the atmosphere. Some of this heat is absorbed

by gases in the atmosphere, such as carbon dioxide (CO_2), water vapour (H_2O), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), etc.

Climate change, also called global warming, refers to the rise in average surface temperatures on Earth due to disruption of the Earth's energy balance. Climate change is due primarily to the human use of fossil fuels, which releases carbon dioxide and other greenhouse gases into the air. The gases trap heat within the atmosphere, which can have a range of effects on ecosystems, including rising sea levels, severe weather events and droughts that render landscapes more susceptible to wildfires.

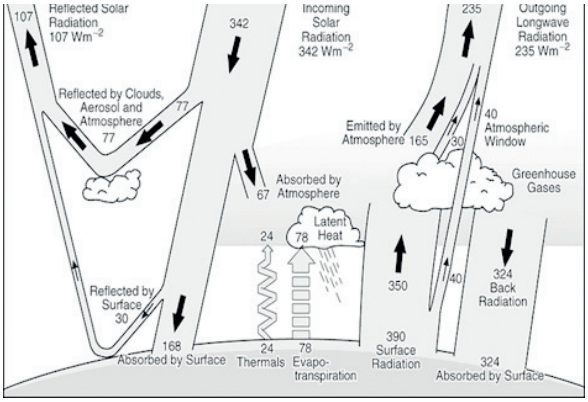
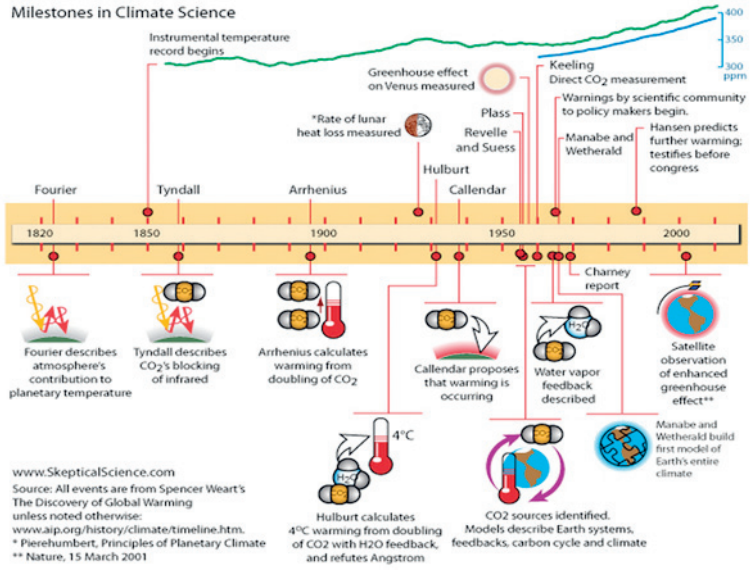


Figure: Energy Balance

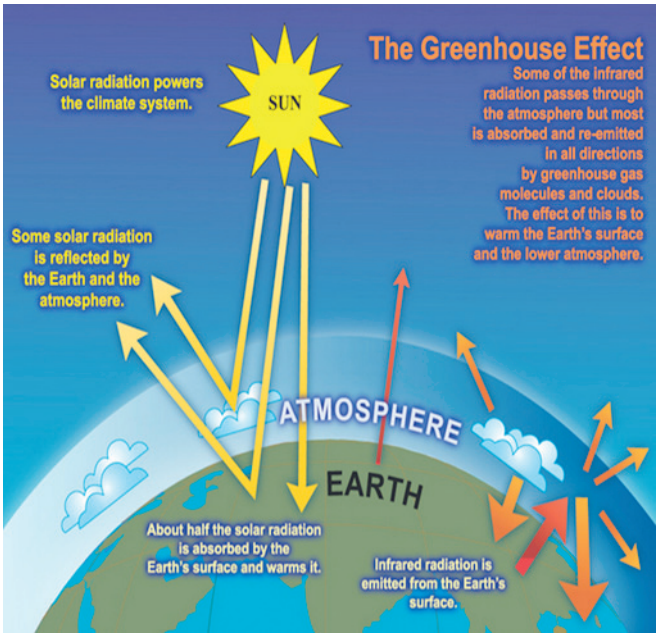
History of climate change



What are the effects of climate change?

Even small increases in the Earth's temperature caused by climate change can have severe effects. Earth's average temperature has gone up 0.77°C over the past century and expected to rise as much as 6°C over the next. That might not seem like a lot, but average temperature during the last Ice Age was about 2°C lower than it is today.Rising sea levels due to the melting of the polar ice caps (again, caused by climate change) can contribute to:i) greater storm damage; ii) warming ocean temperatures are associated with stronger and more frequent storms; iii) additional rainfall, particularly during severe weather events, leads to flooding and other damages; iv) an increase in the incidence and severity of wildfires threatens habitats, homes and lives; v) heat waves contribute to human deaths and other consequences.

The Greenhouse Effect on Earth



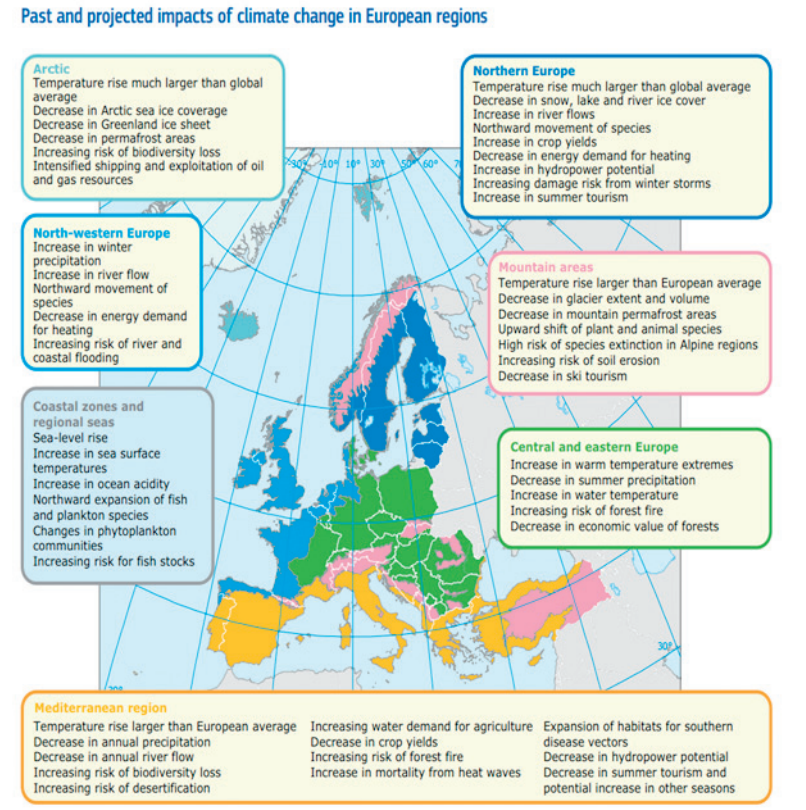
Which are the factors causing climate change?

