

# A.3

## The global engineer in Sustainable Human Development

1. (Re)Shaping knowledge: the contribution of Sustainability Science
2. Linking knowledge with action
3. The role of technology for SHD solutions
4. Understanding the social dimension
5. Translating SHD into business practices



# A.3 The global engineer in Sustainable Human Development

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Global Dimension in Engineering Education

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Front Cover Photo: 'The Faces of Tomorrow'. The youth of Uganda are the faces of tomorrow. A. Corbett

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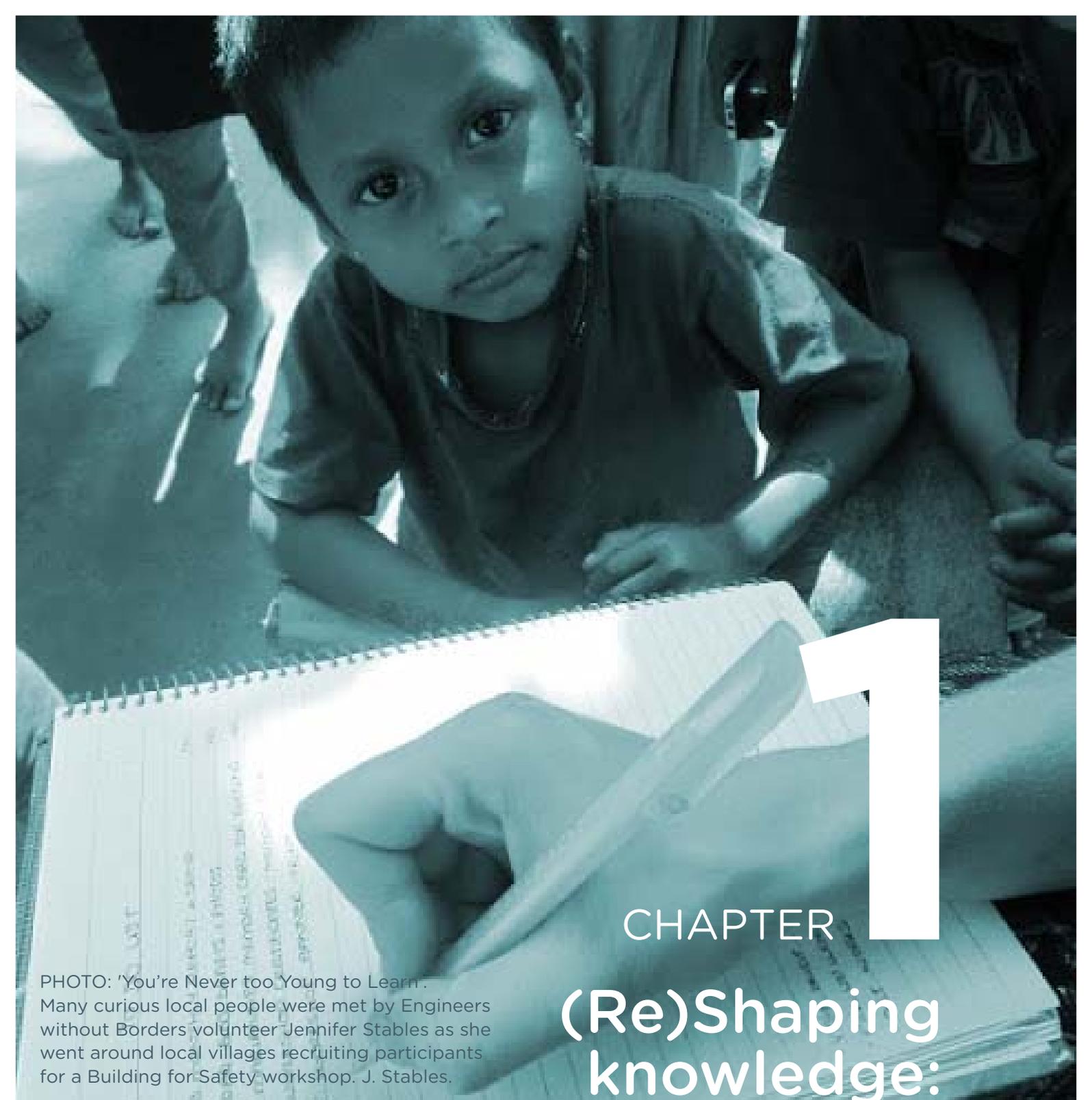


PHOTO: 'You're Never too Young to Learn'. Many curious local people were met by Engineers without Borders volunteer Jennifer Stables as she went around local villages recruiting participants for a Building for Safety workshop. J. Stables.

CHAPTER

1

(Re)Shaping  
knowledge:

the contribution  
of Sustainability Science

# 1

## CHAPTER 1. (Re)Shaping knowledge: the contribution of Sustainability Science

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# 1

# (RE)SHAPING KNOWLEDGE: THE CONTRIBUTION OF SUSTAINABILITY SCIENCE

**Jordi Segalàs, Gemma Tejedor, Gisela Cebrián**, Universitat Politècnica de Catalunya

## EXECUTIVE SUMMARY

Today's society faces many global challenges, such as dealing with the economic crises, climate change, desertification, deforestation, environmental degradation, inequalities, wars and poverty eradication. In this global context, the idea of sustainability or sustainable development has gained widespread international recognition as the way forward to ensure quality of life, equity within and between current and future generations, and environmental health. Although the conceptualisation of sustainability remains controversial, with different perspectives and definitions of the term existing, there is political agreement on the need to build awareness and develop strategies and action plans to deal with current societal global challenges.

In this global context sustainability science has emerged as a new academic discipline that seeks to point ways and practical solutions towards building a more sustainable society. This chapter outlines the emergence of sustainability as a concept. It introduces sustainability science and its fundamentals, linking it to transdisciplinarity research and practice. Finally the precautionary principle and its connection with transdisciplinarity research is discussed and two case studies are provided.

## LEARNING OUTCOMES

After you actively engage in the learning experiences in this module, you should be able to:

- Recognise the complexity of sustainability as a concept.
- Distinguish sustainability science as an emerging academic disciplines and its fundamentals.
- Principles of transdisciplinarity.
- Identify and understand the differences between disciplinarity, multidisciplinary, interdisciplinarity and transdisciplinarity.
- Differentiate the types of knowledge needed in the context of transdisciplinarity.
- Acknowledge the importance of the precautionary principle and transdisciplinarity to deal with environmental hazards and sustainability challenges.

## KEY CONCEPTS

These concepts will help you better understand the content in this session:

- Sustainability science
- Disciplinarity, multidisciplinary, interdisciplinarity and transdisciplinarity
- The precautionary principle
- Co-production of knowledge

## GUIDING QUESTIONS

Develop your answers to the following guiding questions while completing the readings and working through the session:

- How are sustainability and sustainability science defined? What are the current challenges of defining these concepts?
- What are the fundamentals of sustainability science? What are the three levels of the system approached by sustainability science?
- What are the principles of transdisciplinarity? Why is transdisciplinarity needed in the field of sustainability science? What do sustainability science and transdisciplinarity have in common?
- How transdisciplinarity differs from disciplinarity, multidisciplinary and interdisciplinarity?
- What is the precautionary principle? What defines a false negative and a false positive? How the precautionary principle links with transdisciplinarity?

## INTRODUCTION

Today's society faces many global challenges, such as dealing with the economic crises, climate change, desertification, deforestation, environmental degradation, inequalities, wars and poverty eradication (United Nations, 2012). In this global context, the idea of sustainability or sustainable development has gained widespread international recognition as the way forward to ensure quality of life, equity within and between current and future generations, and environmental health. Although the conceptualisation of sustainability remains controversial, with different perspectives and definitions of the term existing (Dresner, 2002), there is political agreement on the need to build awareness and develop strategies and action plans to deal with current societal global challenges (United Nations, 2012).

Sustainability has also gained an academic focus; where different subject areas, such as environmental sciences, economics, sociology, ethics and politics, are continuing to generate and advance scientific knowledge, as well as other forms of knowledge. In this global context sustainability science has emerged as a new academic discipline that seeks to point ways and practical solutions towards building a sustainable society. Sustainability science acknowledges sustainability as a wicked problem<sup>1</sup>, which involves dealing with ambiguity, complexity, multiple stakeholders, worldviews and values, and is difficult to solve because it is an evolving and moving target. Therefore dealing with sustainability requires innovation, creative thinking, problem-driven, action-orientated and transdisciplinary approaches.

## THE EMERGENCE OF SUSTAINABILITY AS A CONCEPT

During the 1960s and 1970s an environmental movement was initiated due to the emergence of different social concerns such as growing pollution and environmental degradation, poverty in non-developed countries and increasing social inequalities. The publication of some books such as *the Silent Spring* by Rachel Carson and *the Limits to Growth* by Meadows et al., to cite two of the most relevant and remarkable books in this area, and the lyrics and music of artists of the time such as Cat Stevens, John Lennon and John Denver, advocated the need for environmental protection, social justice, human rights and equity. These represented landmarks in Western societies and made a public call for global environmental action and political commitment to address development and environmental issues.

Due to the increasing social concerns about the environment, inequalities and development, the first United Nations Conference on the Human Environment was held in 1972 in

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<sup>1</sup> Used to describe problems that are difficult to solve because of their multifaceted and complex nature.

Stockholm. It was the first time that the link between development and environment was internationally and politically recognised and therefore the need to ensure environmental protection and development of non-developed countries as the means to alleviate poverty. Forty years after, in the recently held United Nations Conference on Sustainable Development (UNCSD, Rio de Janeiro, June 2012) the Heads of State and Government affirmed to *'renew our commitment to sustainable development... at all levels, integrating economic, social and environmental aspects and recognizing their interlinkages, so as to achieve sustainable development in all its dimensions'* (United Nations, 2012, pp. 1-2). Although an increasing international and national commitment is plausible, due to the several declarations of good intentions, real progress on this agenda and its means of implementation across the globe has been weak and unequal.

Sustainable development was defined for the first time in 1987, when the United Nations created the World Commission on Environment and Development (WCED) to establish 'A global agenda for change'. In 1987 in its report *Our Common Future*, also known as the Brundtland Report, an explicit link was made between the social, economic, cultural and environmental issues, and sustainable development was conceived as (WCED, 1987, p. 43): *"The development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*.

This definition is one of the most quoted definitions referring to sustainability or sustainable development. Sustainable development was and is seen as a meeting point for environmentalists and developers and as a call to all nations to work on environmental protection, economic growth and social equity. The definitions provided by international and national agencies have been criticised for being vague, abstract, ambiguous, contradictory and non-operational because they do not clarify what methods and innovative processes are required to cultivate sustainable communities. One needs to accept that there exist different worldviews and definitions of sustainability and that there is no consensus on the meaning of sustainability as concept. Therefore different perspectives and definitions are provided by different disciplines such as politics, economics and environmental sciences. The lack of agreement and understanding of sustainability as a concept obstruct it to be taken as an operational and serious concept, often seen as a political construct, vague and meaningless. Frequently it is seen as a 'fashion' and 'media' concept that appears in all the political speeches but meaningless in practice and in the real world.

Sustainability is inevitably political, thus the sustainability debate it is also a debate about current socio-economic systems where present values such as progress and quality of life need to be re-evaluated. Moreover a debate exists around 'strong' sustainability and 'weak' sustainability, the former with focus on ecological and environmental issues and the latter with focus on economic and financial issues (Dresner, 2002).

For Kates et al. (2005) the different ways to define sustainability are as: a concept; a goal; indicators (how it is measured); the values under it; and in practice. In this sense the

flexibility of term can be an opportunity for creating open and dynamic processes of participation, discussion and reflection to be adapted to different contexts and situations. This intrinsic characteristic enables dialogue and cooperation amongst people from different disciplines and sectors with different worldviews and interests to reinterpret, redefine and adapt sustainability to concrete situations and contexts.

## WHAT IS SUSTAINABILITY SCIENCE?

Sustainability science has emerged over the last decades as a new academic discipline. Sustainability science or the science of Sustainability, conveys the notion of multiple sciences to address the common challenge of sustainability. It brings together scholarship and practice, global and local perspectives from north and south, and disciplines across the natural and social sciences, engineering and medicine.

However some controversies related to sustainability science exist. This is due to its novelty and the on-going discourse on its characteristics. Sustainability science has been defined as an applied science. In order to establish sustainability science as a mature applied science it is necessary to make use and integrate the existing scientific knowledge developed in the separate disciplines such as biology, ecology, environmental sciences, law, political sciences, sociology, anthropology, geography, history, economics and engineering. But it is also claimed that sustainability is neither 'basic' nor 'applied' research, but rather an enterprise centered on 'use-inspired basic research', where both the quest for fundamental understanding and considerations of use are important (Clark, 2003).

The Integrated Research System for Sustainability Science (IR3S) sought to clarify the concept of sustainability science through approaching sustainability at three levels of the system: global, social and human. These three interconnected systems are critical to the coexistence of human beings and the environment (Komiyama and Takeuchi, 2006):

- **The global system:** comprises the entire planetary base for human survival; the geosphere, atmosphere, hydrosphere, and biosphere. The earth sustains human life by providing us with natural resources, energy, and a supportive ecosystem.
- **The social system:** consists of the political, economic, industrial, and other structures created by human beings that provide the societal base for a fulfilling human existence.
- **The human system:** the total sum of factors affecting the survival of individual human beings; it is, intimately connected to the social system. The healthy functioning of the human system requires the establishment of lifestyles and values that enable people to live healthily, safely, and securely.

As Figure 1 shows, Komiyama and Takeuchi (2006) exemplified a number of problems that occur on a global scale. So for example a problem appearing from the interaction between the social and global systems is global warming, which requires the creation of a low-carbon society that includes technological and systemic transformations to reduce carbon emissions to the atmosphere because of human activities.

Another example from the interaction between the social and human systems is waste generation. This requires the development of circular (resource-circulating) society, which is based on sustainable production and consumption. In reference to the interaction between global and human systems, human health risks appear as the consequence of environmental degradation and pollution, which necessitate of strategies to mitigate health risks and provide universal access to basic needs such as drinking water, education and health.

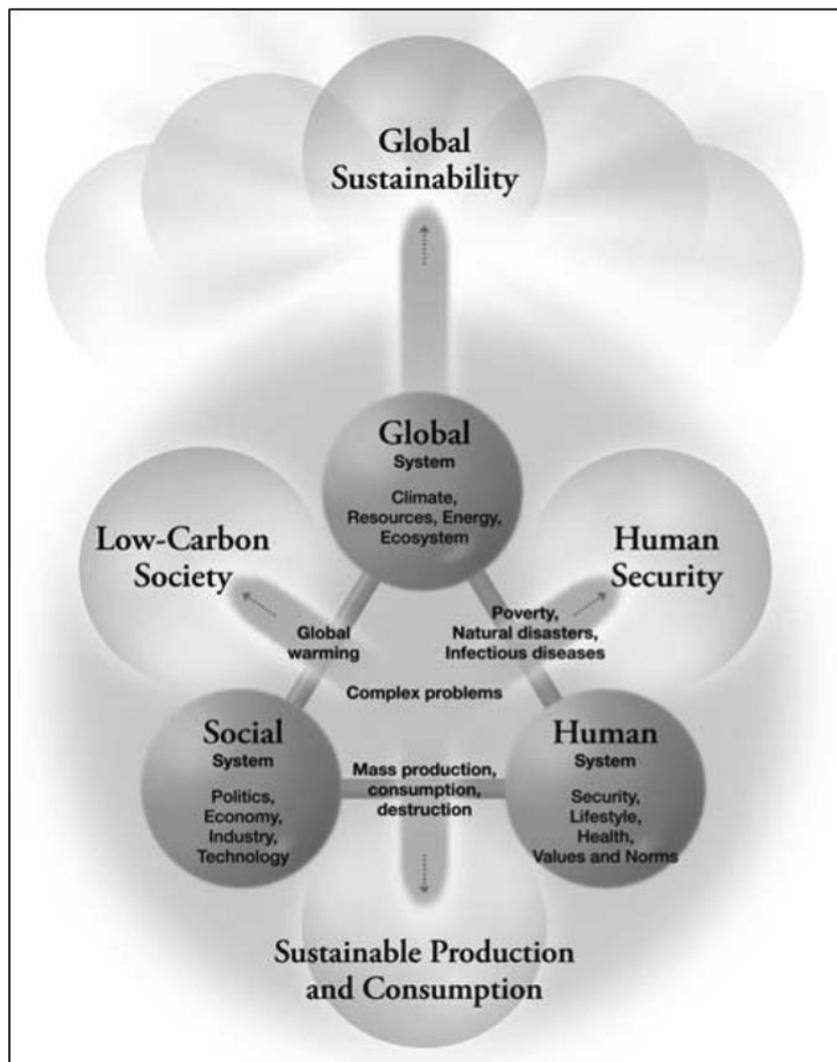


Figure 1 Sustainability science through the lens of three interconnected systems (Komiyama and Takeuchi, 2006).

Sustainability science adopts a comprehensive and holistic approach to the identification of problems, perspectives and practical solutions involving the sustainability of these three systems. It is in essence a dynamic and evolving discipline that provides problem-solving skills, future-thinking and visioning necessary to achieve the sustainability of the human, social and global systems.

Agreement exists on the need to develop new ways of knowledge production and decision-making in order to deal with sustainability challenges. A critical element of sustainability science is the engagement of different actors from outside academia into research processes. This allows the integration of the best knowledge available, the reconciliation of different values and political interests, and taking ownership of problems and solutions. In this sense the multidisciplinary, interdisciplinary and transdisciplinary aspects of sustainability have been widely acknowledged as the means to deal with sustainability. However it needs to be acknowledged that discipline-based science has been the source of almost all the scientific advances of the last century, it has also limited the capacity of science to address problems that encompass several disciplines such as sustainability. Sustainability science entails multiple ideas and perspectives, sometimes differing, by which it is hoped to achieve a more sustainable future. It is viewed as a new paradigm because it challenges existing academic disciplines and knowledge structures.

Participatory, interactive, transdisciplinary, transacademic, collaborative and community-based research approaches are referred as appropriate means to meet both the requirements posed by real-world problems as well as the goals of sustainability science as a transformational academic discipline (Lang et al., 2012). The commonality of these approaches can be found in the establishment of wider participation and research collaborations amongst scientist and non-academic stakeholders from business, government, and the civil society to address sustainability challenges. The next sections focus on the need for and the principles of transdisciplinary approaches.

## THE PRINCIPLES OF TRANSDISCIPLINARITY

Sustainability research and transdisciplinary research strongly overlap and they are often used interchangeably (Kates et al., 2001). In this sense transdisciplinary research also integrates the different academic disciplines, and it is based on participation and collaboration between different actors and stakeholders.

Transdisciplinarity is also seen as an ambiguous and contested concept, with a variety of terminologies and definitions, and diverse research approaches used. In the earlier conceptualisations transdisciplinarity was understood as a superior form of interdisciplinarity, with the aim to develop an overarching framework for complex problems that needed of work across disciplines. By the end of the last century new definitions of transdisciplinarity as a

methodology emerged. This was mainly because of the need to facilitate a broader scientific and cultural dialogue within the new complexity view, and the need to deal with real-life problems such as sustainability (Klein, 2004). Thus transdisciplinarity is a reflexive, integrative, cooperative, method-driven process that aims to (Lang et al., 2012):

- Identify the solutions or transitions of societal relevant problems and concurrently of related scientific problems, by integrating knowledge from various scientific and societal bodies of knowledge.
- Enable mutual learning processes amongst researchers from different disciplines (from within academia and from other research institutions), as well as actors from outside academia, on equal basis; and
- Create and integrate knowledge that is solution-orientated, socially robust, and transferable to both the scientific and societal practice, also considering that transdisciplinarity can serve different functions, including capacity building and legitimization.

### From traditional knowledge boundaries to knowledge co-creation

Early Universities like Salerno, Bologna, Oxford or Cambridge initiated with the creation of Faculties in disciplines such as Medicine, Philosophy, Theology and Law. As Faculties became more and more specialised, disciplines and sub-disciplines arose and multiplied, creating their own disciplinary knowledge associated with these academic disciplines.