Primary cause of climate change is the burning of fossil fuels, such as oil and coal, which emits greenhouse gases into the atmosphere – primarily carbon dioxide. Other human activities, such as agriculture and deforestation, also contribute to the proliferation of greenhouse gases that cause climate change.

While some quantities of these gases are a naturally occurring and critical part of Earth's temperature control system, the atmospheric concentration of CO_2 did not rise above 300 parts per million (ppm) between the advent of human civilization roughly 10,000 years ago. Today it is at about 400 ppm, a level not reached in more than 400,000 years. While carbon has entered the atmosphere for millions of years through natural events such as forest fires and volcanoes, the burning of fossil fuels and clearing of land has resulted in the highest levels of greenhouse pollution in our atmosphere in the last 800,000 years.

How will climate change impact on Europe?

Europe is warming faster than many other parts of the world. The European land temperature over the past decade has been on average 1.3°C higher than in the pre-industrial era, compared with a global average rise of 0.8°C. Impacts vary across the EU but all Member States are exposed to climate change. The Mediterranean basin, mountainous areas, densely populated floodplains, coastal zones, outermost regions and the Arctic are particularly vulnerable to climate change impacts. Some extreme weather events have increased, with southern and central Europe seeing more frequent heat waves, forest fires and droughts. Heavier precipitation and flooding is projected in northern and north-eastern Europe, with a heightened risk of coastal flooding and erosion. An increase in such events is likely to enlarge the magnitude of disasters, leading to significant economic losses, public health problems and deaths.



Source: European Environment Agency http://www.eea.europa.eu/data-and-maps/figures/key-past-and-projected-impacts-and-effects-on-sectors-for-the-main-biogeographic-regions-of-europe-3

Policy for climate change in Europe.Adaptation to changing climate conditions

In April 2013, the European Commission adopted a EU strategy on adaptation to climate change. The strategy aims to make Europe more climate-resilient. By taking a coherent approach and providing for improved coordination, it will enhance the preparedness and capacity of all governance levels to respond to the impacts of climate change.

Adaptation actions

Strategy is based on eight actions:

Encourage all Member States to adopt comprehensive adaptation strategies

- As part of the Adaptation Strategy package the Commission has provided guidelines to help Member States formulate adaptation strategies.

- The Commission will develop an 'adaptation preparedness scoreboard,' identifying key indicators for measuring Member States' level of readiness.
- In 2017, the Commission will assess whether action being taken in the Member States is sufficient. If it deems progress insufficient, the Commission will consider proposing a legally binding instrument.

Provide LIFE funding to support capacity building and step up adaptation action in Europe (2014–2020)

- A climate-action sub-programme will be created under the 2014–2020 LIFE funding programme for the environment. This will substantially increase the LIFE funds available to combat climate change.
- Priority vulnerable areas have been identified to steer discussions with Member States on the 2014–2020 LIFE work programme.

Introduce adaptation in the Covenant of Mayors framework (2013–2014)

- The Commission will support adaptation in cities. It will do this in particular by launching an initiative, based on the model of the Covenant of Mayors, through which local authorities can make a voluntary commitment to adopt local adaptation strategies and awareness-raising activities.

Bridge the knowledge gap

- The Commission will work further with Member States and stakeholders to identify adaptation knowledge gaps and the relevant tools and methodologies to address them. The findings will be fed into the programming of Horizon 2020, the EU's 2014–2020 framework programme for research and innovation, and will address the need for better interfaces between science, policy making and business.
- The Commission will promote EU-wide vulnerability assessments, taking into account, *inter alia*, the cross-sectoral EU overview of natural and manmade risks that it will produce in 2013. It will in particular support the Joint Research Centre in its work on estimating the implications of climate change and undertake a comprehensive review of what global climate change will mean for the EU.

Further develop Climate-ADAPT as the 'one-stop shop' for adaptation information in Europe

- The Commission and the European Environment Agency will improve access to information and develop interaction between Climate-ADAPT and other relevant platforms, including national and local adaptation portals (2013–2014).

- Special attention will be given to cost-benefit assessments of different policy experiences and to innovative funding, through closer interaction with regional and local authorities and financial institutions.
- Work on the inclusion of the future Copernicus climate services (previously known as GMES – Global Monitoring for Environment and Security) will start in 2014.

Facilitate the climate-proofing of the Common Agricultural Policy (CAP), the Cohesion Policy and the Common Fisheries Policy (CFP)

- As part of the Adaptation Strategy package the Commission has provided guidance on how to further integrate adaptation into the CAP, the Cohesion Policy and the CFP. This guidance aims to help managing authorities and other stakeholders involved in programme design, development and implementation during the 2014–2020 budget period.
- Member States and regions can also use funding under the 2014–2020 Cohesion Policy and CAP to address knowledge gaps, to invest in the necessary analyses, risk assessments and tools, and to build up capacities for adaptation.

Ensuring more resilient infrastructure

- In 2013, the Commission will launch a mandate for European standardisation organisations to start mapping industry-relevant standards in the area of energy, transport and buildings and to identify standards that need to be revised to achieve better inclusion of adaptation considerations.
- The Adaptation Strategy package provides guidelines to help project developers working on infrastructure and physical assets to climate-proof vulnerable investments.
- Drawing on the results of its Communication on Green Infrastructure, adopted in May 2013, the Commission will explore the need to provide additional guidance for authorities and decision makers, civil society, private business and conservation practitioners to ensure the full mobilisation of ecosystem-based approaches to adaptation. This will be done by the end of 2013.

Promote insurance and other financial products for resilient investment and business decisions

- The Green Paper on the insurance of natural and man-made disasters, adopted as part of the Adaptation Strategy package, is a first step towards encouraging insurers to improve the way they help to manage climate change risks. A report on the results of the public consultation associated with the Green Paper will be published in the second half of 2013.

- The Commission's aim is to improve the market penetration of natural disaster insurance and to unleash the full potential of insurance pricing and other financial products for risk-awareness prevention and mitigation and for long-term resilience in investment and business decisions (2014–2015). A process has been launched to increase involvement of the insurance and financial sector. The results of this exercise will be disseminated via Climate-ADAPT in particular.