As Figure 2 shows different approaches exist between disciplinarity and transdisciplinarity, including multidisciplinary and interdisciplinarity. **Disciplinarity** is about mono-discipline, which represents specialisation in isolation. In **multidisciplinarity**, disciplines are considered as being complementary and juxtaposed in the process of understanding phenomena. A multidisciplinary approach involves drawing appropriately from multiple disciplines to redefine problems outside of normal disciplinary boundaries and reach solutions based on a new understanding of complex problems. **Interdisciplinarity** involves the combination of two or more academic disciplines into one activity, for example a research project. It is about establishing a dialogue between disciplines, crossing boundaries and thinking to create new approaches. It is related to an interdiscipline or an interdisciplinary field, which is a unit that crosses traditional boundaries between academic disciplines, as new needs and professions have emerged. **Transdisciplinarity** goes a step further, as it implies a research strategy that spans across disciplinary boundaries to develop a holistic approach. The aim is to avoid the fragmentation produced by disciplinarity through focusing on solving problems that require of two or more disciplines at once.

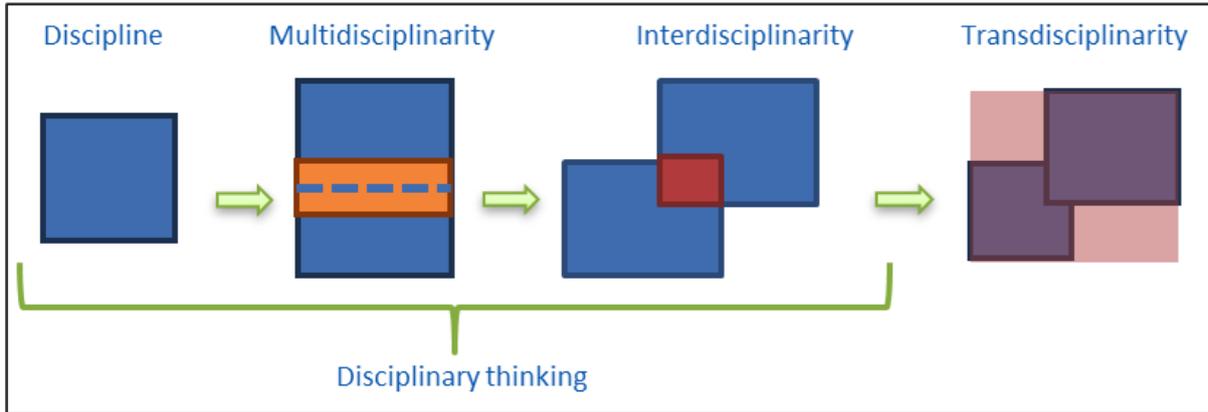


Figure 2. From discipline to transdisciplinarity (adapted from Ramadier, 2004)

Over the last decades many scientists have argued that our relation with a complex world requires complex thought. Max-Neef (2005) suggested that knowledge should be organised around hierarchical systems at four levels: purposive (values), normative (social systems design), pragmatic (physical technology, natural ecology, social ecology) and empirical (physical inanimate world, physical animate world, human psychological world). As Figure 3 points out this corresponds to the pyramid of transdisciplinarity (Max-Neef, 2005), where the four levels (purposive, normative, pragmatic and empirical) are interconnected, including horizontal principles within levels and vertical principles between levels.

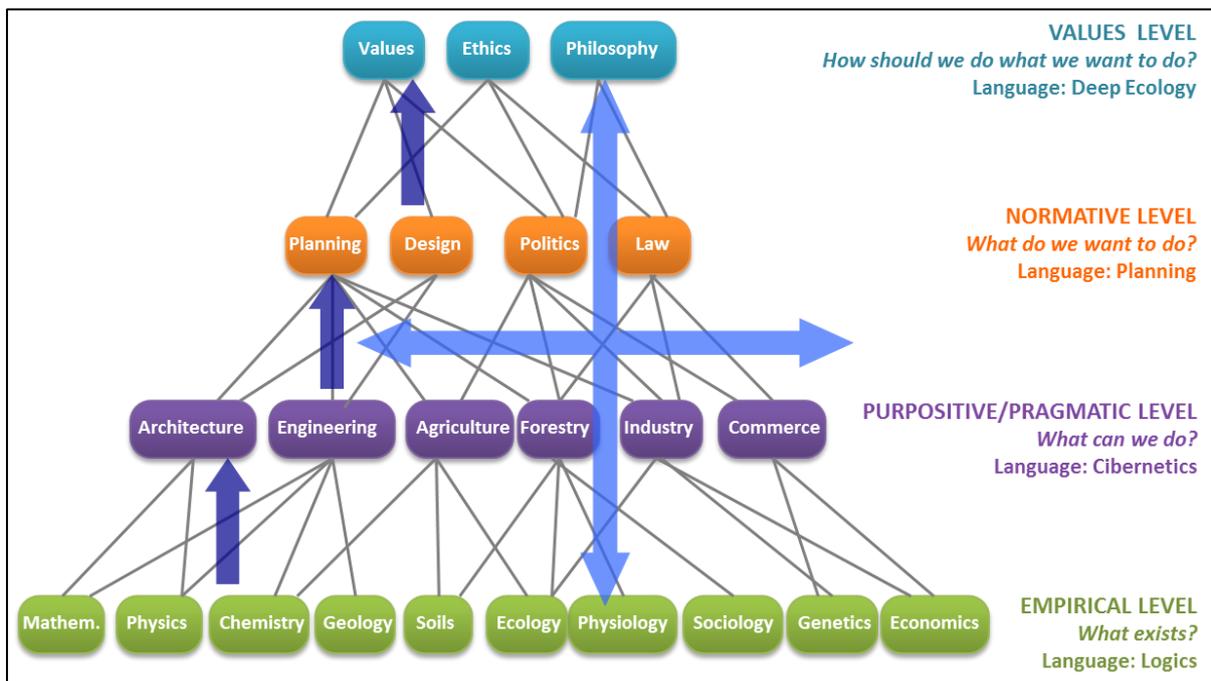
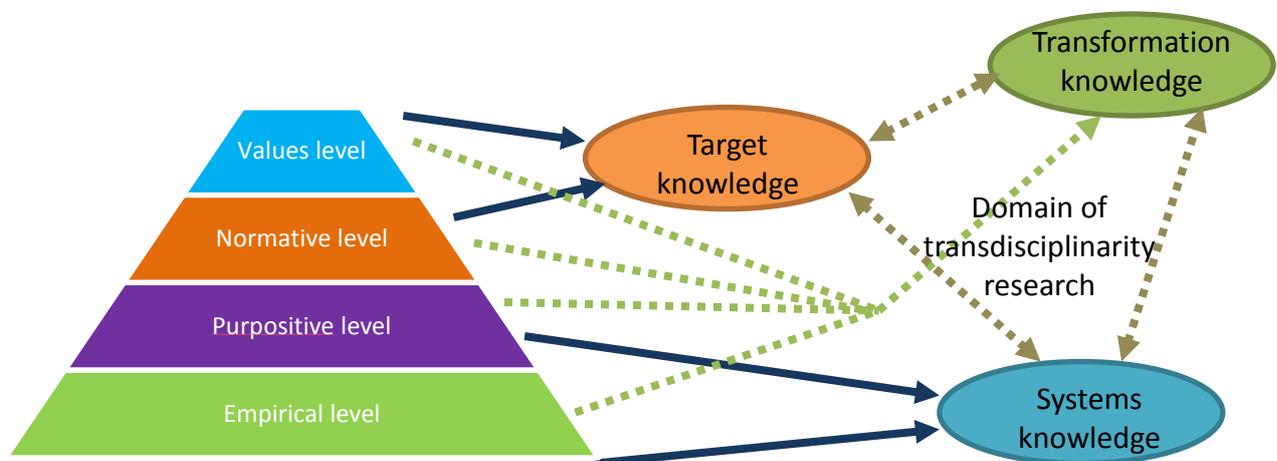


Figure 3. The pyramid of transdisciplinarity (Max-Neef, 2005, p. 9).

Furthermore, in the context of transdisciplinarity research three types of knowledge are needed:

- **Systems knowledge:** related to the origin and development of problems, it seeks to identify causal relations, the interconnections and complexity existent within systems.
- **Target knowledge:** it makes reference to the knowledge and development of the required or desired system status to be reached, for example in the identification of the needs for change, desired goals and better action.
- **Transformation knowledge:** it is about the means to achieve a transformation, in reference to the technical, social, historical, legal and cultural dimensions amongst others. It is related to the means needed to transform existing action into new directions.

The domain of transdisciplinarity research is situated in the interface within these three types of knowledge, which are seen as to be complementary. As Figure 4 shows Gaizulosoy and Boyle (2013) linked the pyramid of transdisciplinarity with the three types of knowledge part of transdisciplinary research processes.



**Figure 4.** Relationships between the pyramid of transdisciplinarity and the three types of knowledge of the transdisciplinary research (Gaizulosoy and Boyle, 2012).

The systems knowledge is mainly acquired from the two bottom levels, which provide the empirical information necessary to understand phenomena and situations. Target knowledge involves visioning for a new system status, and is mainly obtained from the normative and the values levels of the pyramid. Transformation knowledge does not directly link to any of the levels of the pyramid since the means to achieve this transformation are amorphous and

vary according to the problem or situation being address. It is therefore generated through the reflection and synthesis of knowledge from all four levels of the pyramid.

Transdisciplinarity requires of innovative methods that can allow knowledge integration in four differentiated dimensions (see Figure 5):

- Different disciplines in order to establish interdisciplinarity (humanities, social and natural sciences);
- Different systems and compartments to create holistic approaches (such as water, soil, air);
- Different qualities of thought (such as intuition and analysis);
- Different interests of stakeholders.

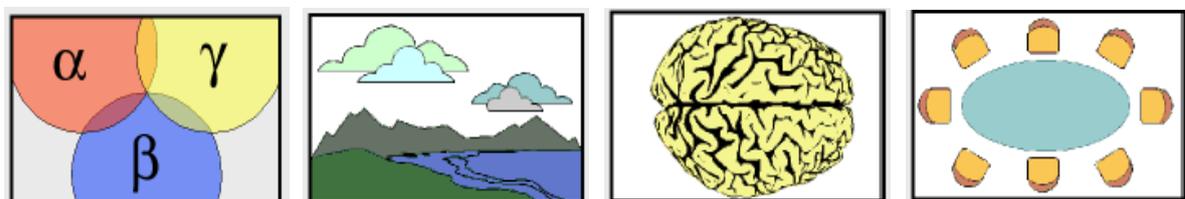


Figure 5. Dimensions of knowledge integration in the Transdisciplinary Case Study Approach (Scholz, 2001).

Transdisciplinarity research is an important methodological approach for sustainability science and practice, because it allows establishing dialogue and collaboration between disciplines. Beyond cross-disciplinary methodologies, transdisciplinarity is transgressor, integrative and transformative because it brings about mutual learning, collaborative research and problem solving. However transdisciplinary research faces a number of challenges such as:

- Crossing boundaries: between disciplines, academia-society, individuals-companies, forms of knowledge generation, forms of communication.
- Integration: considered the main cognitive challenge of transdisciplinary process.
- Moving: from a conception of research on or for society to research with society;
- Process-driven approach and knowledge integration and innovation are integral to transdisciplinary knowledge co-creation.

## THE PRECAUTIONARY PRINCIPLE

The Precautionary Principle has emerged as an approach for the management of new and emerging risks (UNESCO COMEST, 2005). The Precautionary Principle is a strategy to cope with possible risks where scientific understanding is yet incomplete, such as the risks of nano-technology, genetically modified organisms, systemic insecticides and environmental degradation. When human activities may lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or reduce this harm. Morally unacceptable harm refers to harm to humans or the environment that is threatening human life or health, or is irreversible, or inequitable to present or future generations, or imposed without the appropriate consideration of the human rights of those affected.

The judgement of plausibility should be grounded in scientific analysis. Scientific analysis should be ongoing so that chosen strategies and actions are subject to review. These actions are interventions that need to be taken before the harm occurs. These actions seek to avoid or diminish this harm. Actions should be chosen that are proportional to the seriousness of the potential harm, with consideration of their positive and negative consequences, and with an assessment of the moral implications of both action and inaction. The choice of action should be the result of a participatory process, which engages with the community and the different stakeholders.

Central to the application of the Precautionary Principle is the concept of proportionality or cost-effectiveness. Will environmental benefits of precautionary action outweigh the economic and societal costs? For example policies to reduce the threat of climate change will need to include radical shifts in travel and energy-use behaviours. Precautionary prevention has often been used in medicine and public health, where the benefit of doubt about a diagnosis is usually given to the patient ('better safe than sorry'). However, the precautionary principle and its application to environmental hazards and their uncertainties only began to emerge as an explicit and coherent concept within environmental science in the 1970s, when German scientists and policy-makers were trying to deal with 'forest death' and its possible causes, including air pollution.

Since the 1970s, the precautionary principle has increased rapidly in the political domain. The use of different terms such as 'precautionary principle', 'precautionary approach' and 'precautionary measures' is plausible in international treaties and agreements. It has been incorporated into many international agreements, particularly in the marine environment, where an abundance of ecological data on pollution yielded little understanding but much concern: *'huge amounts of data are available, but despite these data... we have reached a sort of plateau in our understanding of what that information is for... This is what led to the precautionary principle'* (Marine Pollution Bulletin, 1997). The United Nations Rio Declaration

on the Environment and Development held in Rio de Janeiro in 1992 extended the idea to the whole environmental arena. It was stated that *'where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation'*.

According to the Wingspread Statement on the Precautionary Principle, formulated by an international group of scientists, government officials, lawyers, and environmental activists the principle of precautionary action has four elements:

- People have a duty to take anticipatory action to prevent harm.
- The burden of proof of harmlessness of a new technology, process, activity, or chemical lies with the proponents, not with the general public.
- Before using a new technology, process, or chemical, or starting a new activity, people have an obligation to examine "a full range of alternatives" including the alternative of doing nothing.
- Decisions applying the precautionary principle must be open, informed, and democratic and must include affected parties.

In the European context, the most significant support for the Precautionary Principle has come from the European Commission's Communication on the Precautionary Principle and the European Council summit held in Nice in 2000. These represented significant contributions to the practical implementation of the Precautionary Principle, especially concerning stakeholder involvement in decision-making processes. The European Commission has put in place a number of laws using the Precautionary Principle. These include: the European Union Cosmetic Directive, which bans the use of chemicals proved or suspected to be carcinogens, reproductive of toxins, or mutagens; the European Union Restriction of Hazardous Substances Directive, which restricts the use of hazardous materials in the manufacturing of various types of electronic and electrical equipment including lead, mercury and cadmium; the European Union Waste Electrical and Electronic Equipment Directive for collection, recycling and recovery of electrical goods; and the European Union Registration, Evaluation and Authorisation of Chemicals, widely known as REACH.

### Case studies based on the precautionary principle

There are multiple case studies of application of the precautionary principle. These case studies can be classified as 'false positive' and 'false negative'. False positive refers to cases with initial tentative scientific evidence of harm, but where it was posteriorly proved that these harms or risks did not exist. False negative makes reference to the cases where early warnings existed but no preventive action was taken. The European Environmental Agency (EEA) published two reports (EEA, 2001; EEA, 2013) with a collection of case studies using

the precautionary principle. The next two case studies show an example of a false negative and an example of a false positive.

#### False Negative: the PCBs case

Polychlorinated biphenyls (PCBs) are chlorinated organic compounds that were first synthesised in the laboratory in 1881. By 1899 a pathological condition named chloracne had been identified, a painful disfiguring skin disease that affected people employed in the chlorinated organic industry. Mass production of PCBs for commercial use started in 1929. Thirty-seven years passed before PCBs became a major public issue and were recognised as environmental pollutants representing a danger to animals and human beings. Large-scale production of PCBs worldwide, and in particular in some eastern European countries, continued until the mid-1980s. PCBs are the first obvious example of a substance that was not intentionally spread into the environment, but became widespread and bioaccumulated to high concentrations.

By the 1930s already existed evidence, some at a low level of proof, that PCBs could harm human beings and the environment because of its bioaccumulation. This information was largely retained within the chemical industry, and it seems it was not widely circulated amongst policy-makers or other stakeholders. The application of the precautionary principle at that time would have prevented the toxic and pollution consequences that now exist. By the end of the 1960s, there was a high level of evidence, mainly due to the Yusho accident, that in certain circumstances PCBs, or their breakdown products, such as dibenzofurans, could cause serious harm to human health and the environment. The findings of Søren Jensen also offered a high degree of proof that PCBs did bioaccumulate and were present in the Baltic food chain. By the late 1970s some governments had accepted that there was a greater risk of harm and enacted legislation to stop new usages of PCBs.

#### False Positive: the Saccharin case

A false positive case study is defined as a case where action was taken on the basis of the precautionary principle, where posteriorly the harmless consequences were scientifically demonstrated. In the late 1970s in The United States of America it became a requirement to label all products containing Saccharin. This was because it was found that Saccharin caused bladder cancer in two-generation rat studies. In 1991, a scientific research was developed to identify the mechanisms that made that Saccharin caused bladder cancer in rats.

Later WHO's International Agency for Research on Cancer (IARC) and the National Toxicology Program revised their classification of Saccharin and provided evidence on the non-relevance or harm of this mechanism on humans. In 2000, as a consequence of this scientific evidence, President Clinton decided to change the labelling requirements in the

United States. In this case labelling requirements and restrictions were unnecessary; therefore this is a clear example of a false positive, where preventive action was taken needlessly.

### Transdisciplinarity and the Precautionary Principle

A large portion of academic research on environmental hazards has focused on the in depth study of environmental hazards caused by specific chemicals, systemic insecticides, and their impact on human beings, the ecosystem and the environmental degradation.

However the study of environmental hazards faces a number of challenges because these are difficult to predict. Research on environmental hazards needs to consider a greater integration of knowledge from different disciplines, as these can provide new information and approaches to identify and predict possible environmental hazards. For this reason research into environmental hazards and sustainability issues requires dialogue, integration and collaboration between disciplines. Knowledge integration, co-creation and innovation, and the understanding of the complexity of systems are needed to identify and predict possible environmental hazards, as well as its associated social and human hazards. For this reason transdisciplinary research plays a critical role in order to provide a more comprehensive, integrative and evidence-based framework. This must consider societal needs, engaging the different stakeholder and the community in a participatory process.

## CONCLUSIONS

As it has been outlined in this chapter different definitions and understanding of sustainability exist. However this can be seen as one the main weaknesses residing within the term, its flexibility can also be seen as an opportunity to create critical reflection, collaborative and innovative processes that include different academic disciplines and stakeholders.

Sustainability science has emerged as new academic discipline, which brings the different disciplines, such as sociology, economics, environmental sciences, engineering and history together to create new ways and practical solutions to the sustainability challenge. In this context, it is plausible the need to move from disciplinary thinking to other forms of knowledge generation and research that favour problem-solving, action-orientation and holism. In this context transdisciplinary approaches emerge as critical to the progress and development of new academic field of sustainability science.

Transdisciplinarity as a research approach spans across disciplinary boundaries to develop a holistic approach. The aim is to avoid the fragmentation produced by disciplinarity through focusing on solving problems that require of a multiple discipline approach. Transdisciplinarity research is a fundamental methodological approach for sustainability science and practice. It allows establishing a dialogue and collaboration between disciplines,

where mutual and transformative learning can be fostered, which can in turn provide innovative solutions to current sustainability challenges that society is facing.