Examples of adaptation projects in EU Member States:

Belgium

Kruibeke flood control area

- Kruibeke is a small municipality in Flanders, across the river from harbour city Antwerp. It is located in a flood prone area of Belgium, once reclaimed from the river Scheldt.
- Face a substantial flood risk when a spring tide occurs with a North Western storm. Twice a year such an event causes a big storm surge to be pushed from the sea into the river Scheldt. This causes high water levels and a severe pressure on the Scheldt dykes. The safety of the area around the river Scheldt needed to be improved to address the existing risk, a matter all the more urgent taking projected climate change into account. By lowering the dyke of the Scheldt along a distance of 8 kilometres, the top of the storm wave is cut off, allowing the water to flow into the designated area (600 ha) in a controlled manner.

Cyprus

Adapting agricultural production to climate change and limited water supply (LIFE project)

- Adaptation of agricultural production to climate change and limited water supply. Minimise agricultural water use by introducing a water-recycling method in a closed, fully automated, hydroponic greenhouse system. Aim to fully recycle the water and also reduce greenhouse gas emissions by using the renewable energy source and minimise water pollution and other environmental effects of agriculture.

Greece

CALCHAS – Development of an integrated analysis system for the effective fire conservancy of forests

- Fire is the most important natural threat to forests and wooded areas of the Mediterranean basin. Evaluation of hazards, good planning, proper management strategies and co-operation are vital elements. Forest-fire simulation tool capable of estimating the evolution of a wild forest fire. The tool does this by using as inputs data on ignition points, real environmental conditions, the vegetation of the area and spatial information (isocontours and ground elevation).

Portugal

Tamera water retention landscape

- Although Portugal has a similar average rainfall to Central Europe the soil is unable to hold on to nutrients and water.
- Projected climate change is expected to aggravate the drought already present. Alentejo in south of Portugal is one of the areas that face serious desertification problems.
- Solution for the disturbed water balance in the region by creating water retention landscapes. These landscapes contain lakes that will provide a solution for desertification, water scarcity, flooding and rural de-population. Retention lakes created by dams. A total of 6 lakes has been built since 2007 and 10 more retention areas are planned. The lake grounds are not sealed, so the water can seep into and soak the surrounding earth-body. In addition, the lakes were built with deep and shallow zones, thereby connecting the lakes to the groundwater.

GIS & Remote sensing to climate change

The use of GIS & Remote sensing can be a valuable tool to monitoring, decision-making and mitigation of climate change. Satellite images are becoming available to more people and record a broad range of information regarding the Earth's behaviour. Such information can make decision-making easier and help adaptation strategies.

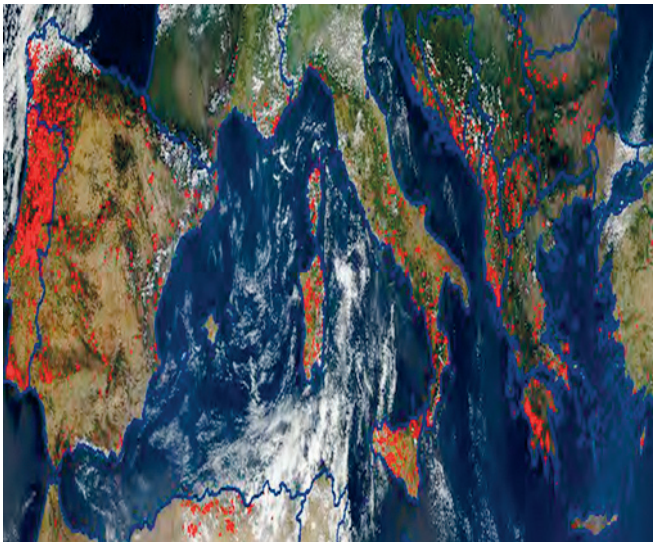


Figure: Wildfires detected from satellite images

Corporate Social Responsibility

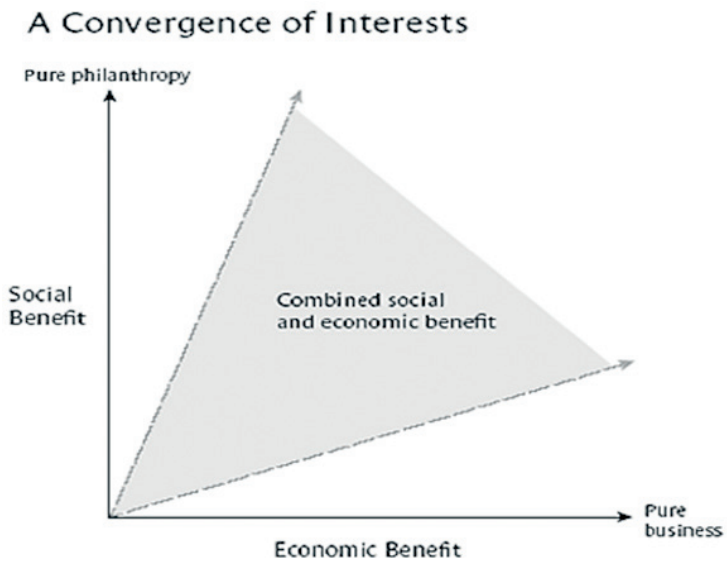
Corporate Social Responsibility (CSR) is:

- *voluntary actions that firms take over and above compliance with minimum legal requirements, to address both its own competitive interests and the interests of the wider society* (UK's Department of Trade and Industry).
- *a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on voluntary basis* (European Commission, 2001).
- firms commitment to social and ecological considerations, beyond *the law requirements*McWilliams and Siegel (AMR, 2001).

Two types of CSR activities:

(i) philanthropy oriented donations, and

(ii) investments along the value chain.



Organizations increasingly are concerned about how their actions affect the environment and social welfare. Employees, consumers, investors, lenders, governmental agencies, and other stakeholder groups are demanding that firms operate in a socially responsible manner. While internalizing societal goals is laudable, organizations cannot want only abandon their profit maximization aims. As with other organizational decisions, CSR decisions are not made in a vacuum but, rather, are made via an informed understanding of the benefits reaped and the costs incurred. To this end, organizations need to assess what they–and others–are getting and giving up from their CSR decisions.

Water management

Introduction

Water management is about solving problems to secure water for people, based on a sound scientific understanding of hydrologic and hydraulic processes. This includes protection from excess water and from water shortage, as well as providing sufficient water for a sustainable environment.