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## FURTHER/SUGGESTED MATERIAL

- Sustainability Summit. Sustainability: Enabling a Transdisciplinary Approach. Leuphana University, Lüneburg (29/02/12 -02/03/12)  
<http://www.leuphana.de/ueber-uns/organisation/fakultaet-nachhaltigkeit/aktuell/leuphana-sustainability-summit.html>
- First Global Conference on Research Integration and Implementation: Linking networks, taking stock, planning for the future, Canberra, Australia (08/09/14-11/09/14). <http://www.i2sconference.org>
- Book: Zander, J., 2010, *The application of the precautionary principle in practice*. Cambridge University Press. Cambridge
- Video: The Precautionary principle <http://vimeo.com/23736841>
- Video: What is the Precautionary Principle, and is it Good or Bad? <http://www.youtube.com/watch?v=3RC7EGDtOYM>
- Report: Late lessons from early warnings: the precautionary principle 1896–2000  
[http://www.eea.europa.eu/publications/environmental\\_issue\\_report\\_2001\\_22](http://www.eea.europa.eu/publications/environmental_issue_report_2001_22)
- Report: Late lessons from early warnings: science, precaution, innovation  
<http://www.eea.europa.eu/publications/late-lessons-2>
- Article: Weckert, J. 2010. In defence of the precautionary principle. IEEE International Symposium on Technology and Society  
<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5514653>
- Journal: Sustainability Science  
<http://www.springer.com/environment/environmental+management/journal/1162>

5



PHOTO: Men producing local liquor based on sugar cane in Chome, Same District, Tanzania. J. Pascual-Ferrer.

CHAPTER

2

Linking  
knowledge  
with action

# 2

## CHAPTER 2. Linking knowledge with action

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# 2 LINKING KNOWLEDGE WITH ACTION

**Massimo Zortea**, Università di Trento

## EXECUTIVE SUMMARY

In this session, we will introduce the issue of linking theoretical sphere with practical sphere while dealing with SHD related decision-making processes. As described in chapter 1, SHD problems are characterized by complexity and uncertainty. They require well-organized participatory processes in which scientific knowledge is complemented with the involvement of actors from outside academia. Although science and technology are undoubtedly acknowledged as central to addressing sustainability challenges, in many fields scientific and technical knowledge remains at a theoretical level.

There's an urgent need to move from traditional and orthodox understanding to a kind of creative knowledge able to manage in adaptive ways solutions diversified for each context. Linking knowledge with action passes through awareness of factors driving or hindering the SHD, the thorough choice of most appropriate methodology for each specific context and the fair mix of technical and human capabilities.

## LEARNING OUTCOMES

After you actively engage in the learning experiences in this module, you should be able to:

- The existing gap between knowledge and decision making/implementation of decisions.
- Different methodological approaches in problem framing/analysis for sustainable solutions.
- A method to build analytical frameworks which include different perspectives in order to evaluate contexts and to deal with their specific problems.
- The value of a fair combination of technical and human capabilities.

## KEY CONCEPTS

These concepts will help you better understand the content in this session:

- Problem framing/analysis
- Scenario analysis
- Fore/backcasting
- Multicriteria assessment
- Transition management
- Technical and human qualities

## GUIDING QUESTIONS

Develop your answers to the following guiding questions while completing the readings and working through the session:

- Which are the factors that favour and the factors that hinder the passage from abstract knowledge to concrete action (application of knowledge)?
- How can we finalize knowledge and its application to SHD?
- What are the most known methodologies for a good decision-making in SHD practice?
- Which are the individual qualities to be developed in the student to connect the knowledge with the action?

## INTRODUCTION

Scientific and technological knowledge form an essential part of policies aimed at promoting sustainable human development (SHD) and fighting poverty. Using scientific and technical knowledge, we have been able to achieve successes unimaginable just few decades ago in fields such as health, telecommunication, education and vocational training, human rights, fights against corruption, etc. Decision-makers in development have become more and more aware that science and technology represent not only an outcome of development but also a primary tool for achieving it (UNPD 2001, p.27).

The most prominent issue when engaging scientific and technical knowledge in SHD decision-making processes is the translation of theoretical opportunities identified by scientific and technological knowledge into concrete results in specific contexts.

At the end of the last century with the launch of MDGs in 2000 a global challenge was issued by development practitioners in science and technology: to make scientific and technical knowledge accessible for all people and individuals scientific and technological knowledge in order to guarantee to everybody all around the world development or at least an opportunity for development. This ambitious goal means making applicable tools for development available in different contexts at different times.

Such planetary challenges reveal in dramatic fashion the limits of scientific and technological progress. Within these we can distinguish:

- A certain dogmatism, i.e. theoretical and applicative rigidity.
- A latent ethnocentrism with a typically western footprint.
- The un-preparedness to address complexity within disciplines but also culturally and institutionally.
- Characterizing developmental approaches in very contexts under the same geographic, geopolitical and anthropological profiles.
- The un-suitableness (in terms of sustainability) of scientific and technological innovations in contexts not predisposed to them, even considering the often ignored asymmetry of power and knowledge between innovative agents and targets of innovation.
- A substantial lack of capability to valorize the local context because of a lack of suitable methodologies for applying innovations which ensure the participation and involvement of all relevant stakeholders in decision-making and implementation processes.

Linking the theoretical sphere (knowledge) with practical sphere (action) means *in primis* to deal with and to overcome these limits.

## LINKING KNOWLEDGE WITH ACTION

On the basis of thoughts expressed in the introduction, it seems important to first of all deepen the general meaning and implication the passage from theoretical knowledge to concrete action, i.e. the application of theoretical knowledge in specific and real contexts and situations. It must be specified now that this overview is focused on how to apply scientific and technological knowledge in processes aimed at promoting SHD.

A first clarification necessary is regarding what the logical and chronological **procedural steps** through which it possible to realize in concrete way the application of scientific and technical knowledge to ensure transformation resulting in SHD. Substantially, these steps are:

- Analyzing the starting point (analysis of problems and of causal chain).
- Fixing an arrival point (i.e. envisaging a new context and/or a situation in which one or more problems from a) will be solved, with a consequent concrete SHD improvement).
- Planning the transition between point of departure and of arrival (establishing goals and results; choosing the tools to be utilized; describing the methods for using those tools, the subjects implementing those actions, timing, costs etc.);
- Implementing the project.
- Evaluating the project once put in action.

Points a) and b) require the key skills of **problem analysis** and **problem solving**. The former can be defined as the settlement, disassembly and reassembly according a rational order of the tangle of situations and factors of which a problematic context consists. The latter is theoretical-practical construction in which, from a rational analysis of problems and causal factors determining them, an intervention is realized aimed at progressively eliminate problems starting from their remote causes: all problematic knots are solved step by step, leveraging on the mechanism of causal relationships linking each knot to its successor.

For a correct execution of problem analysis a suitable awareness of the factors favoring and hindering the passage from theoretical knowledge to its practical application must be acquired (see Table 1 for an example).

Table 1 Factors favouring/hindering SHD

**Table 1** Factors favouring/hindering SHD

	policy	legal standard	project/ programme	business plan
a) geographical/geomorphologic/climatic contexts;	H	M	H	H
b) institutional contexts (legislation, authorities, splitting up of competences);	H	H	M	M
c) cultural / social contexts;	H	M	H	H
d) specific subjects interested and /or involved (actors, stakeholders, passive subjects etc.).	L	L	M	H

L = low influence M= medium influence H= high influence

Moreover it must not be forgotten that definitions of **development** and establishing the ultimate goal of international cooperation are still discussed and debated issues. This lack of a universal definition is problematic even in the evaluation of projects ostensibly considered 'successful', in that it is rare for an expressed positive project outcome not to be given a negative rating by other analysts, simply on the basis of offering different definitions of what is development<sup>1</sup>.

It is by now well-described how the sustainability of development interventions depends on a multitude of factors, including economic, social, environmental and technical issues. However, it is rare for studies and reports on this topic to provide the reader with a global vision of development problems. This difficulty with presenting a comprehensive vision and approach is still found in large part of international cooperation projects

An important distinction exists and must be kept in mind, between promoting development and planning it. In other words, a gap exists between initiatives triggering or promoting development processes, especially in the long term, and initiatives that, although moved by similar aspiration, end up by delivering results that are remote from reality.

Given the difficulties above to be overcome for guaranteeing a substantial effectiveness and positive outcome in terms of sustainable development, one of the most serious risks that a project runs is cultural unilateralism and abstract planning: i.e. **the risk** of applying dogmatic and standardized methods of interpretation, processes and indicators for monitoring and evaluation, not commensurate to the specific context of intervention, to the actors, to the local social, economic, political and anthropological conditions. The logic of development – as multi-dimensional process, open and subject to many factors and pressures– suggests

<sup>1</sup> For more on this topic see Barbier, 2013, pp. 35-53.

instead a diversified, flexible, adaptive approach, receptive of all solicitations coming from stakeholders.

Unfortunately, normal project approaches suffer a rigidity that often predicts their failure, from the point of view of both methodology and content. Such rigidity manifests itself in various forms: it is procedural, as the project is built within a precise spatial and temporal perimeter, with a rather defined sequentiality of actions and expected results; but it is also of content, since general and specific objectives as well as the instrumental actions to achieve them and the results in which such actions aim at concretize must be defined as early as possible in the process.

On the contrary, a more effective attitude to development is generally characterized by the following features:

- Driven by the recipient community or the country.
- Rooted in a vision of long-term development, even past the duration of the project cycle.
- Defined through a participatory process, involving civil society, business sectors, political actors etc. in an open debate.
- Based on solid analyses about the context of intervention, with data acquired by reliable and diversified sources.
- Committed to achieve long-lasting positive impacts for disadvantaged and marginalized groups, especially the poorest; comprehensive and integrated, adding and harmonizing economic, social and environmental goals.

Accordingly an effective and authentic development practice would consist of the following:

- A desire to build processes coherent and respectful of existing strategies and processes.
- Connection of the national levels with the local, with detailed planning, implementation and monitoring at the decentralized level.
- Set some realistic and monitorable targets, connected with clear priorities in budgets
- Define roles, responsibility and relationships of all key participants relevant to the intervention.
- Identify priority demands in the development of capacity or ability
- Build progresses through a monitoring and a continuous improvement scheme taking as its starting point the results of the activities already realized.
- Developing mechanisms and indicators for as objective an evaluation as possible.

Therefore the execution of development processes through the project format can be regarded a real art - not improvisable, but still corresponding to a precise mentality.

In the previous context, a project mentality means *in primis* a propensity to change, to **transformation (transition)**: to accept and to be ready to enact change, on our own habits, in all times and places (Matthies 2013, p.93). This propensity cannot be taken for granted, least of all in all the stakeholders involved in the project. Secondly, a project mentality means an inclination to face with situations proactively rather than to passively suffer them, sometimes without even perceiving them in their entirety. There is a cyclical interaction among the three key aspects of project approach (analysing, planning, realizing): the dynamism that is typical of project mentality also implies a full awareness of these key aspects and the constant attitude to maintain an equilibrium among them.

Thus it can be said that a project intervention is characterized, or should be characterized, by these **distinctive elements**:

- An objective of transformation, understood as transition: a programmed passage by an actual situation (social, economic, environmental, technological etc.) to another future, ameliorative, that represents the final destination of the project.
- A sequential chain of actions, functional to this transition (i.e. the so-called transition management).
- A time scheduling, that is fixing a precise temporal span within which the transformative process takes place.
- A planned employment of determined resources (human, financial, physis, informative, etc.).
- The causal conceptualization of development - a schematic laying out of development processes in a cause-effect dynamics.

The project instrument and approach show evident **strengths** and **weaknesses**. The strengths of the project mentality approach to development are:

- A structured predetermination of objectives, actions and means.
- A concentration on a punctual context, through initiatives and employment of precise and pre-set means.
- A containment of risk in case of failure.
- A better manageability in consideration of the usually more reduced dimensional scale.

The weaknesses of the approach include:

- An economic limit, tied up to the pre-fixed project budget.
- A temporal rigidity, tied up to the project chronogram and to the cycles of implementation and reporting-accounting usually imposed by donors or partners.
- A rigidity correlated to cultural and technical premises, i.e. the fact that project mentality and approach are part of a culture and a know-how important to the promoter but rarely full-shared by the recipients (so-called donor-controlled project approach).

As already stressed in precedence, a propaedeutic condition to any project is the suitable knowledge of **intervention context**. It's an important aspect when dictating the success of the project and it asks in turn for a non-improvised planning and methodicalness. Often, in fact, the application of the wrong methods to achieve a suitable knowledge of the context can produce many wrong and misleading representations on which to act, and results primarily in the failure of the initiative. Rarely is the preparatory work of knowledge of the context included at all, diminishing the intervention to a mere answer a bare list of needs.

When we are about to undertake one or more project initiatives in a determined context it is advisable - both as act of responsibility towards the beneficiaries and as predictive factor of success - to develop a real understanding of the context. We suggest three different phases:

- Determination of the method using which a picture of the context will be built up, shared with all the stakeholders.
- Systematic acquisition of the data and elements of the context.
- A practical construction of the contextual framework, both at national and local level.

These last considerations bring us to the **factors** that favour and/or hinder the passage from theoretical knowledge to their practical application. In the present chapter it's impossible to illustrate such factors in detail, thus we confine ourselves to a simple enumeration:

- Geographical/geomorphologic/climatic contexts.
- Institutional contexts (legislation, authorities, splitting up of competences);
- Cultural / social contexts.
- Specific subjects interested and /or involved (actors, stakeholders, passive subjects etc.)

It's useful here to describe the concept of **technological and institutional lock-in**, i.e. inertia in the process of innovation because of the convergence of technological and

institutional factors (Foxon, 2002), where we can define the concept of institution as any form of constraint that human beings devise to shape human interaction. These include formal constraints, such as legislation, economic rules and contracts, and informal constraints, such as social conventions and codes of behavior.

It is necessary to keep in mind that in all processes of technological change the development of technology both influences and is influenced by the social, economic and cultural setting surrounding that process. Moreover the successful innovation and the consequent take up of a new technology, depends on the path of its development - so-called 'path dependency' – and is influenced by factors such as the particular characteristics of initial markets, the institutional and regulatory factors governing its introduction and the expectations of consumers.

It's necessary to take in account the extent to which such factors favour incumbent technologies instead of new ones. Increasing returns from adoption of a technology (e.g. scale economies, learning effects, adaptive expectations and network economies) foster the lock-in of incumbent technologies, preventing the take up of potentially superior alternatives. Given that all the features identified as creating increasing returns for technologies can also be applied to institutions, it's clear that institutions, especially political, have a similar tendency for increasing returns. The extent to which this lock-in is manifest depends on several factors, such as the importance of collective action, the density of institutions in a particular environment; the possibilities for using political authority to enhance asymmetries of power and the complexity and opacity of politics. As modern technological systems are deeply embedded in institutional structures, all these factors leading to institutional lock-in can interact with and reinforce the drivers of technological lock-in<sup>2</sup>.

With the awareness of the difficulties and risks involved in the passage from theoretical knowledge to practical application, we can trace a general methodological process on how to finalize theoretical knowledge and its practical application to SHD processes. It's helpful in this sense to remember the methodological principles of Goal Oriented Project Planning (GOPP) and of the related Logical Framework Approach (LFA). In extreme synthesis, realizing a SHD process through new technologies or scientific knowledge according to the method GOPP implicates an aware and well-programmed effort of critical formulation, suitable to the external contexts and factors in which abstract scientific and technological knowledge must be applied. It's a question of concretely adapting, also with specific shrewdness, mutable in the time and in the space, contents, modalities and timing of

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<sup>2</sup> See Hale, Held and Young 2013, who use the term of "gridlock" to refer to global cooperation and to the mechanisms that lock-in the evolution of international relationships; they associate gridlock with what they call "self-reinforcing interdependence.

technologies or knowledge possessed in order to finalizing knowledge to action and action to SHD.

There are at least three **logical and procedural passages** of any applicative intervention:

- Focusing the objectives of technical transition in the intervention (which transition, in scientific-technological terms?).
- Addressing such objectives to the attainment of specific SHD objectives (which transition, in terms of SHD, i.e. which concrete results of SHD?).
- Turning the theoretical action (project sequence-procedure) into concrete action (contextualized and historicized procedure) action.

It must be taken in account that any SHD process implicates a transformation of the context, a transition from one state to another and that this transition, in the majority of the cases, derives from a precise decision-making process and not from casual circumstances. This also because a lasting transition of SHD, to be such, must involve one or more macro-systems (for instance agriculture, transports, energy, infrastructures, commerce, communication, health, education, etc.).

Therefore, if at the base of the transition there's a decision-making process, it is also important to plan such process in the best way, using precise methods. In the present chapter we offer a brief review of these methods, postponing to the bibliography and further/suggested materials an in-depth analysis of these.

A general statement: a universally valid method doesn't exist, as the context dictates how specific issues might be approached. More generally, it must be stated that that the success of a SHD decision-making process and of its subsequent implementation – even when scientific and technological applications are involved (e.g. renewable sources of energy) – requires the respect of some unmissable requisites, such as:

- The attitude to overcome the disciplinary dogmatism of problems characterized by complexity and multiplicity.
- The careful perception of the uncertainty and intrinsic complexity of the problems of sustainable development, particularly because of the presence of elevated asymmetries in the relationships of power and in knowledge.
- The active promotion of practices that are participatory and trans-disciplinary, respectful of diversities both of knowledge content and of method to acquire it (e.g. traditional knowledge vs. scientific knowledge, a well-known dualism in matter of biodiversity for development).
- The deep connection with the local context recipient of the application (both in sense of relevance to the problems and real demands of local communities and

of adequacy to the spatial, temporal, institutional, social etc. peculiarities of that context).

- The active involvement in the decision-making process, through a receptive dialogue with all the stakeholders implicated in the intervention.

The four methodologies presented are useful to programming/planning (analysis-ideation-evaluation), while the fifth serves above all to the subsequent implementation/realization, as shown in Table 2.

Table 2 Comparison of methodologies

**Table 2** Comparison of methodologies

	policy	legal standard	project/programme	business plan	objective	subjective
CBA	x	x	x	x	x	
Scenario Analysis	x	x		x		x
Forecasting	x	x		x	x	
Backcasting	x		x	x		x
MCA	x	x	x	x	x	
Transition Management	x		x	x	x	x

### Cost-benefit analysis (CBA)

This is generally defined as a systematic process for calculating and comparing benefits and costs of a project, decision or public policy by comparing the total expected cost of each option against total expected benefits. Usually a CBA has two purposes: to determine whether it is a sound investment/decision (justification/feasibility) or to provide a basis for comparing projects. CBA helps predict whether the benefits of a policy outweigh its costs, and by how much relative to other alternatives. Of course, perfect evaluation of all present and future costs and benefits in terms of economic efficiency and social welfare are not guaranteed. Applied to a single project, CBA attempts to measure the positive or negative consequences of a project, which may include:

- Direct effects on its beneficiaries or participants.
- Direct effects on non-users or non-participants.
- Indirect effects or externalities.

Costs and benefits are put on a common temporal footing using ‘time value of money’ calculations. The value of a cost–benefit analysis depends on the accuracy of the individual cost and benefit estimates. Risk associated with project outcomes is normally handled using probability theory.

This methodology, however, has some limits on reliability, since the exact forecast of the benefits in middle and long-time ranges is often prevented by the limits of scientific knowledge at the time of analysis. This is particularly evident, for instance, in matter of environmental and occupational health regulation: it has been argued that if modern cost–benefit analyses had been applied to decisions such as whether to mandate the removal of lead from gasoline, build the Hoover Dam in the Grand Canyon or regulate workers' exposure to vinyl chloride, these measures would not have been implemented even though they are considered to be highly successful in retrospect.

### Scenario Analysis

This is a strategic process in shape of a “what-if” analysis for studying decisions and their effects by considering alternative possible outcomes, sometimes called “alternative worlds”. Its purpose is not to identify the exact conditions of each scenario; it just needs to approximate them to provide a plausible idea of what might happen: thus, it’s not a predictive mechanism, but rather an analytic tool to manage actual uncertainty. It does not rely on historical data and does not presume past observations to be still valid in the future; instead, it tries to consider possible developments and turning points, taking in account the connections to the past.

More precisely, there could be three different perspectives from which to make the analysis:

- First decision then possible scenarios as effects from it.
- First possible scenarios then the consequent decisions to be taken.
- First decisions then the possible events that affect or influence, but do not cause, the outcomes of it.

This methodology is mainly applied with the first perspective.

Scenario analysis constitutes an important tool for decision making in the world of finance and economics, both at the macro or the micro level. It is used extensively in the financial world for forecasting and analysing possible future events. Scenario analysis has emerged as a tool for strategic planning once the future was perceived as surrounded by a high degree of uncertainty and complexity (Nguyen and Dunn, 2009).