Water is an invaluable and vital source to humanity. Since the ancient era the development of the most ancient civilisations was predominant along river banks. Water is the source of all life, without it nothing can survive. Due to the fact that it

is unequally distributed on the Earth, water may be a rare natural resource when it is not well managed. Trends such as climate change make access to natural resources one of the most important challenges and water management a critical and essential aspect for humanity to consider seriously.

What is hydrology and what hydrologists do?

Hydrology is the science that encompasses the occurrence, distribution, movement and properties of the waters of the earth. It is the relationship with the environment within each phase of the water cycle.The water cycle, is a continuous process by which water is purified by evaporation and transported from the earth's surface (including the oceans) to the atmosphere and back to the land and oceans.

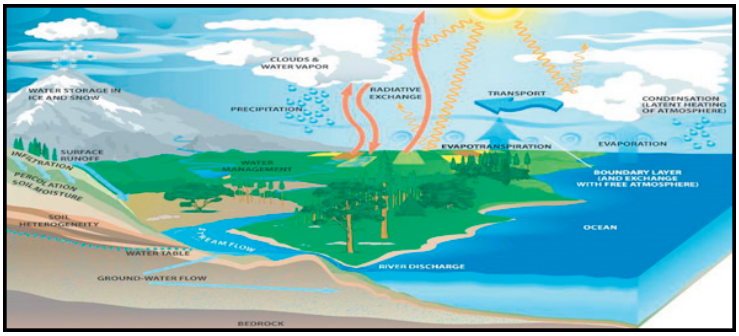


Figure: Water Cycle

All of the physical, chemical and biological processes involving water as it travels its various paths in the atmosphere, over and beneath the earth's surface and through growing plants, are of interest to those who study the water cycle. There are many pathways the water may take in its continuous cycle:

- Rainfall or snowfall and returning to the atmosphere.
- Captured for millions of years in polar ice caps.
- Flow to rivers and finally to the sea.
- Soak into the soil to be evaporated directly from the soil surface as it dries or be transpired by growing plants.
- Percolate through the soil to ground water reservoirs (aquifers) to be stored or it may flow to wells or springs or back to streams by seepage.

In general, the water cycle may be short, or it may take millions of years. During that process, people tap the water cycle for their own uses. The pumping of water from the ground or drawing it from a river or lake is being used for a variety of activities such as households, businesses and industries; irrigation of farms;

and for production of electric power. After use, water is returned to another part of the cycle: perhaps discharged downstream or allowed to soak into the ground. The returned water normally is lower in quality, even after treatment, which often poses a problem for downstream users.

Hydrology has been a subject of investigation and engineering for millennia. Around 4000 B.C., the Nile was dammed to improve agricultural productivity of previously barren lands. Mesopotamian towns were protected from flooding with high walls. Aqueducts were built by the Greeks and Ancient Romans.

The water footprint of a product

The amount of fresh water used during the various steps of processing to produce a product. It is separated in three groups:

1. Green water footprint, which is the amount of rainwater evaporated or incorporated into product.
2. Blue water footprint, which is the amount of surface or groundwater evaporated, incorporated into product or returned to other catchment or the sea.
3. Grey water footprint, which is the amount of polluted water.

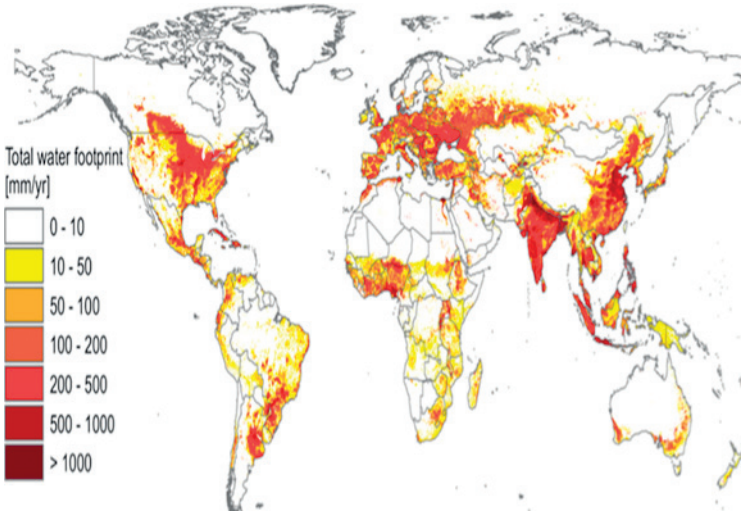


Figure: Upper image: Total globalwater footprint; Lower image: Water consumed for a product.

Floods

Flood is the *relatively high water levels* caused by excessive rainfall, storm surge, dam break or tsunami that *overtop* the natural or artificial banks of a stream, creek, river, estuary, lake or dam" (SCARM, 2000).

The causes of flooding events can be grouped into:

Basic causes:

- Extreme rain events
- Melting of snow and ice
- Blockage of streams or drainage systems
- Failure of dams and control works
- Coastal storm surges, wind, waves

Modifying factors:

- Catchment characteristics (topography, soils, veg., etc.)
- Catchment moisture
- Storage (natural or artificial)
- Channel and drainage network factors

The floods are dependent on the causes leading to such events while the flood category depends on magnitude, frequency and consequences of flooding controlling the degree of the flooding event (minor, moderate or severe).

Flood hazard

Flood hazard is the potential for future loss of life, injury and economic loss caused by future flood events. The degree of flood hazard varies with or is affected by:

- Severity of flooding
- Flood characteristics (e.g. depth, velocity)
- Local topography

- Population exposed to flooding
- Economic consequences of flooding

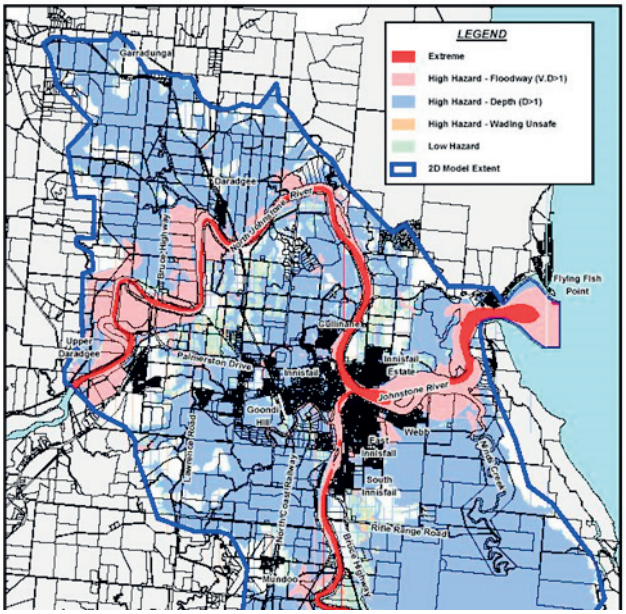


Figure: Example of flood hazard map

Flood management

The flood management is an essential measure nowadays in order to reduce flood-related impacts on communities living in floodplains and reduce private and public losses caused by flooding events.

Flood management can consist of three phases:

Floodplain management (before flood):

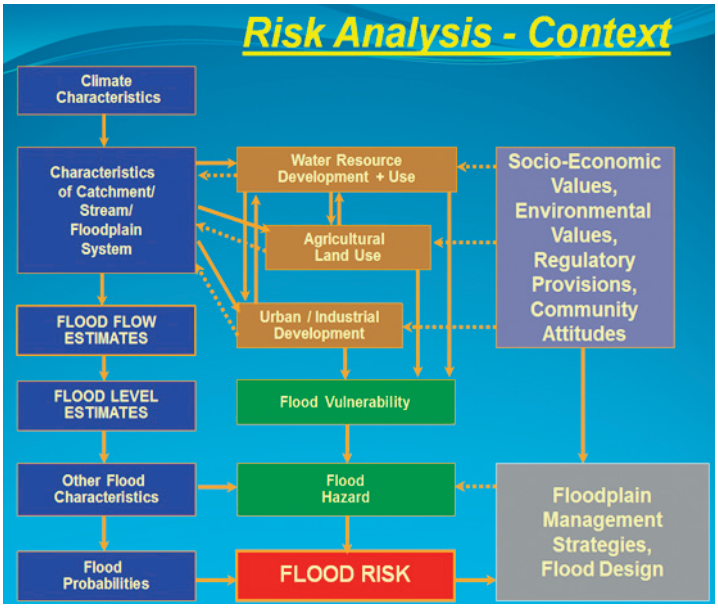
- preventive activities to reduce flood impacts
- environmental management activities

Flood response (during flood):

- operational activities
- emergency management

Flood recovery (after flood):

- assistance to get back to normal life
- disaster relief



Flood Management Strategies

Few of the flood management strategies include:

1. Hard engineering solutions
2. Storage modifications
3. Land-use management strategies

Figure: Cabbions & storage modifications (Dam).

Drought

Drought and as a result desertification of a region can be linked to human activities and climate change. Europe is experiencing dryness, generally through the central part of the continent. In Asia, drought continues to be focused in the eastern and especially south-eastern parts of the continent.

What is drought?

Drought is an insidious hazard of nature. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time – usually a season or more – resulting in a water shortage for some activity, group, or environmental sector.

What causes a drought?

One of the main causes of a drought in a region is due to climate change. A region may be influenced by micro-climate or macro-climate changes resulting in depletion of precipitation over time. The decreased precipitation affects streamflow, soil moisture, groundwater recharge, reservoir and lake levels. Another cause of drought phenomenon is the continuous increase of population. As a consequence a large part of natural land is being converted into an agricultural one. Extensive irrigation of the surrounding water supplies for the farming of crops etc. results at some point available water supplies not being able to meet water demands. In addition, Widespread cutting down of trees for fuel reduces the soil's ability to hold water – drying out the ground, triggering desertification and leading to drought.

What are the impacts of droughts?

Drought presence endangers lives and livelihoods through thirst, hunger (due to crops dying from lack of water) and the spread of diseases. Its geographical impact forces people to migrate and, as a result, puts pressure on resources in neighbouring countries. From geomorphological perspective a drought can increase soil erosion, provide regional aridity and desertification of an area.

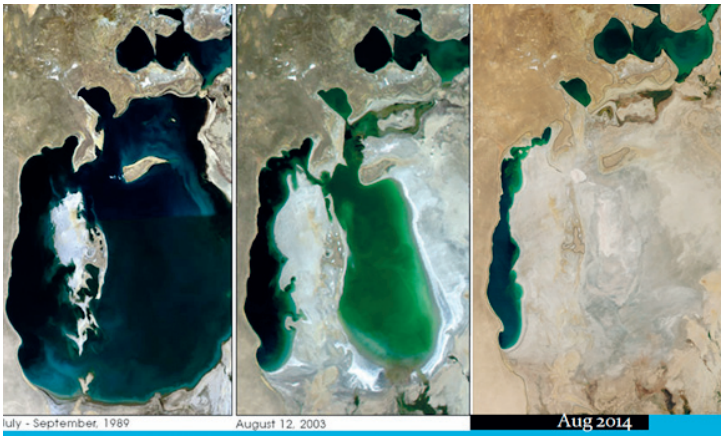


Figure: Example of drought situation and desertification

The climate change and water management can become more than a scientific problem. Aside from scientific problems, there might be political problems as well.Water can be the object of international negotiations or may be a cause of war.With the very high numbers of international watercourses which are shared between countries, water and its use is undoubtedly a cause of tension and often strains relations between countries, real 'water wars.' The water of the Nile asserts Ethiopia, Egypt and Sudan, countries which crosses. According to the United Nations, to1991, Cairo was ready to use force to protect its access to the waters of the Nile."The waters of the Nile will be the cause of the next war in our region, not politics" said Boutros Boutros-Ghali, a former Secretary General of the United Nations.

Figure: Water conflicts among the countries sharing Africa's big river systems

GIS in water management

The water scarcity is a serious issue with nearly 1.2 billion people, approximately one-fifth of the world's population living in areas where water is insufficient. Geographic Information System (GIS) is a critical tool for establishing water resource solutions, which include assessing water quality and management. By 2025, some 1.8 billion people will be living in countries or regions with absolute water scarcity. There is a social responsibility to become more efficient stewards of all aspects of water resource management as two-thirds of the world's population is predicted to be under these stress conditions.

Geospatial professionals with advanced GIS expertise are at the forefront of the water management industry because the ability to manage the infrastructure is predicated on knowing what is where –from fresh water reservoirs and detention recharge basins to wastewater treatment facilities, water and sewer lines and local points of service.

Enterprise GIS offers a single authoritative data source for all water-related infrastructure and resources that allows for integrated data analysis to monitor climate impacts, determine seasonal surpluses or deficits and manage supply and demand based on historical trends.

Rather than seeking alternative water sources, GIS can be used more effectively to estimate impervious surface areas to calculate appropriate storm water runoff rates. When water supplies get scarce, people will want to know where every drop is, more actively use of GIS to manage water resources and usage patterns will become essential.