Scenario analysis techniques characteristically synthesize quantitative and qualitative information, constructing multiple scenarios or alternative portraits of the future. Mathematics and statistics play a crucial role in such analyses. Usually scenario analysis considers three different scenarios: base case, worst case and best case. The base case is the expected scenario, i.e. what the expected outcome will be if all things will proceed normally. The worst and best cases are scenarios with minimum and maximum favourable conditions, but still

confined within the concept of plausibility. These three levels typically allow for a reasonable spread of results and insights, but it is also possible to define other levels or types of scenarios; however, the number of scenarios should not be excessive (Maack, 2000).

This methodology is similar to sensitivity analysis and to simulation analysis: it's more complex than sensitivity analysis because in scenario analysis all inputs are changed towards one extreme while in sensitivity analysis only one input is changed while keeping the other constant, in order to study the reaction to that input's variation; it's less complex than simulation analysis because it considers only the two extreme and one base case scenarios.

### Forecasting and Backcasting

Forecasting is the process of making statements about events whose actual outcomes typically have not yet been observed. Backcasting is a method in which the future desired conditions are envisioned and steps are then defined to attain those conditions, rather than taking steps that are merely a continuation of present methods extrapolated into the future.

An example of Forecasting may be estimation of some variable at some specified future date. Forecasting is similar to prediction, but more specific: both might refer to formal statistical methods employing time series, cross-sectional or longitudinal data, or alternatively to less formal evaluative methods<sup>3</sup>. The choice between these two methodologies can differ according to areas of application: for example, in hydrology, the terms "Forecast" and "Forecasting" are sometimes reserved for estimates of values at certain specific future times, while the term "Prediction" is used for more general estimates, such as the number of times floods will occur over a long period.

Backcasting starts with defining a desirable future and then works backwards to identify policies and programs that will connect the future to the present. The basic question of Backcasting is: "If we want to attain a certain goal, what actions must be taken to get there?". Backcasting is increasingly used in urban planning and water and energy resource management. A very interesting case study is offered by Herrmann (2011), who presents an approach for the deduction of long-term strategies for corporations in the energy sector. His methodology, also applicable in other sectors, provides essential input for the solution of the problem of man-made climate change. Unsustainable development trends like anthropogenic climate change introduce a strong need for restructuring the energy sector, but energy corporations face substantial problems while adjusting to these fundamental changes. Therefore an alternative approach is necessary to incorporate the need for sustainable development into business strategy: Strategic Backcasting can be that.

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<sup>3</sup> Several examples can be found in Randers, 2012.

## Multicriteria Assessment (MCA)

This is a way of evaluating and comparing options on the basis of a number of different criteria or objectives. The ways to do this can vary, and there is no single, established procedure for MCA, so it is better seen as an approach, underpinned by a set of general principles, than as a specific methodology. Multi-criteria analysis is undertaken to make a comparative assessment between projects or heterogeneous measures and it can be applied at all levels of decision-making, from the consideration of project alternatives to broad-reaching policy decisions guiding a transition towards sustainability and the green economy. It's particularly useful as a tool for sustainability assessment where a complex and inter-connected range of environmental, social and economic issues must be taken into consideration and where objectives are often competing, making trade-offs unavoidable. Complexity can arise because of the number of options, difficulty of comparing options, need to integrate social, economic & environmental considerations, competing values, data uncertainty, etc. In the evaluation field, MCA is usually an *ex ante* evaluation tool, and is particularly used for the examination of the intervention's strategic choices. In *ex post* evaluations, multi-criteria analysis can contribute to the evaluation of a programme or a policy through the appraisal of its impacts with regards to several criteria.

Generally MCA is conceived as a three stage process:

- Defining a set of criteria, reflecting the objectives to be achieved.
- Scoring different strategies or options according to each criterion.
- Aggregating the scores for each criterion and providing an overall assessment of each option.

Some typical characteristics make good MCA criteria: they have to be complete, operational, decomposable, non-redundant, and minimal. By using MCA, participants don't have to agree on the relative importance of the criteria or on the rankings of the alternatives: each one enters his/her own judgment, and makes an identifiable contribution to a jointly reached conclusion.

MCA has a number of strengths:

- It's highly flexible, enabling both quantitative and non-quantitative measures to be combined.
- It helps to ensure that the procedure reflects the preferences and interests of all actors concerned, since weights are defined by the stakeholders themselves.
- It helps stakeholders understand the aggregation process, and is thus likely to engender greater trust in its results.
- It allows different points of view to be dealt with explicitly.

- It doesn't require assignment of a monetary value to all quantities.

At the same time, it reveals several weaknesses:

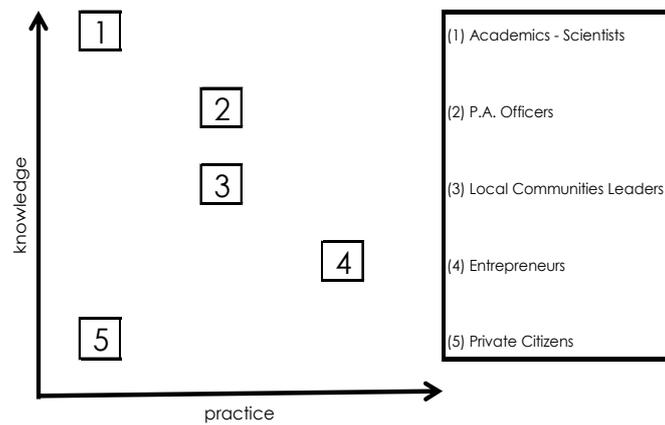
- Its success depends on how effective the process of stakeholder engagement is and biases in this process are likely to feed through into the results
- Localisation of stakeholders may also mean that the weights applied may differ greatly from those used in other situations, making comparison difficult
- Reproducibility of the results may also be low, both between different stakeholder groups and between the same stakeholders at different times
- MCA does not overcome fundamental problems associated with comparing entities that someone could believe not comparable
- Evaluation methods available vary without any clear indication that one is better than another
- Since many of the methods are complex and remain obscure to decision-makers, they can lead to mistrust or excessive faith in the results<sup>4</sup>.

### Transition Management

This is an alternative model of governance, especially in environmental matters, which seeks to guide a gradual, long-term process for transformation of socio-political landscapes, or socio-technical practices from one equilibrium to another. For example, consider the transition management approach addressing the complex issue of sustainable development. Sustainable development in itself is a dynamic, multi-dimensional, multi-actor and multi-level problem, in a constant state of flow. The current global political system is insufficiently equipped to deal with such complexity and even incremental measures will not address the fundamental system failures underpinned without an approach really alternative to traditional politics (see Vazquez-Brust and Sarkis 2012).

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<sup>4</sup> For an example of the application of MCA to Sustainable Forest Management, see Mendoza and Macoun 1999.



**Figure 2** Different proportions of knowledge/practice in actors

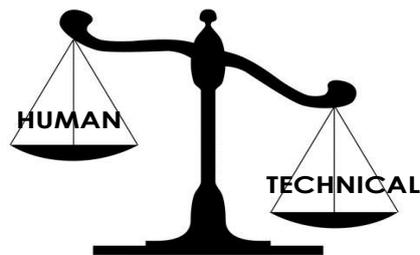
*Figure 2* Different proportions of knowledge/practice in actors

Transition Management steers development in a more sustainable direction to lessen inherent uncertainty (Davies 2012, p.11), produce desirable social achievements and enhance resilience during the transformation of socio-technical systems. It's oriented to enable, facilitate and guide the social, technical and political transformations required by embedded societal systems to bring about sustainability. This challenge needs to be addressed on multiple levels and dimensions. Therefore, transition management attempts to widen participation by encouraging bottom-up approaches, supported in a top-down manner. Unlike traditional forms of regulation that use command and control techniques, transition management does not seek to control the uncertainties of change but steer, indirectly influence and redirect the choices of actors towards sustainability. This is primarily achieved by engaging a wide range of stakeholders over the multiple levels to create shared visions and goals which are then tested through the experimentation, learning and adaptation at the niche level.

Transition management must work within three separate levels:

- Regime (the Meso level) refers to the dominant practices, rules and technologies that provide stability and reinforcement to the prevailing socio-technical systems
- Niche (Micro) is the level at which the space is provided for radical innovation and experimentation. This level is less subject to market and regulation influences and can facilitate the interactions between actors that support product innovation.
- Landscape (Macro) refers to the overall socio-technical setting that encompasses both the intangible aspects of social values, political beliefs and world views and the tangible facets of the built environment including institutions and the functions of the marketplace such as prices, costs, trade patterns and incomes.

Each level has its own set of actors that interact in different ways, including; among them: Government, market-based actors, and civil society. There are different types of transition management strategies which they can be summarized in: strategic, tactical and operational. A further activity can be considered: establishing the process of assessment and evaluation of societal change. Each activity has its own actors, agendas and strategies which co-evolve (O’Riordan and Voisey, 1998).



**Figure 1** Balancing human and technical qualities

*Figure 2* Balancing human and technical qualities

After that brief view, we hope that the necessity of developing in our students a **twofold order of qualities and skills** appears more evident, in order to make them to acquire the capacity of linking theoretical knowledge and practical action: **scientific and technical skills**, involving both abstract and concrete and sunk in precise contexts aspects (e.g. variation of determined technical parameters according to latitudes, seasons, geomorphology etc.); and, just as relevant, **human and relational skills**, i.e. the capacity of understanding and respecting different cultures, sensitivities, experiences, points of view, rhythms and life styles, adapting and confronting our own and transforming the meeting of two cultures from obstacle to opportunity.

It results, at this point, that such a double process of learning and maturation needs to be characterized by a meaningful presence of didactic experiences out of classrooms and laboratories, integrating practical experience in theoretical teaching. The case of International Cooperation, with the experiences on the field that countersign it, represents a very effective example of such an experience.

Such experiences however have to be characterized by a gradualness in duration, intensity, commitment, level of knowledge and responsibility submitted to the student, etc, and must be supported by a proactive accompaniment of the teacher or the tutor in the preparatory phase, in carrying out phase and finally in the evaluation phase, that serves to consolidate what has been technically and personally acquired.

We confine ourselves here to list the most meaningful of those experiences, in ascending order of commitment and complexity:

- Exercises with case studies and games of role; b) stages/internship yet during the official curriculum
- Degree theses or doctoral researches on the field
- Stages/internship after the conclusion of the official curriculum
- Management of projects for didactic purposes
- Management of projects in convention with specific project partners.

## CONCLUSIONS

At the end of this chapter, we can summarize as follows the achievements to be reached after committing to the linkage of knowledge with action:

- Helping all students understand the complexity of SHD oriented decision-making processes.
- Opening their minds to multifaceted and multilevel factors that favour or hinder SHD processes through the passage from the abstract knowledge to the concrete action.
- Developing a vision able to subdue individual knowledge and capabilities to the global and local effort of SHD.
- Raising their awareness that SHD decision-making and implementation processes require a set of methodologies well applied and diversified according to each specific context, in order to translate in reality theoretical schemes and concepts, even if scientifically based.
- Guiding them to discover how a careful combination of scientific and traditional knowledge is recommendable for this purpose.
- Enhancing in each student's academic "walk" the attention and growth both of technical and human qualities, as effective tools for taking care SHD processes.

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## FURTHER/SUGGESTED MATERIAL

### PowerPoint Presentations

- Society for Sustainability and Environmental Engineering – Engineers Australia, *A tool for sustainability assessment: Multi-criteria analysis*, PowerPoint Presentation, available at [www.engineersaustralia.org.au/sites/default/files/sess\\_8\\_mca\\_2013.pdf](http://www.engineersaustralia.org.au/sites/default/files/sess_8_mca_2013.pdf)
- Gritsyuk et alii, IATE Obninsk, *Multicriteria Decision Analysis with the use of DECERNS DSS*, available at [http://mcdmsociety.org/conference2011/pdf/1295res\\_1307636576.pdf](http://mcdmsociety.org/conference2011/pdf/1295res_1307636576.pdf)

### PDF materials

- European Commission - EuropeAid, *Multi-criteria Analysis*, working paper, available at [http://ec.europa.eu/europeaid/evaluation/methodology/examples/too\\_cri\\_res\\_en.pdf](http://ec.europa.eu/europeaid/evaluation/methodology/examples/too_cri_res_en.pdf)

### Websites

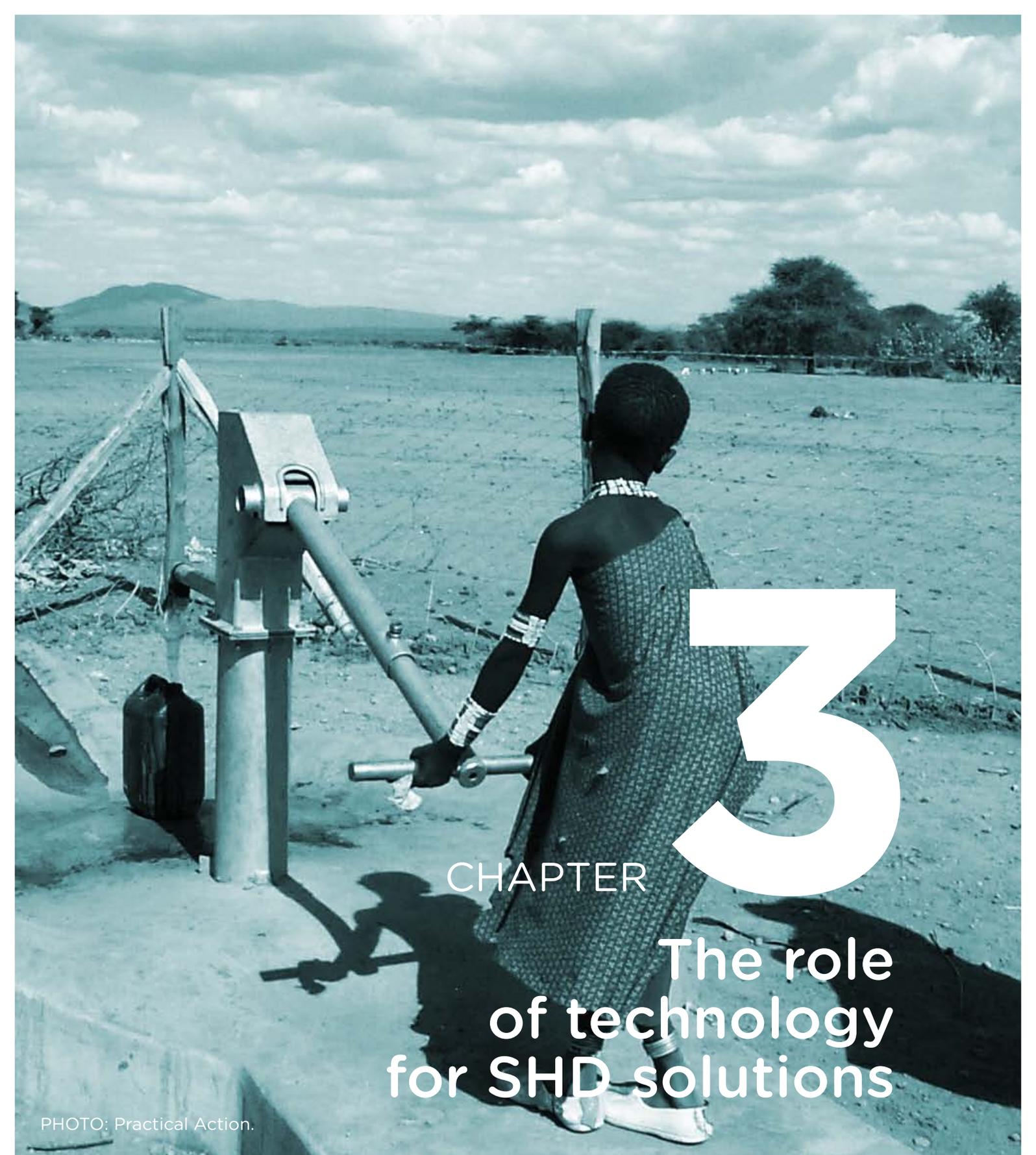
- Mindtools, *Deciding, Quantitatively, Whether to go Ahead (Also known as Benefit-Cost Analysis)*, available at [www.mindtools.com/pages/article/newTED\\_08.htm](http://www.mindtools.com/pages/article/newTED_08.htm)
- Hadley J., Decision Analytics Blog by Lumina, *Estimating Risk: the importance of Scenario Analysis*, available at <http://decision-analytics-blog.lumina.com/risk-assessment/estimating-risk-the-importance-of-scenario-analysis/#sthash.T65LEz1c.dpuf>

### Videos

- On Cost-Benefit Analysis CBA: [www.youtube.com/watch?v=3LeV98kPKFk](http://www.youtube.com/watch?v=3LeV98kPKFk)
- On Scenario Analysis: [www.youtube.com/watch?v=kz1PSPfIEjs](http://www.youtube.com/watch?v=kz1PSPfIEjs)
- On Scenario Analysis: [www.youtube.com/watch?v=0pOhD-JjPh8&index=2&list=PLrR\\_PvpgDmw0l5nCNj0fEjGVQgS5rTORiN](http://www.youtube.com/watch?v=0pOhD-JjPh8&index=2&list=PLrR_PvpgDmw0l5nCNj0fEjGVQgS5rTORiN)
- On Forecasting: [www.climate.gov/news-features/videos/climate-forecasts-improve-humanitarian-decision-making-west-africa](http://www.climate.gov/news-features/videos/climate-forecasts-improve-humanitarian-decision-making-west-africa)
- On Backcasting: <http://upcommons.upc.edu/video/handle/2099.2/3163>
- On MCA: [www.youtube.com/watch?v=ydpjkkOvP5M](http://www.youtube.com/watch?v=ydpjkkOvP5M)
- On Transition Management: [www.youtube.com/watch?v=FHF0e11OgBw](http://www.youtube.com/watch?v=FHF0e11OgBw)
- On Transition Management: [www.youtube.com/watch?v=UHHL7xvko5l](http://www.youtube.com/watch?v=UHHL7xvko5l)

## Courses

- 14) IAIA10 Training Course #3, *Multi-Criteria Analysis (MCA): A Tool for Sustainability Assessment*, managed by trainers J. Pope and D. Annandale, available at [www.iaia.org/iaia10/documents/pdfs/3%20MultiCriteria%20Analysis.pdf?AspxAutoDetectCookieSupport=1](http://www.iaia.org/iaia10/documents/pdfs/3%20MultiCriteria%20Analysis.pdf?AspxAutoDetectCookieSupport=1)



# 3

CHAPTER

## The role of technology for SHD solutions

PHOTO: Practical Action.

# 3

## CHAPTER 3. The role of technology for SHD solutions

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# 3

## THE ROLE OF TECHNOLOGY FOR SHD SOLUTIONS

**Dr. Mike Clifford**, University of Nottingham

### EXECUTIVE SUMMARY

The role of technology in facilitating Sustainable Human Development (SHD) is considered. Historically, technology has enabled considerable advances in material science, power generation, transport and communication, but progress has often been at the expense of the environment and has exacerbated serious social problem.

The prospects for the future are mixed; will technology continue to be used irresponsibly for the benefit of the few, or will appropriate technologies improve the lives and conditions of those with the greatest physical needs?

## LEARNING OUTCOMES

After you actively engage in the learning experiences in this module, you should be able to:

- Recognize and explain the essential elements of the historical role of technology in facilitating SHD.
- Describe the physiological needs that technology can address.
- Describe possible roles that appropriate technologies can play in SHD.

## KEY CONCEPTS

These topics will help you better understand the content in this session.

- Environmental technologies.
- Technologies for SHD, appropriate technologies.
- Emerging technologies and their applications in SHD.
- Understanding of the internal structures of technologies and the social context in which these details come to have particular meanings.

## GUIDING QUESTIONS

Develop your answers to the following guiding questions while completing the readings and working through the session.

- Is technology a force for good?
- Can technology improve the living conditions for the whole population?
- Why are appropriate technology solutions difficult to find?