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Ambivalued Innovation and Interactive Research Design*

1. Introduction

The paper addresses one of the challenges to the concept of innovation articulated recently by V. Blok and P. Lemmens (2015). The traditional understanding of innovation has been predominantly profit-driven ('economized') (Solow 1956; Griliches 1957, 1960; Arrow 1962; Antonelli 2008; Godin 2008; Greenhalgh and Rogers 2010). In view of the recognition of the market failure problems (Arrow 1962; OECD 2011), new approaches to understanding of innovation have been offered, in particular, 'responsible innovations' (European Commission 2013; Owen et al. 2013; van den Hoven et al. 2014, 2015). Nonetheless, this approach apparently inherits the same economized concept of innovation as the traditional one (Blok and Lemmens 2015; Rimes et al. 2014). To come to terms with the economization and its consequences a more thoroughgoing revision of the concept of innovation is presumably called for. The paper propounds this kind of revision as implied by a value-based view (Molina 2014) of the entire research process resulting in innovations. It is argued that from the earlier stages of the research process innovations inherit *ambivalued* characteristics: Constant Cultural Value (CCV) and Variable Utility Value (VUV), corresponding to different dimensions of knowledge and scope of manipulated objects involved. The distinction of the two kinds of values inherent in all stages of research, and also in innovations, articulates the wide-spread recognition of this two-dimensional character of

* A draft of this paper was presented at *Philosophies of Entrepreneurship and Innovation and Creativity Track* during the conference "Philosophy of Management," 9–12 July 2015, Oxford.

innovations, as reflected for instance in the exploitation vs. exploration dilemma in organizational studies (Benner and Tushman 2003). The idea of the constant cultural value strengthens the rationale for public interventions in addressing innovation market failures as illustrated with a recent application of EU innovative public procurement instrument.

The paper derives also the consequences of the ambivalued concept of innovation for methodology of innovation studies. Given the recent advances in methodology of interdisciplinary studies (John W. Creswell et al. 2011; J. W. Creswell 2008; O'Brien et al. 2013; Tashakkori and Teddlie 2010; Teddlie and Tashakkori 2006, 2009, 2012), it would seem that the most natural choice for innovation studies would be mixed-methods design (Kawalec 2014a, 2014b). However, as I argue in this paper, it would not capture adequately the ambivalued nature of the concept of innovation. Hence, an original methodology is proposed, which modifies the mixed-methods approach to form *interactive innovation research design*. The idea of interactive research design is illustrated in detail with a recent innovation study.

2. The Concept of Ambivalued Innovation

It is a commonplace observation that there is a continuous process leading from basic research to innovation diffused on the market (Balconi et al. 2010). However, the distinction between innovation and invention (Adolf et al. 2013; Maggitti et al. 2013) reflects that there is also an important conceptual discontinuance in this process. The ambivalued account of the concept of innovation, propounded in this paper, is an attempt to provide an explanatory framework for innovation studies, which would capture these two – seemingly divergent – aspects of innovations.

The major observation underlying the distinction of innovation vs invention stems from different characteristics of knowledge involved in both stages of the innovation process (Fagerberg et al. 2012; Jayawarna and Holt 2009; Martin et al. 2012; Vessuri 2012). The basic research generates pure knowledge (Calvert 2006; Calvert and Martin 2001), which can be coded (Arrow 1962) (pure cultural value)[2] and then transferred as input to the subsequent stages of the innovation process. Innovation, as the ultimate output of the entire innovation process, however, embeds localized and contextualized knowledge which gives rise to a wider

[2] I. Nonaka et al. go as far as to claim that "Knowledge creation is also a self-transcending process, in which one reaches out beyond the boundaries of one's own existence … [S]elf-transcendence is fundamental since tacit knowledge can only be shared through direct experiences, which go beyond individuals" (Nonaka and Nishiguchi 2001: 18).

spectrum of product functionalities as valuable market commodities (pure utility value).

This view, however, does not take into account at least two important characteristics of scientific knowledge (Adolf et al. 2013), which support the claim – propounded in this paper – that these two kinds of values are inherent in the outcomes of each stage of the innovation process.[3]

(1) As amply argued by R. Giere (2006), even at its most theoretical stage generation of new knowledge in scientific research involves (cognitive) manipulation of some kind of objects, which embed human knowledge.[4] At the stage of basic research, those objects – Giere's 'external representations' – can be characterized as *unique*, *symbolic* and *causal*. Even in cases of possible alternative solutions to the research question only one of the considered representations is taken as potentially correct. The representation is symbolic as it has to be capable of being internalized by the cognitive agent.[5] However, being elaborated through the later stages of the innovation process the representation is used to expand the scope of material objects which can be manipulated (constructed) accordingly[6] up to the point when there are ready prototypes, blueprints, etc. A critical point in this process is reached, roughly speaking, when the standard design of the product necessary for its mass-production in large quantities is accomplished (Teece 1986, 2006; Kawalec 2013).

The continuously more successful re-design of material objects is conditional upon the accurate identification of causal mechanism at the stage of basic research.[7] Thus, each of the unit products instantiates 'nomological machines' (Cartwright 1999; Pemberton and Cartwright 2014), which – as, for instance, reverse engineering makes evident – can be read off from them as the ultimate outcomes of the entire innovation process without carrying on basic research itself (Berends et al. 2014). Thus, each of the unit products inherits and instantiates the same

[3] There is also an important observation that with continuous development of technology its link with science has become more intimate than at the beginning of modern science: "The separation of the components of the innovation process into self-contained and independent stages that serially interlink may increasingly be under attack as an artificial form of analysis" (Geisler 2001: xiv).

[4] On Giere's account (2006: 97) they are referred to as 'external representations,' whose role is further explicated on the grounds of cognitive science in terms of 'distributed cognition.'

[5] A recent comprehensive account of the internalization process is given by (Danks 2015).

[6] A detailed study of how the symbolic representation is applied to manipulate material objects and to intervene in the corresponding causal systems of material objects is presented in (Heidelberger 2011).

[7] A standard interventionist account of causal mechanism is here taken for granted (Jim Woodward 2002; James Woodward 2003; Pearl 2009; Gerring 2012).

cultural values (e.g. truthlikeness, creativity, novelty) that have been generated at the opening phase of basic research.

As a matter of elementary economic consideration, however, it has to be admitted that there is a major shift in commodity value between the symbolic representation, which is available for cognitive manipulation at the initial stage of basic research and the unit output of the mass-production. For the symbolic representation – as in principle as immaterial and thus unavailable to appropriation mechanisms – constitutes a *public good* with positive externalities, being non-excludable and non-rival (Greenhalgh and Rogers 2010; Kealey and Ricketts 2014). Its utility value steadily grows with the scope of material objects which instantiate the symbolically represented manipulable mechanism up to the point of the standard design of the product. At that point, as is well known (Teece 1986, 2006; Fischer and Henkel 2011; Kawalec 2013), its market utility (economic value) grows immensely. So, throughout the innovation process the outputs inherit the same cultural values as the initial invention (statement referred to hereafter as: Constant Cultural Value, CCV in short), but they significantly change their economic value (hereafter: Variable Utility Value, VUV in short). In order to reflect this two-dimensional characteristics of the concept of innovation I coin the term "ambivalued."