## INTRODUCTION

With regard to the complex social and environmental issues we are currently facing, technological solutions are expected to play a key role in the solution – despite being often perceived as a part of the problem. This session will present an alternative perspective on technologies in sustainable human development (SHD) problems by examining emerging and appropriate technologies and how these are used to address development concerns.

## BACKGROUND AND HISTORY OF TECHNOLOGY IN SUSTAINABLE HUMAN DEVELOPMENT

Engineers are optimists. When discovering a problem, something deep within the engineer stirs and like a space rocket launch sequence, we initiate the methodological approach of defining a design brief and developing design-led solutions, which are iterated and tested until the final product or service is launched in the relevant market. Social scientists, on the other hand, tend to be more pessimistic; observing rather than engaging directly with the messy world is what they do best.



*Figure 1 EWB-UK placement volunteer aids in surveying the route for 6 km of pipeline to provide drinking water for a community of 3000 people in South Kyrgyzstan. (EWB-UK, 2008)*

Both these stereotypes have their merits and their problems. The engineer's boundless optimism cannot accommodate problems which have no solution. When things do not go to plan, prototypes are discarded, and a new approach is tried: 'think of it as a challenge rather than a failure'. Whereas, the social scientist will probably say, "I told you so".

Engineers also love to innovate, even when there is little need to do so. Inventing is another inbuilt trait, which sometimes obscures the obvious and denigrates older technologies. The urban myth<sup>1</sup> that NASA spent a large amount of money to develop a pen capable of writing in zero-gravity conditions, while the Russians used pencils, may be only partially true, but is a good illustration of over-thinking a solution to a problem when a simpler one already exists.

The role of technology in Sustainable Human Development (SHD) is complex and controversial. Problems such as deforestation, environmental pollution and climate change have arguably been exacerbated by technological development. Whether further technological development can provide solutions to these grand challenges remains to be seen.

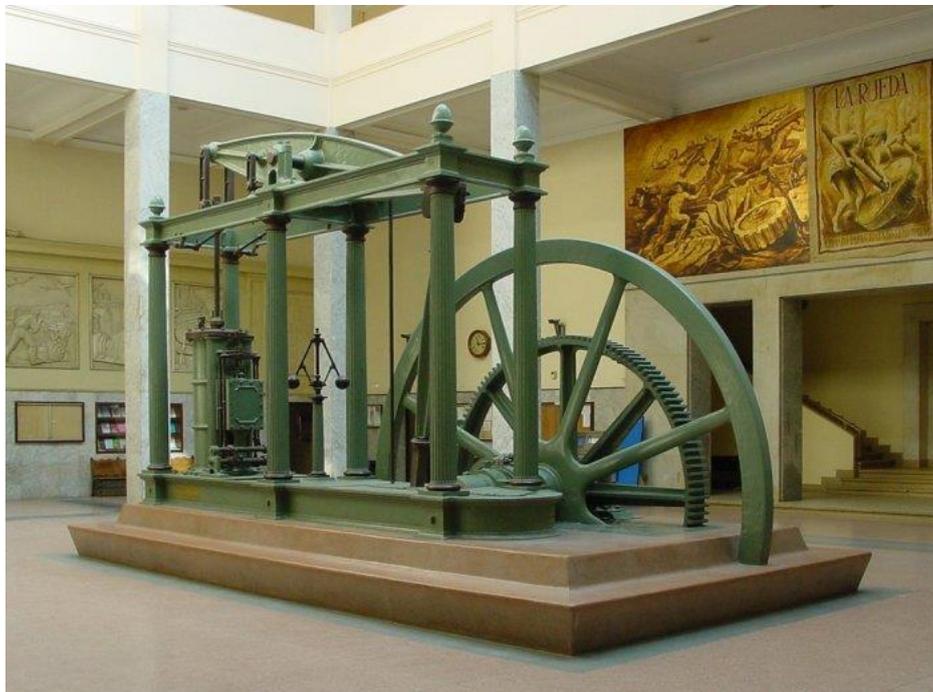


Figure 2 A scale model of Watt's steam engine (Wikimedia Commons, 2004).

The history of technology throws up many paradoxes around these issues. For instance, the development of the steam engine in the UK by Savery, Newcomen, Watt, Trevithick and others was partially due to a lack of fuel (Marsden 2002). The use of timber was restricted and surface

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<sup>1</sup> The Wikipedia Page for the Fisher Space Pen Company gives a good overview of the myth and its debunking: [http://en.wikipedia.org/wiki/Space\\_Pen](http://en.wikipedia.org/wiki/Space_Pen) [Accessed 25 February 2014].

deposits of coal had been used up, so deeper mine shafts were being dug. However, these mine shafts were prone to flooding, so a solution was needed to pump water out of the mines. The increased availability of coal was then used to power the growing number of steam engines used both in mines and in other industries such as textile mills. Steam engines do not appear to have provided a sustainable solution to the problem for which they were developed; rather, they became part of a bigger problem of unsustainable use of fossil fuels.

It is interesting to draw parallels today with the use of fracking and other environmentally damaging mining/exploration processes intended to meet an ever growing demand for cheap energy. The focus in the media on energy prices rather than energy usage is telling; a straightforward way to reduce domestic energy bills is to cut energy consumption (through the use of insulation, turning down thermostats, turning off unwanted lights/appliances, etc.) but this represents a change in behaviour, which is perhaps harder to accept than assigning blame for rising fuel bills elsewhere.

Up to the mid-20<sup>th</sup> century, engineering was usually employed as a response to a physical need. For example, Abraham Darby's efforts to refine iron production were motivated by the need for cheaper cooking pots; and water chlorination policies were developed partially in response to Dr. John Snow's discovery of dirty water as the primary method for the spread of cholera in the 1854 epidemic in London. The situation in engineering innovation today, however, is very different.

In 1981, Radford noted that the progress made in material science, power generation, machine tools, transport, and communication have transformed human existence throughout "most of the world", removing muscular effort and drudgery from the factory and the home (Radford, 1981). The challenges facing 'the rest of the world' are certainly not trivial:

- 22,000 children die each day due to poverty (UNICEF).
- Around 27-28 percent of all children in developing countries are estimated to be underweight or stunted.
- Every year there are 350–500 million cases of malaria, with 1 million fatalities.
- 1.1 billion people in developing countries have inadequate access to water, and 2.6 billion lack basic sanitation.
- There are 1.8 million child deaths each year as a result of diarrhoea.
- Nearly a quarter of the world's population are without adequate shelter.
- In developing countries, 2.5 billion people rely on biomass—fuel wood, charcoal and animal dung—to meet their energy needs for cooking. Indoor air pollution resulting from the use of solid fuels claims the lives of 1.5 million people each year (WHO, 2006).



**Figure 3** (clockwise from top left) *The malaria epidemic: A mother and child visit the Chianda Clinic in Zambia (Gates Foundation, 2009). A young boy from the slum in Manohara, Nepal, stands on a water storage tank, shared between the slum dwellers and a wealthier community nearby (EWB-UK, 2008). The UN World Food Programme (WFP) and the Agency for Technical Cooperation and Development (ACTED) jointly distribute food in Léogâne, Haiti, as the Sri Lankan Battalion of the United Nations Stabilization Mission in Haiti (United Nations Photo, 2010). A stove used to burn plantation waste. The smoke causes health issues in users (Wikimedia, 2011).*

Engineering/technical solutions exist for many of these problems – the difficulty facing engineers and development workers is in implementation. In some cases, the solutions proposed are too expensive – a manageable design flaw, in theory, as the engineer can focus her efforts on reducing costs - but in many instances it is a lack of political willpower or cultural resistance to change rather than a lack of technology which are the main barriers to be overcome.

For instance, the National Institute of Allergy and Infectious Diseases estimates that the cost of global measles eradication may run as high as \$4.5 billion (Perry et al., 2014). While this figure initially seems very high, relative to other expenditures it does not seem as unobtainable: it is roughly half the initial costs of the Large Hadron Collider and less than 0.5% of the world’s total annual spend on the military.

It is hard to believe that at the same time as up to 28% of children in developing countries are underweight, over half the UK population is either overweight or obese. Nearly 26 million tons of food waste is generated annually in the U.S. and that food waste created by the U.K. could lift 150 million people from starvation in one year (BBC News, 2013). The tragedy is that humanity is like a man who has his head in the oven and his feet in the freezer; on average he feels fine.

Clockwork radio inventor, Trevor Bayliss (1999), puts the choice facing engineers in this way. "Increasingly we in the West are going to have to put aside our toys, the multitude of appliances and accessories that devour electricity and suck dry our earth's resources. Or else we must find new ways to power them" (Bayliss, 1999).

So, is there anything worthwhile left for an engineer to do in the 21st Century? This sentiment is not new. In his 1843 report to Congress, the then-commissioner of the Patent Office, Henry L. Ellsworth, stated that, "The advancement of the arts, from year to year, taxes our credulity and seems to presage the arrival of that period when human improvement must end."

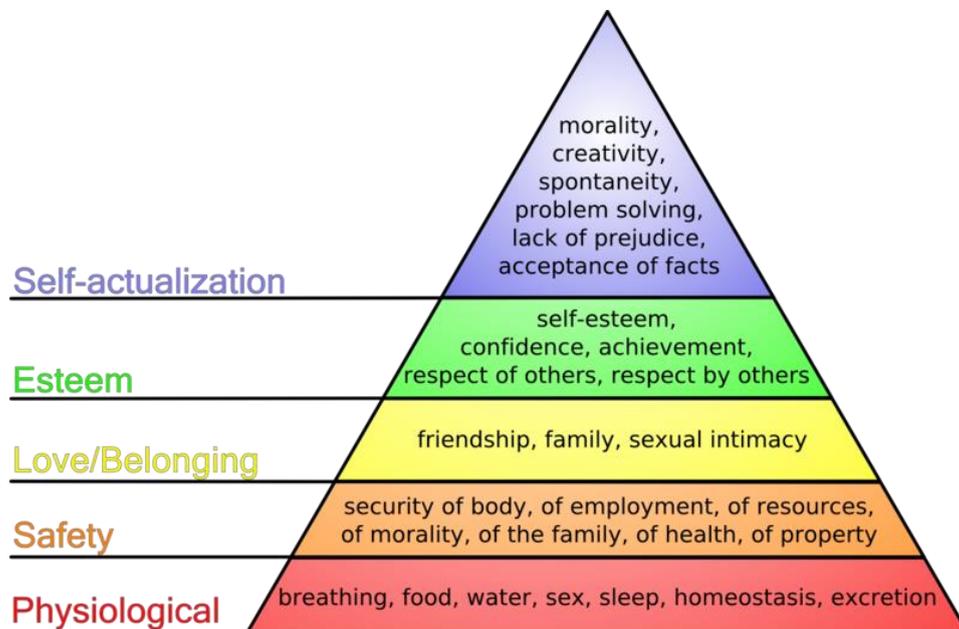


Figure 4 Diagram of Maslow's Hierarchy of Needs (Finkelstein, 2006).

Maslow (1943) ranked human needs in a pyramid, with basic physiological needs such as the need to eat, to breathe, to sleep at the bottom of the pyramid. The next layer includes the need for physical safety and security. Next comes the need to belong, to love and be loved, which are topped by esteem and other higher "self-actualisation needs". Having met most basic needs in the West, engineering has attempted to scale the pyramid. Aided and abetted by marketing, innovations claim to meet higher and higher needs: buy these trainers and you will be accepted. Use this deodorant and you will be attractive to the opposite sex. Subscribe to our mobile phone network and your talk will be unlimited. In the 21<sup>st</sup> Century, consumerism, not necessity, is the

mother of invention.

The influence that technology can have on culture is discussed by Postman (1993), who classified cultures into three types: tool-using cultures, technocracies, and technopolies. Until the seventeenth century, all cultures fitted into the first type. Tools were invented to do two things – firstly to solve urgent basic physical problems such as grinding corn, ploughing land, transporting water and so on, and secondly to serve the symbolic world of art and religion. The integrity and dignity of the culture was not threatened by the use of such tools. However, in a technocracy, tools play a central role in the thought-world of the culture. The very instruments created to meet the needs of society threaten to transform and indeed overthrow it. In Huxley's *Brave New World*, the revolution is complete – Technopoly eliminates alternatives to itself by creating a culture that seeks its purpose and finds its satisfaction in technology. The means to an end has become an end in itself. Thomas (1996) expressed these concerns as follows:

*"There is no doubt that the scientific and technological revolution of the modern period has been a tremendous expression of human creativity, It has eliminated distances and created the global community materially. It has given us the knowledge necessary to produce goods and services in abundance. It has given us power for social, psychic and genetic engineering, to control disease and death as well as birth. But as we survey the world situation today, the general feeling is that along with many benefits, many of the promises of technology stand betrayed and there is evidence of a lot of technology having become instruments of exploitation of peoples, destruction of cultures and dehumanization of persons and pose threat of destruction not only to the whole humanity through nuclear war but also to the whole community of life on the earth through the destruction of its ecological basis."*



Figure 5. Young child listens on a mobile phone in the Takalafiya-Lapai village in Niger State (World Bank, 2010).

While we may be reluctant to identify our own culture with Huxley's Brave New World, it is important to ask just how far along the road to Technopoly the (so-called) Developed World has come. In a culture defined by the Internet, the mobile phone and the car, have the tools become idols? Whilst mobile phone technology in Africa and Asia has opened a lot of opportunities for farmers to connect to markets and for basic communication purposes, those developing new phones concentrate on styling and incorporating additional features such as video rather than addressing robustness, reliability and longevity. Bacon wrote that knowledge should be sought, not "for superiority of others, or for profit, or fame, or power...but for the benefit and use of life"<sup>2</sup>. In today's consumer driven society, many engineering and scientific projects undertaken by industry and academia alike fall far short of these high moral standards. Although research into space exploration has had beneficial spin-offs such as the development of semiconductors and satellites to monitor the climate, these were not the primary goals of the research. It is difficult to see recent plans for a manned mission to Mars primarily for "the benefit and use of life" rather than as an attempt to grab newspaper headlines and political support.

## REDEFINING RESEARCH PRIORITIES

While a deeper understanding of how atoms are held together may provide clues as to the foundations of matter, and exploring deep space with costly telescopes and space probes may hint at the origins of life, considering the pressing needs of people in developing countries have led some to question scientific research priorities. This is not to say that fundamental research should be avoided or that research into physics is largely a waste of time and money, but while many people lack access to basic facilities such as safe drinking water, shelter, and adequate food, where should our priorities lie?

Raymond Branch (1987) was bold enough to state in 1987 that "there are some extremely expensive areas of research that should not be pursued now." Brand was commenting specifically on a plan at that time to spend \$USD 3 bn on a superconducting super collider. Unfortunately, Brand's advice seems to have been taken on board by the US House of Representatives rather belatedly, as in 1993 they decided to call a premature halt to the project after 14 miles of tunnelling had been completed and \$USD 2 bn spent.

It is of particular concern that while richer nations can perhaps afford such frivolities, in countries where poverty is more acute, engineering priorities are governed by the desire for superiority over neighbouring lands by developing nuclear weapons, launching space programmes, and so on, rather than tackling hunger, malnutrition and disease. In an address to the British Association, Professor Sardar stated that most Muslim countries (many of them in the developing world) are happy to imitate research priorities of industrialized countries rather than work at shaping their own science policy based on their own needs and resources:

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<sup>2</sup> A quote from "The Great Instauration" by Francis Bacon, 1620.

*“So instead of focusing, for example, on diarrhoea and dysentery in Pakistan, flood control in Bangladesh and schistosomiasis in Egypt and the Sudan, these countries blindly follow the international agenda and devote their meagre research funds on equally meagre work on cancer and heart diseases.”*

All the while, urgent work is needed on developing materials for quick and clean temporary housing, efficient and cheap methods for supplying emergency water, and mechanisms for providing basic health care and preventing the spread of diseases. All the incidence of cancer in Africa is increasing, cases are often the result of the reduction in immunity in patients suffering with HIV/AIDS.

But before we claim the moral high ground, we need to realise that we are engaged in technology races of our own, and that the Technopoly that we have become is the goal to which many nations aspire. Research objectives are increasingly being set by multinational corporations rather than by national governments. In the 1990s, public investment in research and development in science and technology stagnated while private funding increased five-fold from \$100 bn to \$500 bn (Coventry, 2003).

The most striking case was in agricultural research. Private sector research amounted to \$10 bn per year – much of it in the field of biotechnology – a figure 25 times greater than the combined annual research budgets of the members of the Consultative Group on International Agricultural Research (CGIAR), an international network of agricultural research institutions. The 2001 Human Development Report commented that scientific research effort will be concentrated towards the priorities of multinational corporations rather than the needs of the developing world, stating that as a result we are more likely to find a cure for baldness than for malaria. The situation is changing, slowly, with donations from charitable organisations such as the Gates Foundation being used to fund research into AIDS, tuberculosis and malaria.

## APPROPRIATE TECHNOLOGY SOLUTIONS

The need for energy is a rich area for application of the principles of appropriate technology. Developing world countries consume far less energy per capita than those in the developed world. For instance, in one year the average US citizen consumes 12.4 MWh per person, 1476 times more energy than the average Cambodian who consumes 8.4 kWh (World Bank, 2013). There is a positive correlation between power consumption and standard of living, and as nations become more developed, energy usage tends to increase – however, in order to live in a sustainable manner, global energy usage must not be allowed to increase. This requires, therefore, a reduction in the energy use in developed nations and a managed increase for developing countries.

The source of power must be considered carefully: rather than building more coal and oil fired power plants, appropriate solutions should be sought. Examples of these could be: to make greater use of more efficient modes of transport (buses, trains, trams, and bicycles, etc.); to look for alternative power sources (wind farms, wave power, hydroelectric schemes and other 'expensive' technology for developing countries; whilst developing nations might be more attracted to simpler windmills, biogas and solar engines). Solar power is a particularly good example of where an appropriate solution may be a photovoltaic cell, a solar collector, a solar engine or a simple solar cooker, depending on the location and available technology.



Figure 6 PV Cell, solar collector, solar cooker

Many other case studies exist of appropriate solutions to underemployment in developing countries. These include setting up small industries such as making soap, bicycles, footwear and furniture, as well as passenger transport schemes. A key factor predicting success all these cases is the involvement of local communities in decision making, and the appropriate use of indigenous technical knowledge.

Juma (2006) notes that the first step in moving ahead will be to challenge the worldwide engineering community to come up with solutions relevant to developing countries. Significant challenges remain – for example, coming up with economic and practical solutions for removing arsenic from water – but the emphasis should be on implementation as well as scientific development.

## NOT-SO-SUCCESSFUL APPROPRIATE TECHNOLOGIES

### One Laptop Per Child

It is inevitable that information technology will have an increasing role in poor countries. The

availability of mobile phones in Uganda and Rwanda, where three competing networks provide coverage even of many rural areas, makes the internet within the reach (if not within the pocket) of many remote communities. It is claimed that such access could transform local farming practices with access to information about agricultural management – for example, seed and fertilizer information, weather forecasting, etc. Recent debate, however, has not focused on providing Internet access to farmers, but to their children.



*Figure 7 One Laptop Per Child*

In Jordan, for example, King Abdullah has launched a program called ‘Big Ideas for a Little Country’ which intends to reform the education system by the use of computers in schools (BBC News, 2004). This scheme has the backing of several US multinationals, but has faced opposition from within Jordan by those who think that the immediate needs of the country will not be served by what is perceived as a Western approach to industrialisation using American technology.

High profile schemes such as the One Laptop Per Child (OLPC) initiative (founded by Nicholas Negroponte from MIT) have generated much in the way of media interest: a poor child carrying a laptop computer certainly makes for a stunning image and a good storyline. However, there exists considerable scepticism that the OLPC scheme, and indeed others like it, will make any lasting impact on education in poor countries.

Nigeria's former education minister, Dr. Igwe Aja-Nwachukwu, questions the approach: "What is the sense of introducing One Laptop Per Child when they don't have seats to sit down [in]..., when they don't have uniforms to go to school in, [when] they don't have facilities?" The Indian Ministry of Education has called the OLPC scheme "pedagogically suspect", whilst the Education Secretary Sudeep Banerjee said the country needed "classrooms and teachers more urgently than fancy tools." Nicholas Negroponte says he ignores criticism of the project, but a spokesperson for the OLPC cites political reasons for the criticism and emphasises the need for educational reform (Fildes, 2007).

OLPC's website acknowledges that one reason for lack of education in poorer countries is that educational budgets are stretched: "...the resources that developing countries can reasonably allocated to education [is] sometimes less than \$20 per year per pupil, compared to the approximately \$7500 per pupil spent annually in the U.S." (OLPC, 2013). It goes on to argue that because the gap is so wide, pouring additional resources into education budgets is not the answer, and that a radical new approach to education is required – enter, the laptop.

There are several flaws in this argument. First, if education budgets can be cut by the increased use of information technology, why is spending on education in the U.S. – a developed country with high levels of IT in classrooms – so much higher than in poor countries? Second, even if laptops did represent a cost-saving opportunity, at \$200 per machine, it would be a 'cost-saving' that poor country education programs could scarcely afford. Laptops do not address the educational priorities for many countries: teachers, classrooms, and books are priorities that may have escaped the attention of those behind the OLPC scheme, who operate largely in environments where these priorities are taken for granted.

It is interesting to note that there is more demand for the laptops produced by the OLPC in richer countries than in poorer countries. OLPC has announce that it will be providing laptops for schools in Birmingham, Alabama, as well as seeing significant interest in their "give one, get one" scheme which ran in 2008 (OLPC, 2008).

### PlayPump

Another high-profile "appropriate" technology project that has recently run into difficulties is the PlayPump scheme, which combined children's playground equipment with deep bore water pumps. The simple idea of using the energy created by children whilst playing on a roundabout to pump water was seized upon by the media and supported by organizations including the Case Foundation and Save the Children.

The costs of installation were to be met by advertisements carried on billboards attached to the pumps. Pumps were installed in many locations in southern Africa starting in 2005, but many

have fallen out of use and PlayPumps International folded in 2010.



Figure 8 *The PlayPump.*

There are various reasons for the failure of the program. These include:

- A lack of interest from advertisers – Who wants to advertise in remote villages?
- High initial costs - \$14,000 per pump, making the PlayPump much more expensive than a conventional hand pump.
- Mismatch between energy requirements to pump water and the amount of energy produced by children at play.
- Concerns over child labour – Children being forced to ‘play’ to pump water.
- Maintenance issues – no local capacity to repair or replace broken components.

## SOME RATHER MORE SUCCESSFUL APPROPRIATE TECHNOLOGIES

High-profile success stories of appropriate technology solutions are much harder to find, as small-scale locally applicable solutions do not generate as many media headlines or be so attractive to financial investors.

### The Simputer

A more appropriate response to the desire for technology in education has been the development of the ‘simputer’ – a cheap handheld computer developed by scientists and engineers at the Indian Institute of Science in Bangalore (Simputer, 2000). The computer is the first to be designed and manufactured in India and is aimed at providing cheap access to computing. Simputers have been used by the government of Karnataka to automate the process of land records procurement, in Chattisgarh for the purpose of e-education, to facilitate Electronic Money Transfer between UK and Ghana, and even by police forces to track offenders

and issue travel tickets. Unfortunately, the project has suffered delays and setbacks partly due to the indifference of computer manufacturers and software companies and a lack of financial support, and is currently out of production.

### The Jiko Stove



Figure 9 *Jiko Stove*

One area rich for appropriate technology solutions is in food preparation and cooking technologies. It is estimated that of the 2.7 bn people worldwide who live mostly on incomes of less than \$USD 2 per day depend on solid biomass fuels (e.g. charcoal, animal dung, grass, agricultural residue, etc.) to meet their basic energy needs for cooking and heating. Many of these people cook on open fires, often inside their homes. As well as being inefficient with regards to the use of scarce firewood, women and children (as the primary individuals in the home responsible for cooking and cleaning) are exposed to harmful levels of wood smoke, which is a major cause of respiratory disease and premature death. In addition, cook stoves are estimate to contribute around 1/3 of global carbon monoxide emissions while the black carbon particles and other pollutants in biomass smoke are also though to play a role in global warming.

Improved cook stoves, designed to burn biomass fuels more cleanly and efficiently than traditional stoves, have been promoted by charities and governments in many developing countries since the 1970s. A variety of approaches have been tried, including 'build-your-own-stovfe' projects, community-focused participatory schemes, manufacturing stoves in remote

villages and market-based commercial activities. In some countries, these new stoves have been well-received. For example, in Kenya, 80% of urban families use a metal 'jiko' charcoal stove for cooking, which uses 50% less fuel and also decreases cooking time. The cost of the stove can be recovered in fuel savings in just a few months. It is estimated that the widespread uptake of the jiko stove in Kenya saves 206,000 tonnes of wood or 570,000 hectares of trees per year.

### Bottle Lights

In 2002, a Brazilian mechanic, Alfredo Moser, developed a way to light his house during daylight hours without electricity. He used plastic bottles filled with water and a little bleach. By inserting the bottles into holes cut into the corrugate iron roof, daylight is able to enter the house. The simple idea has spread throughout the world, and is said to be used in over one million homes (Zobel, 2013).

### Plastic Water Bottle Purifier

Another good use for plastic bottles is to use them to purify water. It is claimed that a clear plastic bottle filled with water and exposed to the sun for 6 hours will kill off harmful bacteria (Jorgustin, 2012).

## CONCLUSIONS

Technological solutions are expected to play a key role in addressing the complex social and environmental issues we are currently facing. However, technology must be used and developed in an appropriate way if sustainable human development is to be achieved.

Although much of engineering practice in the 21<sup>st</sup> century could be classified as trivial in the face of the larger global issues we face, there is hope. The modern engineer needs to take a wide perspective seeing the potential for improving the lives of the poor through the appropriate use of technology as well as tackling the engineering challenges facing the developed world and global issues such as climate change. The time is ripe to assess the sustainability and appropriateness of technology used in the 'over-developed world'; meeting the physical needs (rather than the social wants) of the present must not be allowed to compromise our ability to meet the needs of future generations.

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## Figures

**Figure 1.** EWB-UK placement volunteer aids in surveying the route for 6 km of pipeline to provide drinking water for a community of 3000 people in South Kyrgyzstan. Copyright 2008 by Stephen Jones. Submitted to the EWB-UK 2008 Photography Competition. Reprinted under CC BY-NC-ND 2.0 license.

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**Figure 3.** The malaria epidemic: A mother and child visit the Chianda Clinic in Zambia. Copyright 2009 by the Gates Foundation. Accessed on Gates Foundation Flickr photostream: <http://www.flickr.com/photos/gatesfoundation/> [25 February 2014].  
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**Figure 3.** A young boy from the slum in Manohara, Nepal, stands on a water storage tank, shared between the slum dwellers and a wealthier community nearby. Submitted to the EWB-UK 2008 Photography Competition. Copyright 2008 by Ameer Shaheed. Reprinted under CC BY-NC-ND 2.0 license.

**Figure 3.** The UN World Food Programme (WFP) and the Agency for Technical Cooperation and Development (ACTED) jointly distribute food in Léogâne, Haiti, as the Sri Lankan Battalion of the United Nations Stabilization Mission in Haiti. Copyright 2010 by the United Nations. Accessed on United Nations Photo Flickr photostream: <http://www.flickr.com/photos/35483578@N03> [25 February 2014]. Reprinted under CC BY-NC-ND 2.0 license.

**Figure 3.** A stove used to burn plantation waste. The smoke causes health issues in users. Copyright 2010 by . Accessed on Wikimedia Commons: [http://en.wikipedia.org/wiki/File:The\\_rural\\_stove,smoky,pollution,TamilNadu-230.jpeg](http://en.wikipedia.org/wiki/File:The_rural_stove,smoky,pollution,TamilNadu-230.jpeg) [25 February 2014]. Reprinted under CC BY-SA 3.0 license.

**Figure 4.** Diagram of Maslow's Hierarchy of Needs. Copyright 2006 by J. Finkelstein. Accessed on Wikimedia Commons: [http://commons.wikimedia.org/wiki/File:Maslow%27s\\_hierarchy\\_of\\_needs.png](http://commons.wikimedia.org/wiki/File:Maslow%27s_hierarchy_of_needs.png) [25 February 2014]. Reprinted under CC BY-SA 3.0 license.

**Figure 5.** Young child listens on a mobile phone in the Takalafiya-Lapai village in Niger State. Copyright 2010 by Arne Hoel/World Bank. Accessed on World Bank Flickr photostream: <http://www.flickr.com/photos/worldbank/> [25 February 2014]. Reprinted under CC BY-NC-ND 2.0 license.

**Figure 6.** The largest photovoltaic solar power plant in the United States is becoming a reality at Nellis Air Force Base. When completed in December, the solar arrays will produce 15 megawatts of power. Taken 2007 by USAF. Accessed on Wikimedia Commons: [http://en.wikipedia.org/wiki/File:Nellis\\_AFB\\_Solar\\_panels.jpg](http://en.wikipedia.org/wiki/File:Nellis_AFB_Solar_panels.jpg). This photo is in the public domain.

**Figure 7.** OLPC XO Repair Center at August Town Primary School, Jamaica. ([olpcjamaica.org.jm](http://olpcjamaica.org.jm)). This repair team is part of the Computer Club. Copyright 2011 by OLPC. Accessed on OLPC's Flickr stream: <https://www.flickr.com/photos/olpc/5763753458/in/set-72157626814643658>. Shared under a CC BY 2.0 license.

**Figure 8.** Play Pump. Copyright, Practical Action. Used with permission.

**Figure 9.** Jiko Stove. Copyright 2007 by Adam Hooper. Taken from: <https://picasaweb.google.com/lh/photo/R1mqVcfXB70g9iNzjG8OsQ>. Shared Publically.

## FURTHER/SUGGESTED MATERIAL

- The Handbook of Sustainability Literacy: Appropriate Technology and Appropriate Design  
<http://arts.brighton.ac.uk/stibbe-handbook-of-sustainability/chapters/appropriate-technology>
- iBook: Sustainability & Engineering Part I  
<https://itunes.apple.com/gb/book/sustainability-engineering/id572912964?mt=11>
- iBook: Sustainability & Engineering Part II  
<https://itunes.apple.com/gb/book/sustainability-engineering/id573166431?mt=11>
- Appropriate Technology Sourcebook  
<http://villageearth.org/appropriate-technology/appropriate-technology-sourcebook>



PHOTO: 'Clean Up' Senior Field Coordinator briefs volunteers on teams and tasks for a communal clean-up effort for a new project site in Kibera, Nairobi. J. Mulligan.

CHAPTER

4

Understanding the social dimension

# 4

## CHAPTER 4. Understanding the social dimension

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# 4

## UNDERSTANDING THE SOCIAL DIMENSION

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### EXECUTIVE SUMMARY

Considering the social context is essential in order to ensure successful outcomes in project development. This session introduces methodological approaches useful to identify and comprehend stakeholders' relationships and discourses. Furthermore, it aims to shed light on the social consequences of envisaged changes as imposed by the project, and to promote stakeholder engagement over the course of project development and implementation.

Understanding of the social dimension can improve the way projects are integrated in the local context. The analysis of institutional context, local culture, power relationships, and political background can contribute to a better understanding of problems faced by the local community and enrich the search for context-based solutions, adapting them to each specific circumstance. Therefore, this chapter offers methodological tools to identify key stakeholders, to analyze their interests, importance and influence on the outcomes of an initiative, project or program.

## LEARNING OUTCOMES

After you actively engage in the learning experiences in this module, you should be able to:

- Understand the importance of the analysis of stakeholders and policies during all the phases of a project.
- Draw the stakeholders' map of a particular context.
- Describe actors' perceptions, discourses towards an intervention or a development project.
- Analyze relationships among stakeholders, their influence and power that each sector may exert on the development of a project. How actors' engage or offer resistance towards potential changes can affect the success of a project.
- Draw some recommendations to promote public participation in a project.
- Describe the obstacles or drivers to promote participation.

## KEY CONCEPTS

These concepts will help you better understand the content in this session:

- Stakeholder mapping and analysis in a project development.
- Public engagement and participatory approaches to improve project design, implementation, management and monitoring.

## GUIDING QUESTIONS

Develop your answers to the following guiding questions while completing the readings and working through the session:

- What are the problems that a project seeks to address? How stakeholders perceive a project and its outcomes?
- Who are the stakeholders? Who are the affected groups? Who are the most powerful stakeholders? Who are the less powerful and disadvantaged groups?
- Which are the dynamics of a particular stakeholders system?
- Which methodological tools are more adequate to promote stakeholder engagement and participation in a project?

## INTRODUCTION

When planning a new engineering project or policy, it is essential to take into account the context of the proposed area of work. This is especially true in international projects, where cultural differences between project team members and the local community can be significant and incorporating their perspectives and experiences into the project development and implementation process is one of the most important skills an engineer can have. This practice is important for practical as much as ethical or moral reasons: considering stakeholders' interests in different project phases (design, implementation, management and evaluation) will improve the effectiveness of the project and the benefits to the community involved. By increasing the contribution of the local community to the project, it also anticipates and minimizes the potential for conflict at later stages in the project cycle.

The aim of this session is to discuss the integration of the social dimension into project development and implementation processes. It will introduce methods which can help systematically organize and analyze strategic information in order to aid in appropriate project development.

One of the first tasks to undertake in socially-conscious project development cycles is the analysis of the stakeholder system. This involves identification and characterization of the different actors involved in or affected by the project. While it is difficult to incorporate the whole spectrum of stakeholders into a single analysis, taking time to build up an accurate picture of stakeholder networks can reduce the risk of failure in the future by building solid foundations for strong relationships in the present.

Stakeholder mapping and analysis have their origins in organizational research and business management studies. However, its evolution and application into other fields such as natural resource management or rural development have made it an increasingly important tool in various disciplines in the last few decades. The underlying aim of stakeholder analysis is to identify societal actors (individuals, groups, institutions, etc.) who might be relevant for the planning, design, implementation and evaluation of a particular project or policy. In the context of sustainability or international development, it is a valuable technique to use to facilitate the integration of the interests of disadvantaged groups into the project development process. It is most effective when introduced early in the project development cycle, allowing for the fullest possible participation by relevant stakeholders. It also enables the early identification of those who do or do not support a certain initiative, in order to more effectively resolve conflict or misunderstandings in the future. Once stakeholders have been identified, they should be described as specifically as possible using qualifiers such as power, influence capacity, interests and position towards the proposal.

## WHO ARE THE STAKEHOLDERS?

Stakeholders or actors are individuals, groups, organizations or institutions who, directly or indirectly, stand to gain or lose from a given project or policy. According to World Bank (2007), stakeholders can be of any form, size and capacity: i.e. any organization, entity, corporation or institution from the public or private sector, NGO or international agency having direct or indirect relationship with the project under development. In the context of engineering or technical projects, most stakeholders fall into one or more of the following categories: international actors (e.g. donors), national or political actors (e.g. legislators, governors), interest groups (e.g. unions, associations), commercial/private for-profit, nonprofit organizations (NGOs, foundations), civil society members, and users/consumers.

Groups of stakeholders may have certain characteristics in common, but its identity (belonging to a particular group), geographical area, shared interests, etc. Shareholders may also possess strategic information or resources relevant to the proposed project. In general, stakeholders can be split up into two categories (World Bank, 2007):

- Primary stakeholders who would be directly affected by the proposed project, including the principal project beneficiaries.
- Secondary stakeholders who would be indirectly affected by the proposed project.

Often, those groups whose participation is required for the achievement of the project are called “key stakeholders” (Freeman, 1984). They are agents of change with the power to decide and influence relevant areas which may affect the development and implementation of the project.

Some common identifiers of key stakeholders are:

- **Location:** They are part of society living in the area of the project implementation.
- **Role:** They have roles and responsibilities directly related to the project objectives.
- **Capacity:** They have skills, abilities, knowledge, infrastructure, or financial resources to which could benefit the achievement of project objectives.
- **Influence:** They have the ability to negotiate with various agents and / or government levels that allow for consensus to be built.

Decisions made by stakeholders depend on a combination of several factors: their in/formal role in society, their belief systems, their skills and the opportunities provided by the environment in which their action takes place can all influence the position the actor takes on

the project. The methodology presented next will facilitate the process of analyzing the factors which influence stakeholder decisions.

## STAKEHOLDERS ANALYSES

The stakeholder analysis combines different types of tools to offer a methodological process which aids the project team in identifying key stakeholders, their interests, relevance and influence in relation to their project. Moreover, it provides the informational and analytical basis to promote public participation in the project and ensures that decisions taken address local needs.

Therefore, it is highly recommended that the process of stakeholder analysis is conducted using participatory methods in order to promote the engagement of the stakeholders from the project outset. Through this process, stakeholders and project team members can achieve a common understanding of the project and learn from the others' perspectives. This is a first step towards achieving compromise and ensuring accountability between the project team and the stakeholders.

The methodology presented in below has been adapted from similar processes developed by the FAO (Food and Agriculture Organisation of the United Nations, 2006) and World Bank (2007). It is laid out in a 5 step process and should be understood as a combination of various different techniques rather than a single tool. Although it is drawn in a linear structure to make it easier to understand, some of the steps may overlap one other, and a cyclical and reflexive procedure is often advisable<sup>1</sup>. Each step has key questions associated with them, and suggested methods for sourcing the information needed to address the questions.

### Step 0: The Framing Phase

The starting point of the stakeholder analysis is to compile and review existing information on the proposed geographical area of the project, as developing an initial understanding of the geographical context will help frame the scope of the analysis and facilitate the identification of the stakeholders. This would include information on local geography, history, politics and institutional frameworks, cultural and religious aspects of community life, demographics, as well as environmental factors such as wildlife, water, natural resources, etc. This step is based on a static analysis of resources such as bibliographic sources and technical documents and plans.

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<sup>1</sup> Remember, the best way to perform a stakeholder analysis is in collaboration with actors through participatory methods such as workshops and interviews. (FAO, 2006)

The Framing Phase can also promote dialogue among stakeholders as it helps identify common understandings of the main issues dealt with by the project. Moreover, this phase allows for a smoother transition into Step 1, by making it easier for the project team to identify stakeholders.

### Step 1: Stakeholders Identification and Analysis

This phase aims to identify key stakeholders. It requires understanding of the legal, political, or institutional framework which regulates the project, the technical actors that intervene in it and the local community affected by the project.

The expected output of this step is a broader knowledge of a wide range of project stakeholders, as well as the ability to distinguish between those who may control or influence project decisions, who have the technical information or expertise, etc.

This step requires the project team to ask the following questions:

- Who might have an interest in the project? Who are potential beneficiaries?
- Who might be adversely affected? Who are the vulnerable groups?
- Which administrative bodies are responsible for the project development, evaluation and monitoring?
- Who holds the legal competence to facilitate the implementation of the project?
- Who might have the capacity to empower or restrict participation in the project?
- Who can participate with technical knowledge or expertise on the project?
- Which sectors of the society might be interested on the process of project development?

These questions can be dealt with by two complementary processes:

- **Desk work:** Literature review through direct or indirect sources. Non-specialized or thematic studies from the proposed project area can be helpful. It is recommended to get information about potential stakeholders in directories, databases, organizational charts, surveys, reports or written records issued by local authorities, donor agencies, administrative bodies, experts, academics, non-governmental organizations, business and industry, media publications etc.
- **Field work:** Some of these questions cannot be answered through desk-based research alone: some stakeholder interests are less obvious than others and may be difficult to find, especially if they are “hidden,” multiple or in contradiction with the stated aims or objectives of the organization or individual. Thus, in some cases, an assessment of stakeholder interests will require some form of consultation, either directly with these stakeholders or with others “on the

ground” who are familiar with the groups you are interested in. This process can be based in a set of exploratory interviews initially asking for clarification of relevant individuals roles in the project. The researcher can also ask the interviewee to suggest other stakeholders in order to expand upon their existing list (this is known as snowball sampling (Flick, 2008)) . Apart from having a wider and more accurate picture of the stakeholder system, these exploratory interviews provide a mediated first contact with local community members, build trust between stakeholders and the project team and start to identify future potentially controversial project issues. The field work and interviews should be informed by earlier research (see the ‘Desk Work’ section above), which can also be revisited later in the project cycle during further interview and research rounds.