The ambivalued nature of innovation can also be observed at the later stages of the diffusion process. It is a commonplace that the rate of adoption depends on the "perceived" rather than "objective" features of objects (Ryan and Gross 1943; Coleman et al. 1966; Kinnunen 1996; Peres et al. 2010; Vishwanath and Chen 2011; Gyaase and Williams 2013; Rogers 2003). The changes in the rate of adoption as well as (dis)continuance decisions of the users reflect the variability of the utility value of the innovation in question, which, nonetheless, preserves its unchanged cultural value (Yu and Chen 2012). For instance, during the process of creative destruction a given product, which increasingly loses its unit value on the market (Schumpeter 1934; Antonelli 2008; McCraw 2007), still exhibits the same ingenuity as when it was designed by an engineer in accordance with the relevant causal laws.

(2) On the "ivory tower" view of science (Polanyi 2000; Thorpe 2014), inventors were conceived of as autonomous agents pursuing their own interests and the output of their work instantiates purely epistemic values, in particular "the truth." This view (Kitcher 2001, 2011; Longino 2002; Ryan 2014) is no longer tenable in philosophy of science community. Science is recognized as embedded in a network of institutions of contemporary democratic societies, which impacts it to respond to the social preferences (Schutt 2014). However, in order to address the social

needs in innovative and more effective ways researchers still have to undertake basic research and generate new knowledge. So, the output of scientific research is now recognized as relevant to the society in question not only in what constitutes "value for money" (Czarnitzki and Lopes-Bento 2013), but it also forms a publically accessible storage of ideas, which can be further developed for the benefit of the individuals and companies – by the present and future generations (Geisler 2001; Lockwood 2013; Phelps and Hoye 2014). Thus, the growing public awareness of the democratic governance of science is accompanied by the recognition of the constant cultural values of science outputs for the society. This recognition is evident, for instance, in the arguments from "innovation market failures," which indicate that public subsidies are necessary to develop this potential into real commodities valuable for the society at large.

Moreover, an intuitive recognition of the ambivalued nature of innovation has led to postulates regarding new forms of innovation ownership. The dichotomy between private and public ownership, as (Leadbeater 2001; Holtgrewe 2006) argue, has to be overcome and "innovative forms of ownership" need to be created in order to enable effective commercial exploitation of 'ambivalued' knowledge.[8]

3. Implications of Ambivalued Innovation for the STI Policy Decisions

In economic theorizing it is the free market that is supposed to settle the balance between the aspects of innovation utility, namely profit – on the innovator's part – and welfare on the part of the innovation adopter (Baumol 2002; Henrekson 2014). It turns out, however, that there are areas of the market, where the mechanism fails to stimulate innovation activity on the part of innovators (OECD 2011; Takalo 2013). So, the expected utility would be too low to stimulate investments in innovation, or the utilities stemming from the innovation will inevitably lead to substantial spillover effects, benefiting thus different stakeholders, including also market competitors of the innovator (Stephens et al. 2013; Howells and Bessant

[8] E. Geisler (2001: 228) suggests also a different argument supporting the ambivalued nature of innovation. He notes: "In the absence of a truly convincing economic justification for S&T, the answer to why companies engage in S&T may also be attributed to the cultural appreciation of how S&T contributes to corporate growth, success, and survival." From this perspective, CCV appears not only relevant to the public agents, but would also play a major explanatory role in accounting for private companies' incentives in undertaking the whole spectrum of the research and development stages leading to innovation. A detailed argument elaborating this line is, however, beyond the scope of the present paper.

2012; Arpino and Mattei 2013; Huergo and Moreno 2014; Takalo et al. 2013; Jaffe 2006). Since innovator will not be in a position to monetize this benefit, it is claimed that public investment should intervene in order to balance the market and adequately stimulate innovator's investment (Takalo 2013).

Now, the question is whether the ambivalued nature of innovation contributes to this discussion. It seems that the decision process, for instance in financing a particular innovative project (Yu and Chen 2012), would be entirely based on how its outcome will balance the utility values. Will considerations of utility always outweigh the relevance of cultural values of innovations? It may seem that the answer is in the positive. But the case of biofuels brought out in (Blok and Lemmens 2015) indicates that it would presume the infallible knowledge about how the present and – more importantly – the future utility are going to evolve on the free market, when confronted with other commodities and substitutes. On the other hand, cultural values of innovation develop naturally their spillover effects on the market (Jaffe 2006; Crescenzi et al. 2012; Stephens et al. 2013; Howells and Bessant 2012). Thus, it seems that in the case of areas of market innovation failures, it is the cultural values of innovations that should be the prime consideration of decision makers. As in such cases – by definition – market will not reach the equilibrium at the level reflecting the 'real' utility of the innovation, and which will evolve on the basis of the cultural values inherited in an innovation. If the innovation is a fundamental discovery, like the decoding of the human genome (Lander et al. 2001; Huang and Murray 2010; Koepfli et al. 2015), then it will obviously have an immense spillover effect on a large number of economy sectors.

Of the recently applied innovative policy measures addressing innovation failures it is innovative public procurement (Edquist et al. 2015; Guerzoni and Raiteri 2015; Warwick and Nolan 2014) that seems to capture the ambivalued nature of innovation for highly contextualized domains. A recent example illustrating it is the project BRODISE (www.brodise.eu), which is intended to demonstrate how the joint innovative public procurement of three harbor cities in the Mediterranean area can be used stimulate SMEs to develop innovative and commercially viable soil treatment technologies. The new knowledge required for the development of the technologies in question will obviously extend the scope of manipulable objects from the site-specific treatments to general-purpose ones. With new functionalities the utility value of the treatment technologies will increase the commercial market value. On the other hand, however, the new technologies will embed cultural values (e.g. original combination of the existing treatments with new ones; novel conception of complex soil treatment; creative adaptation of the complex treatment to site-specific problems), appending thus the existing stock of public knowledge and thus enabling further spillover effects. It seems evident in this example that

it is the cultural values of the expected outcomes that are of primary concern of the public authorities involved in innovative public procurement. For even in the case if the enterprises involved in this particular project would fail, still the whole project will have a spillover effect in provisioning subsequent innovative approach to complex soil treatments.