Finally, it is also advisable to consult other experts, academics or technicians who have already worked in the area. They can enrich the process providing their experience and pointing out sensitive or previously overlooked issues requiring further consideration.

A database with the basic information about the relevant stakeholders should be created over the course of completing the research and interview process. It is important to incorporate specific information as much as possible for each identified stakeholder. It is also advisable to group actors into homogeneous groups characterized by similar problems and interests, level of commitment, etc. (See figure 1 and table 1 as examples).

Examples of different grouping types are:

- **Role:** Stakeholders can be grouped by their role in public administration/governance, the economic sector (business groups, retail representatives, agriculture cooperative, etc.), the social sector (neighborhood associations, religious leaders, unions, etc.), environmental groups, technical actors (academia, consultants, etc.)
- **The scale of their action:** international, national, regional or local.

**Table 1** List of stakeholders in a case study of coastal risk management in Ebro Delta (Spain).

Source: Roca et Villares, 2012.

STAKEHOLDER TYPE	STAKEHOLDER INTERVIEWED
Political Institutional	General Directorate for Coasts: (Tarragona Region). Ministry for the Environment. Delta del Ebro Nature Park. Use Management Section.

	Deltebre Town Council L'Ampolla Town Council
Socioeconomic	Rice Growers' Association Irrigators' Association Expropriated rice field owners Seafood company L'Ampolla Fisheries Association Sant Joan Fisheries Association Hunting Club Hotel Restaurant
Expert	Faculty of Geology. University of Barcelona (UB) Maritime Engineering Laboratory Technical University of Catalonia (UPC) Juan Carlos III University, Madrid

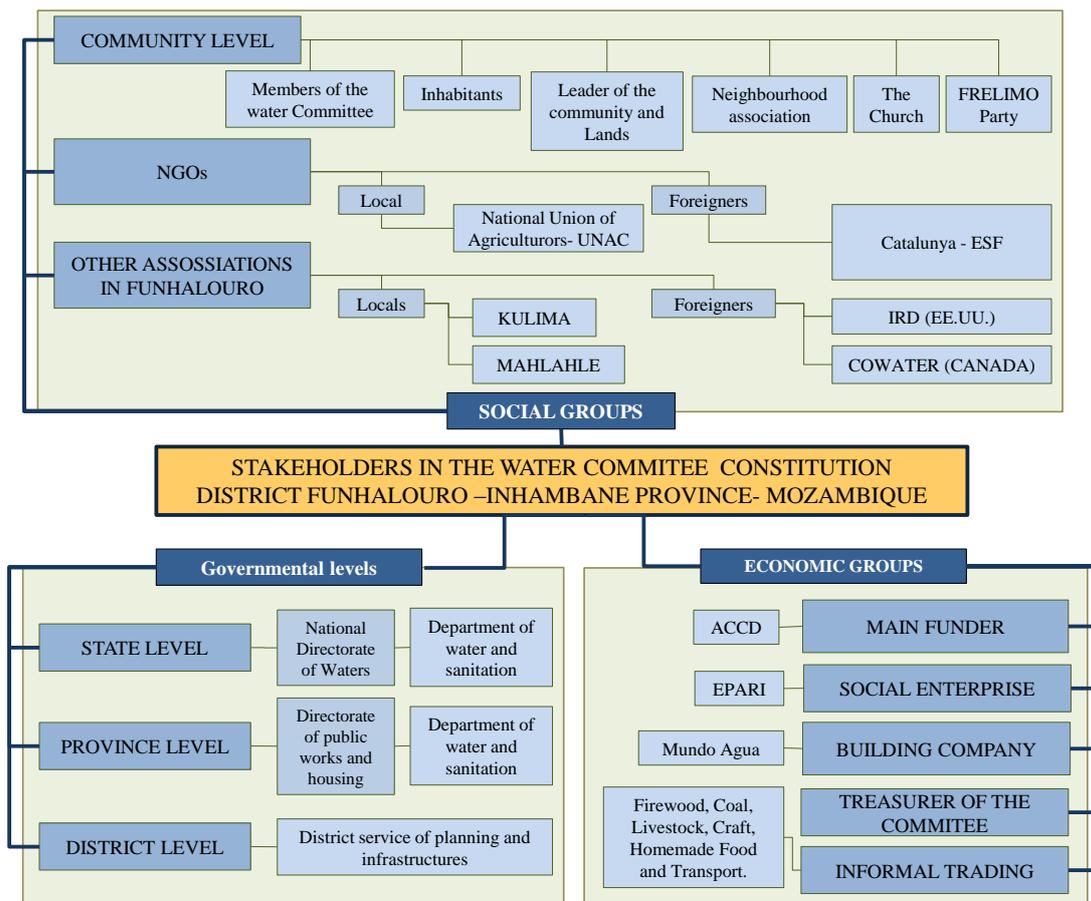


Figure 1 Example of stakeholders' system of water management in a community in Funhalouro (Mozambique). Source: Milanese, 2014.

## Step 2: Positions and perceptions towards the project (stakeholder characterization)

In general, people have different perceptions of reality: we use of different frames of reference to interpret reality as it happens to us (Jussim, 2012). Most conflicts which arise over the course of a particular project are related to the individual perceptions of stakeholders and the significance that they attach to different aspects of the project. Therefore, at this stage it is important to understand stakeholders' position towards what is being proposed, their interest or level of engagement, and any concerns they may have.

As this requires a more in-depth knowledge of the stakeholders than the previous step, a more comprehensive methodology is required to gain information. Several stakeholders should be selected from the stakeholders database generated in the previous step in order to obtain a deeper insight on their knowledge and perceptions. Interviews and workshops can be used to gain an understanding of stakeholders expectations of the project and the project team and the impacts they anticipate the project having on their lives.

It should never be assumed that all actors within a category are homogeneous in their perceptions. The perceptions that people generate are dependent on many factors, which require further exploration in subsequent analysis. Each case must be considered without preconceptions in order to avoid making hasty conclusions.

This step requires the project team to ask the following questions:

- In what way do the stakeholders perceive the proposed project will impact on their lives?
- In what way are these perceived impacts in conflict with the project? In what way do they support or endorse it?
- What are the perceived benefits or drawbacks, according to stakeholders?
- What are the resources that each stakeholder has to influence or mobilize the other groups?
- Who are likely to be the supporters and opponents? Who appears neutral or indifferent?
- What further relationships have you identified among the stakeholders?

As stated above, in-depth informational interviews are the best way to get answers to these questions. Participatory methods, such as workshops, are also encouraged. A discussion on how best to carry these out can be found in Flick (2006) and Babbie (2007). It is recommended that a social researcher participates in the project team in order to provide assessment on the social science methods. Some useful methods are:

- **In-depth Interview:** In-depth interviews provide a detailed, sectorial vision. The results obtained cannot be generalized to the whole of the sector, but they do indicate certain demands that can be considered significant. The strength of the in-depth interview method lies in the greater understanding of the perceptions and attitudes of interviewees towards a certain topic; limitations include the fact that results cannot provide statistical description and there is the potential for the subjective perspective of the research to affect the results. In order to extract the greatest amount of information from the interviews, conversations should be recorded (with the permission of the interviewee) and revisited later for further analysis. A good model to emulate is the journalistic interview.
- **Participatory workshops:** Another option to gain in-depth knowledge on stakeholders perceptions of the project is to hold participatory workshops. These involve discussing relevant topics in a structured session simultaneously with several individuals. Participatory workshops can bring out aspects of the discussion topic that would not have been anticipated by the researcher. They also tend to bring up entirely separate discussion topics that would not have emerged from face-to-face interviews, as the purpose is to explore rather than to explain. Limitations of participatory workshops include difficulty analyzing data as it is mainly qualitative and the problem of 'group think' among participants, which is defined as the tendency for some participants to conform with opinions of the most outspoken ones (Babbie, 2007). Moreover, depending on rates of illiteracy in the community, communication effectiveness can affect the success of the workshops unless efforts in alternative communication and in participatory techniques are made (for instance, the use of photographs and drawings to illustrate important concepts).

The output of this step should illustrate what kind of discourses and opinions exist within stakeholder groups in relation to the proposed project. In some cases, it might be useful to indicate the priority level each stakeholder assigns to each issue in relation to the project. The results should facilitate the identification of 'opponents' and 'promoters', (i.e. those against or in favor of the project). In addition, those identified to have neutral or indifferent positions should be outlined as they might become partners or opponents later on in the project.

The information gathered during Step 2 can be organized using matrices (see, for example, Table 2) or sociograms (graphic drawings of the stakeholders and their relationships (Flick, 2006) (Figure 2).

Table 2 Sample matrix for stakeholders' characterization. Source: Own Elaboration.

STAKEHOLDERS (S)	S1	S2
Level of action (International, national, regional, local)		
Status (Formal, Informal)		
Resources controlled (legal, economic, information, mobilization capacity)		
Modes of expression and action		
Impact on the project (high, moderate, low, none)		
Formal responsibilities		
Position in front of the project (Opponent, neutral, promoter, supporter...)		

An understanding of how stakeholders interrelate, what type networks they belong to and the structure of those networks can also be worked out quantitatively using Social Network Theory (Bodin et Prell, 2011). However, this methodology would require a expert on network analysis and other type of skills that exceeds the scope of this chapter.

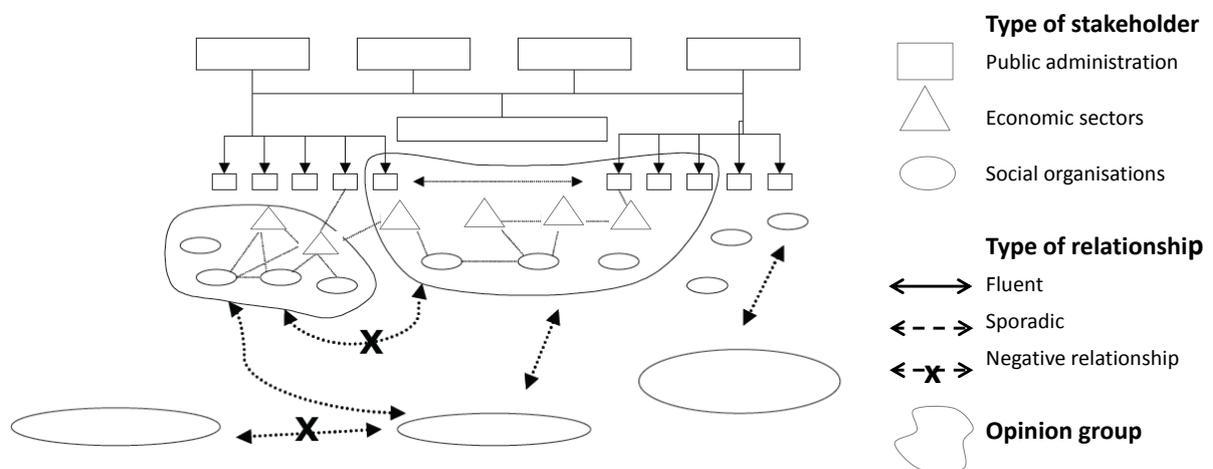


Figure 2 Sociogram of stakeholders' system and their relationships.

### Step 3: Power and relationship analysis

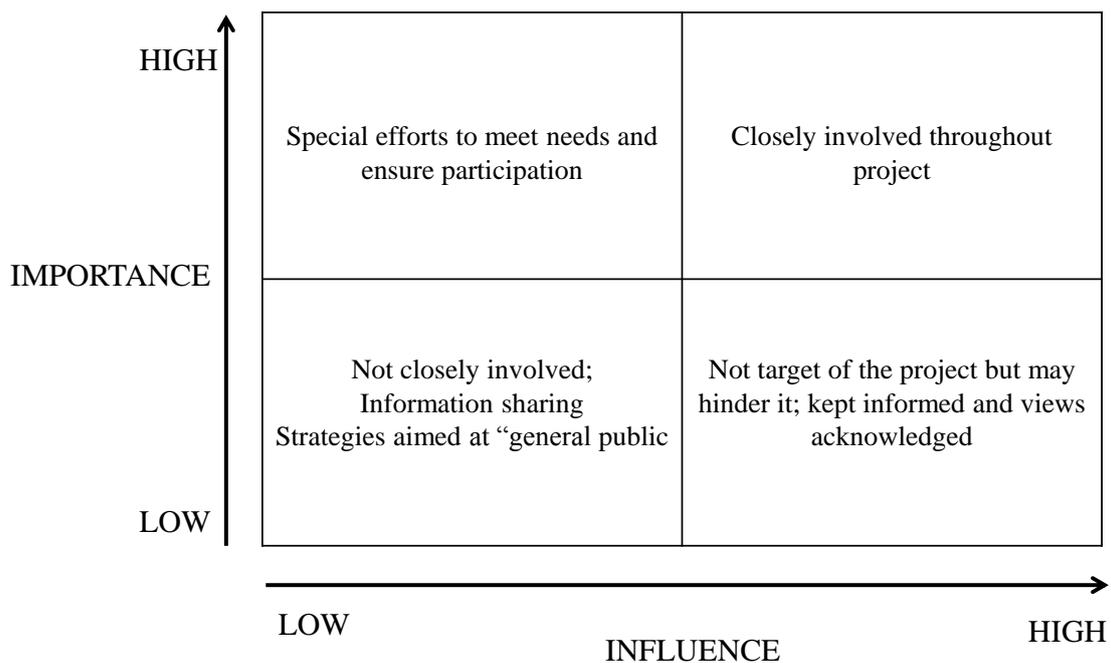
Step 2 research should provide the project team with the foundational information necessary to start to identify power relationships among stakeholders. Several particular pieces of information gained in Step 2 are important for understanding their power dynamics within stakeholder groups; Through this Step 3, the level of interest stakeholders have in the

project, their capacity to influence or affect the project and the social group to which they belong or can reasonably be associated with might be clearer by answering the following questions:

This step requires the project team to ask the following questions:

- Which are the stakeholders' interests that align most closely with project objectives?
- What are the stakeholders' positions on the specific project?
- Which stakeholders might form alliances?
- Who are the most important stakeholders (based on a power and influence analysis)?

Graphical representation of stakeholder influence versus relative importance can be useful in further analysis (see Figure 3).



**Figure 3** Classification of stakeholders according to their level of influence and their importance (FAO, 2006; World Bank, 2007).

The level of influence a stakeholder has on the project refers to their ability to affect the implementation of the project, and indirectly references the type and amount of resources the stakeholder controls. Influence can be exercised through affecting project decision making or implementation processes. The ability to influence project direction may come from a stakeholder's status or power, from informal connections with leaders, etc. The level

of interest is the personal level of significance the stakeholder attaches to the achievement of the project outcomes.

Stakeholders who are important to the project are generally those whose needs the project seeks to meet as well as those whose interests converge with the projects' objectives (see Figure 3). Actors with high influence and high importance are those who should be closely involved with the project to promote the achievement of results. Actors with high influence and low importance are not as important to the success of the project but have the potential to influence the progression of the project. Actors with low influence and high importance may require special efforts to enable them to become active participants to ensure that their needs will be met. For instance, rural women in a reproductive health project may have very limited influence over the project but their participation is crucial. Actors with low influence and low importance do not necessarily need to be reached out to for the purposes of project participation, but could be the target of general awareness-raising projects along with members of the general public.

Similar tables can be built with other variables such as: leadership (the willingness to initiate or lead an action for or against the project), control of strategic resources (legal, financial, lobbying, personal networks, etc.). In addition, some actors may possess significant influence over others actors, and multiple derivative tables could be constructed to illustrate networks of power within stakeholder circles. Tables could show dominant actors (high influence/low dependency), linking actors (high impact/high dependency), autonomous actors (low influence/low dependency) and dominated actors (low influence/high dependency). Stakeholders' attributes help explain the odds of a stakeholder becoming a "convener" or a facilitator to promote consensus and dialogue among opposing parties (World Bank, 2007).

This is a complex process as actors are not static and may evolve and undertake different roles over the course of the project. Moreover, the power assigned to each stakeholder is a qualitative label with subjective connotations. To develop as accurate a stakeholder map as possible, an in-depth knowledge of the stakeholder system is required, so participatory methods are again recommended to conduct this step of the analysis, especially when the project team are in culturally unfamiliar contexts.

#### Step 4: Action Plan

Previous steps try to ensure that the correct stakeholders are identified and accurately represented, ensuring that stakeholders become active participants in the development of the project. Different mechanisms can be proposed to generate interest and maintain commitment over the entirety of the project. For that purpose, it is important to consider the stakeholder analysis performed in order to ensure that key stakeholders receive priority.

Such participatory strategies should also facilitate and build alliances among different actors of the project.

By considering each stakeholder according to the analysis performed in the previous steps, varying levels of participation should be promoted for each group (since all stakeholders cannot and should not be deeply involved all of the time). Simplifying Arnstein’s Ladder (1969), four general types of participation levels might be:

- **Providing Information:** a one-way flow of general information to keep people informed about developments.
- **Consultation:** a two-way flow of more specific information, where views are taken into account in decision-making
- **Collaboration:** two-way communication where stakeholders assume greater control over decision-making in a partnership with the donor/lead agency
- **Empowerment:** two-way communication where primary control of decisions is entrusted to the stakeholders, often after capacity-building efforts have taken place to make this possible and in accordance with donor financial and reporting requirements. Table 3 illustrates how to organize this type of information.

Table 3 Participatory mechanism planned in each project phase.

	Information (one-way flow)	Consultation (Two-way flow)	Collaboration (Increasing control over decision making)	Empowerment (Transfer of control over decisions)
Project Design				
Project Appraisal	Insert specific participatory mechanism for key stakeholders such as Information campaign for general public, workshops with community groups, educational campaigns for children or target groups.			
Implementation				
Monitoring				
Evaluation				

Finally, it is important to note that projects which impact communities and community members cannot be implemented without the equal input of men and women. Gender is a key issue that affects many aspects of society including equity, wealth, power, etc., and it is

therefore is crucial to take into account, especially in communities where gender roles can figure more prominently in social structures.

## CONCLUSIONS

In summary, what has been proposed in this session is a switch from a strictly technical approach to project development and implementation to a more collaborative model. Applying this collaborative model in practice allows project team members to explore the main driving forces behind a particular area's persistent problems. This should be based on an accurate identification and characterization of the stakeholders and their relationships.

The best way to collect information on the project area is through a combination of office and field work, in close collaboration with stakeholders and using appropriate participative mechanisms. This is true for several reasons. First, it provides a broader view of the key issues affecting the project and facilitates the integration of a plurality of values and concerns in the process of project development. This minimizes the potential for future conflicts by improving the legitimacy and transparency of the project with members of the community. Second, it improves collective attributes such as sense of place, compromise and trust which reinforces not only decision-making but also local relationships. Third, it promotes social learning as the process itself develops participants' capabilities to debate and understand others' perspectives (Pahl et al. 2004). Fourth, it strengthens environmental awareness while enhancing the understanding of the links between the different dimension of problems addressed (e.g. social, political, economic, biophysical). Finally, opening up the scope of the project development process allows the project team to obtain much richer and more creative options for meeting project aims.

This approach, however, is not without limitations. The timeframe available for project development, as well as the need for higher human and financial resources are considered to be drawbacks. Nonetheless, collaborative approaches allow for a good opportunity to generate a wide variety of knowledge to inform decision-making process in a socially robust manner. It is important when working with collaborative methods that the person or people responsible for implementing this methodology should possess a certain set of skills; these include the ability to deal with different types of information, an open attitude to foster communication bridges and to build trust with stakeholders, the capacity to distinguish and consider such issues as gender among different situations.