John Marburger in 2005 initiated in the USA a program of elaboration of "science-based science policy"(Fealing 2011; Fealing et al. 2014). The program is expected to develop very valuable evidence-base for policy makers, which – in principle, at least – is supposed to allow to trace the effects of each US dollar spent from public money on innovation in terms of job creation and well-being. But from the argument presented in the preceding paragraph it follows that the project is fundamentally misguided as it is wholly oriented towards tracing changing utilities of innovations and thus providing the wrong kind of information for the decision makers.

A similar objection may be formulated against the "Public Values Mapping" approach (Bozeman and Sarewitz 2011; Bozeman and Johnson 2014). It is based on an important recognition of the role of social preferences and the idea that they should impact the areas of research undertaken by science. But on this approach it is utility considerations that become the measure of effective public policy (Bozeman et al. 2015; Rimes et al. 2014).

4. Implications of Ambivalued Innovation for methodology of innovation studies

There is a growing awareness among interdisciplinary scholars that complexity of social phenomena requires new methodological approaches to research design (Mitchell 2009; Maggitti et al. 2013). Mixed-methods approach has recently emerged as the 'third' paradigm alternative to the former ones: post-positivist (quantitative) and interpretivist (qualitative) (Ahmed and Sil 2012; Bergman 2010; Clark and Creswell 2011; Morgan 2007; Sale et al. 2002; Sandelowski et al. 2012; Sommer 2011; Tashakkori and Teddlie 2010; Teddlie and Tashakkori 2009, 2012). In investigating a single research question mixed-methods approach engages (simultaneously or concurrently) different qualitative and quantitative methods. Their results are integrated – by means of meta-inferences – into a comprehensive multidimensional, but yet single answer to the initial research question (Venkatesh et al. 2013; Kawalec 2015, 2014a, 2014c).

Seemingly the mixed-methods approach is appropriate to capture both the qualitative and quantitative aspects of innovation (Kawalec 2014a) as postulated

by M. Rogers (Tidd 1997; Audretsch and Kayalar-Erdem 2005). Let us consider diffusion of innovations as an example. The Bass model, and its derivatives (Bass 1969, 2004; Mahajan et al. 1990; Peres et al. 2010), describe the quantitative aspect of diffusion, its rate in time and space, as well as provide us with precise predictions conditional on the past observations. However, to understand the mechanism of diffusion, the role of different communication sources, to appreciate the agents' subjective perception of innovations and – most importantly – to acknowledge the social consequences of diffusion, the qualitative research methods are necessary (Greenhalgh and Rogers 2010; Morlacchi and Martin 2009; Nilsson et al. 2014; Rogers 2003). Mixed-methods approach apparently provides us a good opportunity to combine the two into a complex understanding of the process of diffusion, its mechanisms and communication patterns (Berghman 2006; Litan et al. 2012; Meuer et al. 2014).

The ambivalued nature of innovation, as it seems, requires a significant modification of the mixed-methods approach. I claim that in order to adequately reflect the CVC and VUV components of innovation an *interactive* approach is needed. The basic difference with the standard mixed-methods design is that the researcher is continuously revising the research design conditional on how the results obtained thus far delimit initial research question (Kawalec 2012, 2014b). On this view, the research on innovation is itself a creative process, which requires an on-going adaptation of the known techniques in order to determine the answer to the research question. Even though there are yet no cases of innovation studies, which would in full extent address CVC and VUV components of innovation, there is a relevant example, which can illustrate the *interactive* nature of research design I propound in this paper. The investigation of the economic impact of SWIFT for the effectiveness of banks was a large-scale study, which systematically employed the mixed-methods design (Biddle and Emmett 2011; Scott and Zachariadis 2010, 2012; Zachariadis et al. 2013).

The research question concerned the economic impact of SWIFT on banks. The first-round (quantitative) econometric analysis revealed the positive impact. As it turned out in the first-round qualitative assessment of the opinions of bank experts and managers the result was unintuitive and unexpected. This observation effected in appending the initial research design with qualitative studies on banks, including a detailed case study of a small UK bank. Concurrently, new rounds of econometric analyses were carried out, which were designed taking into account the outcomes of the qualitative studies. The final result revealed two contextualized causal mechanisms operating in respectively small banks (increased profits as a result of increased number of operations) and large banks (decreased operational costs for international money transfers). The whole process of introduction of the

SWIFT from its inception was also investigated by archival studies and interviews with the authorities engaged in initiating the process.

I take the research on SWIFT to approximate the interactive version of mixed-methods approaches in studying the ambivalued innovations. The CCV of SWIFT is only of marginal interest to the researchers, who focus on its economic aspect and provide a detailed study of how VUV of SWIFT evolves both from the perspective on an individual bank and the large sample of banks.

There is also an important difference between the SWIFT study and the projected interactive mixed-methods approach. The potential of CCV is reflected in its *prospective* design-oriented perspective (Börner and Polley 2014; Burch and Heinrich 2015; Guice 1999; Pavie and Carthy 2014; Toker and Gray 2008; van Bavel et al. 2013). Given our cognitive limitations the prospects for design-oriented VUV (including value sensitive design as a methodology to pursue the ideal of responsible innovations) are limited as cogently illustrated by discussion of the example of biofuel market in (Blok & Lemmens 2015). Thus, in such cases, including also the SWIFT study, *retrospective* analysis seems more adequate to reflect the causal mechanisms involved in shaping the changes in the utility value of an innovation (Perks and Roberts 2013). However, as the cultural value of innovations is constant throughout the research and development process and also throughout different phases of diffusion, I find it prone for the *prospective* design analysis. The very fact has already been reflected in the ambidextrous organizational studies (Benner and Tushman 2003), which emphasize the need to frame the organizational structure to enable both exploratory and exploitation activities.

5. Conclusion

The paper propounds the concept of ambivalued innovation, which intends to capture cultural constancy and market variability of different kinds of values embedded in innovations. It also draws some of the consequences for public policy and for methodology of innovation studies. The latter is proposed in the form of *interactive* modification of mixed-methods research design. There are also some important limitations to the present study. Perhaps the most perspicuous one concerns management of innovations. If the proposed account of ambivalued nature of innovation is correct, than it seems that the major challenge for innovation management would be to balance CCV and VUV in order to optimize market entry and diffusion (Dobni 2010; Driessen and Hillebrand 2013; Gaubinger et al. 2015; Hienerth et al. 2014; Pinkse et al. 2014; Rothwell 1992; Joseph Tidd 2010).

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