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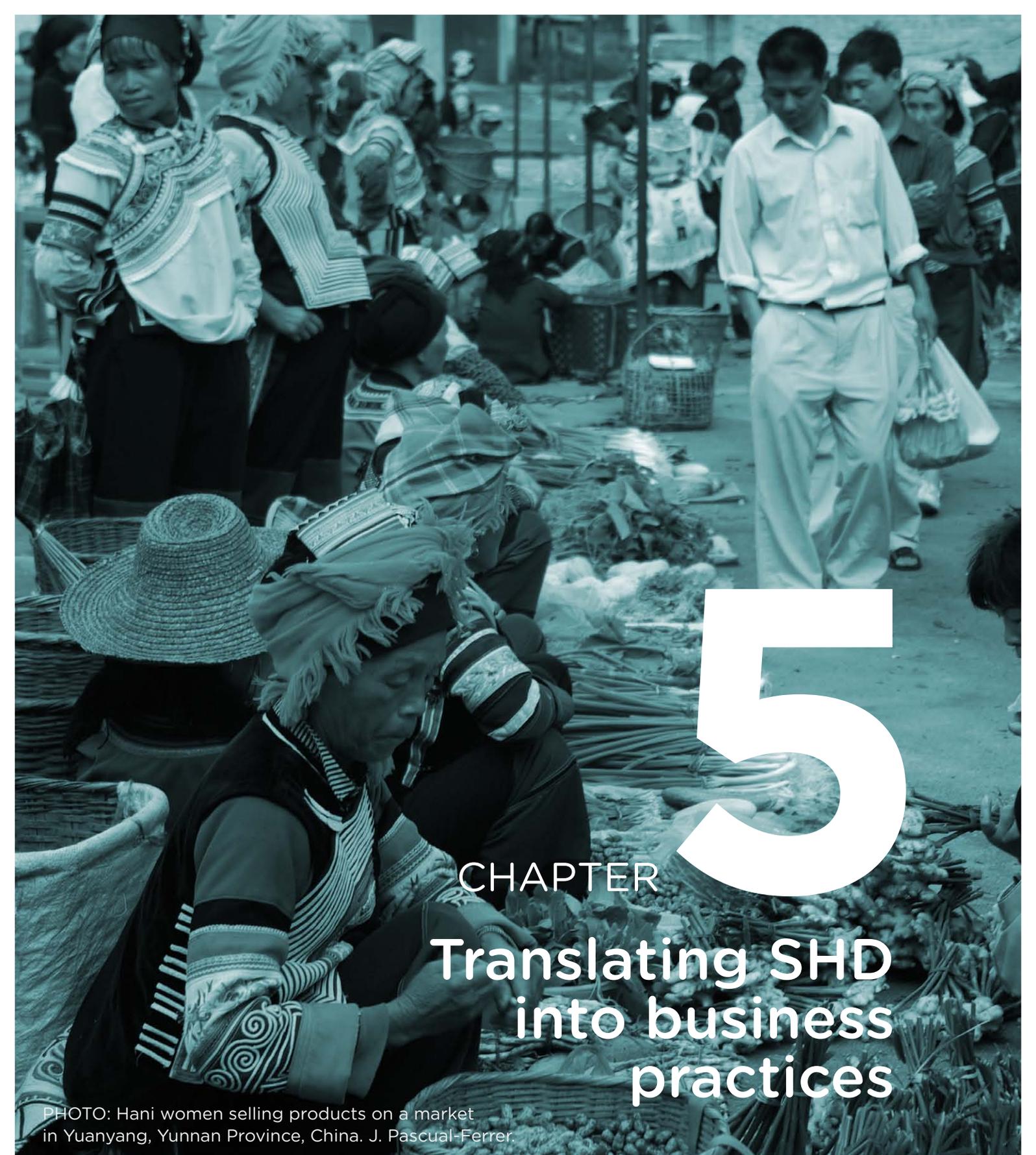
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## FURTHER/SUGGESTED MATERIAL

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- Work Group for Community Health and Development at the University of Kansas. The Community Tool Box: <http://ctb.ku.edu/en/table-of-contents/participation/encouraging-involvement>



# 5

CHAPTER

## Translating SHD into business practices

PHOTO: Hani women selling products on a market in Yanyang, Yunnan Province, China. J. Pascual-Ferrer.

# 5

## CHAPTER 5. Translating SHD into business practices

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# 5

## TRANSLATING SHD INTO BUSINESS PRACTICES

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### EXECUTIVE SUMMARY

In this chapter we will investigate the area of "Enterprise and Development". Beginning with a general look at the role of business in Human Development activities, some indications are given as to how the system of development cooperation is transforming, together with a review of existing convergences between the business sector and human development.

The core of the approach focuses on the joint work undertaken between actors of different natures, strategic objectives and interests, in a way that brings added value to development interventions. The complexity of global challenges, such as the fight against poverty or climate change, calls for companies, governments, international agencies and civil society to opt for ways of collaborating in which their abilities and strengths can complement each other, in order to provide innovative and effective solutions.

Following an overview of the key issues in the debate on corporate participation in the international development agenda, a road map is drawn up of the areas where business activity has the greatest potential to contribute to human development and the fight against poverty, defined according to the results of recent debates and reflections on the international agenda, and from the lessons gleaned from the initiatives that are most innovative in their exploration.

## LEARNING OUTCOMES

After you actively engage in the learning experiences in this module, you should be able to:

- Understand the recent, rapid changes in the framework of cooperation.
- Recognise the potential of the business sector in the fight against poverty.
- Identify opportunities and risks in the area of Enterprise and Development.
- Possess criteria to assess experiences in terms of their potential impact.

## KEY CONCEPTS

These concepts will help you better understand the content in this session:

- Human Development and the fight against poverty.
- Responsibilities of the business sector.
- Multi-actor cooperation to combine efforts in human development outcomes.

## GUIDANCE QUESTIONS

Develop your answers to the following guiding questions while completing the readings and working through the session:

- What role should the business sector play in the fight against poverty?
- How can the traditional actors in cooperation support the business sector in this area, and how should they guarantee they ensure proper alignment with shared and global objectives?
- Identify examples of companies that actively participate in human development work and evaluate their alignment with their expertise as a company.
- Reflect on the measures that would ensure proper collaboration between the traditional actors and the business sector in the area of development cooperation.
- Define your position concerning the size of the business actor involved in a human development task, and the size of the problem dealt with through this action. Look for arguments on the compatibility or incompatibility between micro-actions and macro-actors, and micro-actors macro-actions.

## INTRODUCTION

Political, economic and social changes are significantly modifying the stage of international relations. These changes have a decisive influence on the system of cooperation, introducing new determinants and, at the same time, permitting new responses to the problems of poverty and exclusion.

The way in which development is financed is changing. In the last two decades, the resources allocated to developing countries through direct foreign investment, private financing or remittances have been greater, and have grown faster than the flow of ODA (see Figure 1). This means ever-greater attention is directed towards these private flows, with increasing discussion on how to increase the impact these flows have on reducing poverty.

Since the International Conference on Financing for Development was held in Monterrey, in 2002, the international community has been very active in seeking out innovative sources of financing. This search is now made more urgent by the growing need for the resources required to solve global problems, such as climate change, but also by budgetary restrictions, given that the serious economic and financial crisis many donor countries have been suffering since 2008 is causing a significant reduction in budgets for Official Development Assistance. According to data from the Development Assistance Committee (OECD, 2013), official development assistance declined by 4% in 2012, in addition to the previous 2% fall in 2011. This represents 0.29% of the combined GDP of all DAC countries. In the case of Spain, reductions have been much more significant than the average. The ODA of 2012 represented 0.15% of GDP, down by almost 50% compared to 2011, while in 2009 0.47 % gross national income was dedicated to this end.

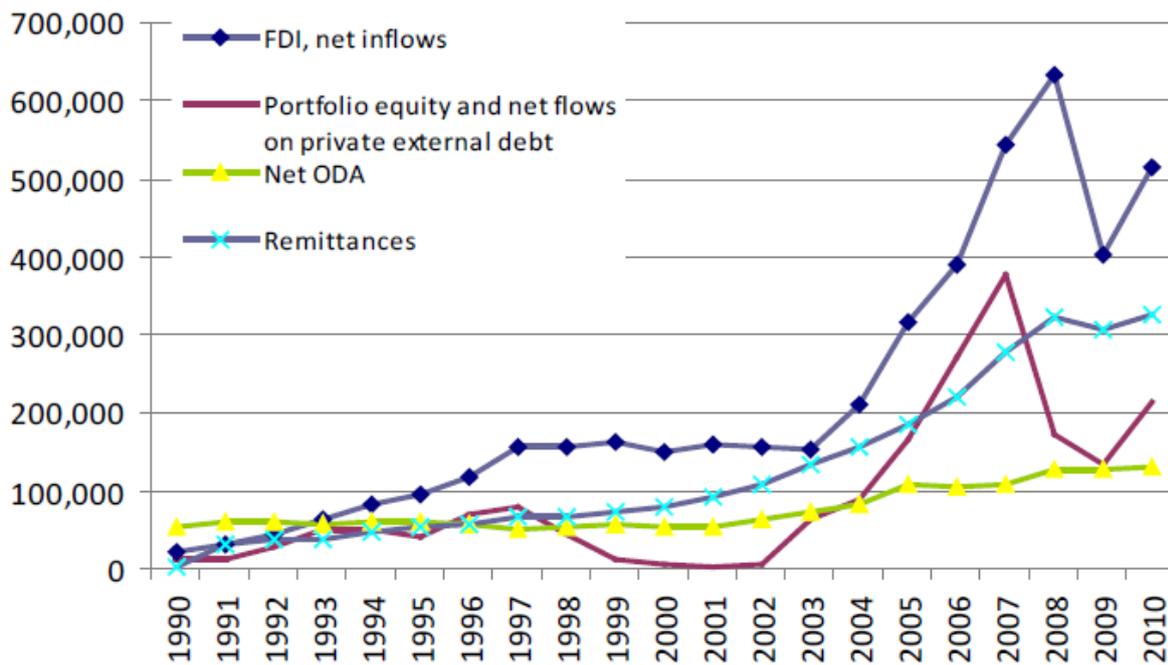


Figure 1 Financial flows to developing countries, 1990-2010 (millions of current US\$)  
(Source: World Bank, World Development Indicators. Cited by Alonso, 2012)

In parallel to the debate on sources of funding, another has been taking place on aid effectiveness, driven especially by the holding of four high-level summits on the topic (Rome 2002, Paris 2005, Accra 2008, and Busan 2011). It is of interest to note some changes that occurred at the last conference in Busan, as they represent a turning point in some of the dynamics referred to.

Firstly, the five principles of effectiveness agreed in the Paris Declaration were reaffirmed in Busan; however, it had to be recognised how little progress had been made in the six years since their approval. Secondly, the greater influence gained by donor countries outside the Development Assistance Committee of the OECD, and the greater influence of recipient countries in discussions, has caused the doctrine that the CAD has developed over its more than fifty years of existence to have increasingly less influence. Finally, the increased presence of civil society and the business sector has forced the agenda on effectiveness to be opened up and an appeal to be made for actors to engage in joint work (alliance).

## HUMAN DEVELOPMENT, ECONOMIC DEVELOPMENT AND ENTERPRISE

The theoretical underpinnings of the human development paradigm are attributed to Amartya Sen, awarded the Nobel Prize in Economics in 1998 for his contribution to the understanding of development as a process of expanding capabilities and freedoms. The association of Amartya Sen with two other extraordinary thinkers on development, Dudley Seers and Mahbub ul Haq, with the shared objective to focus the goal of development on people, rather

than on GDP growth, was instrumental in the process which led to the publication, in 1990, of the first Human Development Report of the United Nations Development Programme (UNDP) and its Human Development Index, which has been a point of reference ever since.

It is generally recognised that there is a close connection between human development and economic development. In fact, one of the most serious criticisms of the structure of the Human Development Index is the marked correlation between its three variables: domestic product, life expectancy and educational level. This is because when each of the three variables are considered separately the classification of countries does not present great changes, which suggests a strong dependence on one of them, see GNP, or an absent fourth variable.

The State plays a key role in the promotion of human development. The 2013 Human Development Report "The Rise of the South: Human Progress in a Diverse World", analysed the policies of the countries that have achieved the most rapid progress, and noted that one of the three drivers of transformation is a proactive developmental State (the other two drivers are the tapping of global markets and determined social policy innovation).

However, the role of the State alone, being essential, is not sufficient. Firstly, if human development means increased capabilities and freedoms, civil society organisations have an important role in defending and advocating it. In some countries, improvements in life expectancy, health, education or income, have been overshadowed by a lack of freedom, and the same UNDP report, despite not being overly critical of this aspect, indicated "enabling greater voice and participation of citizens" as a challenge for the future. Furthermore, much of the economic dynamism enjoyed by the countries that have made the most rapid progress in human development parameters has been driven by their business sector.

Thus, the three pillars upon which the relations of a society and its economy rest are: the Government (public sector), business (private sector), and the third sector (the so-called non-profit sectors). Each has its own function, and should perform it by itself, without expecting the other sectors to substitute it.

In analysing the transactions made between the various organisations and the populace, we can see how decisions made by business, government and the third sector have a major impact on the lives of the people. Furthermore, increased understanding and mutual recognition seem to occur between organisations, which means that each is able to identify their distinct and complementary role, and organise their contribution to broader processes in coordination with other actors (Mataix et al., 2008).

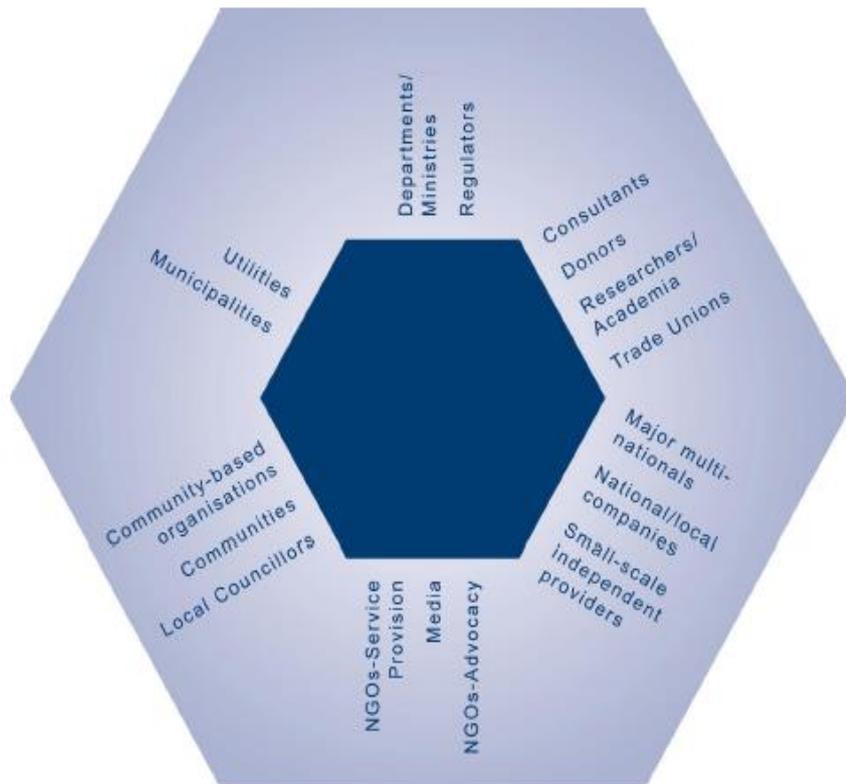


Figure 2 Development actors

(Source: *Building Partnerships for Development in Water and Sanitation (BPD)*)

Before we begin to investigate the role of business in development and cooperation more deeply, it may be necessary to clarify that the term "enterprise" applies to a very wide range of organisations, ranging from a large multinational that manages budgets larger than the sum of many governments, to an informal microenterprise that provides a precarious livelihood to a poor woman. Although each has a role to play in the arena of development, their potential and their responsibilities are not comparable. So, when we speak of "enterprise and development" it is usually necessary to begin by clarifying what type of company we are referring to in order to be able to analyse its capabilities and motivations.

### Position of the system of international cooperation in the business sector

The international system of development cooperation has evolved considerably in recent years, both in theory and in practice. One of the drivers of this change is the need to adapt to a new international situation, find more effective ways of promoting human development and encourage more efficient use of resources for this purpose. Another important factor is the interest companies themselves have in shaping the Development Cooperation agenda.

Companies have traditionally had a major role in channelling a large part of public funds allocated to development cooperation. Beyond this involvement, in recent years a new

framework for approaching companies is being generated, as part of a reconfiguration of cooperation that aims to incorporate a more strategic culture and a rapprochement between organisations from various sectors. The UN is playing an important part in this change.

In 1999, the then Secretary of the UN, Kofi Annan, proposed the creation of an alliance between the United Nations and the private sector, a "global pact of shared values and principles" (speech by Kofi Annan at the World Economic Forum 1999, Davos). This proposal led to the establishment of the Global Compact, which asks companies to embrace, support and put into practice certain values concerning human rights, employment standards, the environment and the fight against corruption.

In 2000, this pact was integrated across the board in the agenda of the Millennium Development Goals (MDGs), through the MDG 8, "the creation of a global partnership for development", which acts as the key instrument for achieving the other objectives. In this way, a door was opened to strategic partnership with the business sector in the fight against poverty. In addition to this explicit appeal to the business sector to engage in a specific goal ("in cooperation with the private sector, make available the benefits of new technologies, especially information and communications technology"), debate was raised concerning the impossibility of making progress on the MDG without the involvement of business, given the close links between them, as illustrated in Figure 3.

Kofi Annan continued to push strongly for the inclusion of the private sector as a strategic partner in the system of cooperation and, in July 2003, he announced the creation of the Commission on the Private Sector and Development within the UN. The purpose of this committee was to identify and examine ways of addressing the obstacles that limit the expansion of the private sector amongst low-income communities in developing countries, in addition to analysing how the market can generate development and wealth on the local and national level. In the words of Kofi Annan: "Our experience has shown that a large part of the work for development is about preparing the ground for sufficient private sector activity to provide the jobs and income needed to build a more equitable and prosperous society. Yet the UN has only sporadically tapped the power that can be drawn from engaging the private sector in the work of development." Several years later, in 2008, the United Nations Development Programme (UNDP) published the book "Creating Value for All: Strategies for Doing Business with the Poor", which highlighted inclusive business as a tool for fighting poverty, using the laws of the market themselves.



Figure 3 Ways that business influences Human Development

For its part, the European Commission's Green Paper "EU development policy in support of inclusive growth and sustainable development. Increasing the impact of EU development policy" (European Commission, 2010) indicated the need to maintain an ongoing dialogue with the private sector in order to define cooperation strategy: "Non-state actors are a force for and a component of development with their multiple roles of advocacy agents, service providers and donors or lenders in their own right, thereby bringing insight and added value. A regular dialogue with them needs to be sustained, such as the one launched by the Commission aiming at reaching consensus on the challenges ahead and the areas most in need of change."

The participation of the business sector in promoting development also featured at the Fourth High Level Forum on Aid Effectiveness in Busan, 2011. Along these lines, the final declaration, "Partnership for Effective Development Cooperation", recognised that development cooperation at present consists of a wide range of actors, amongst which the business sector is called on to play a major role. One of the proposed actions to reach the common objectives agreed on at the summit is the inclusion of the private sector in a partnership based on shared principles and differentiated commitments. Furthermore, the part of the document entitled "From aid effectiveness to effective development co-operation"

highlights the role of the private sector in promoting innovation, the mobilisation of resources on a domestic level, and in the creation of wealth and employment.

At Busan, an initiative called "building blocks" was launched with the aim of enabling all actors and development organisations to make concerted efforts in order to continue to make progress in some fields. One of the "building blocks" that was established was that of the "private sector." However, progress in implementing the ideas raised initially is slow. This is partly because the efforts of the international community have, since 2012, focused on discussion of the Post 2015 agenda, where the business sector is once again highly prominent.

At the Rio+20 conference in 2012, one of the main themes of discussion was the "Green Economy", which focuses on the development of economic sectors that are more respectful towards the environment, and that can in time gradually replace those of greater impact. Furthermore, the concept of Sustainable Development Goals (SDGs) was introduced, and the debate intensified on the integration of sustainability in the goals that replace the MDGs. In the Post 2015 discussion, the theme of business reappears and the business sector makes its own contribution to the debate, for example, through the Business and Industry Advisory Committee to the OECD (BIAC, 2013).

It would seem to be a fact that the objectives of development, sustainability and the fight against poverty set as priorities by the international development agenda require the involvement of the business sector, which has established itself as a key partner, together with governments, civil society and international institutions.

The potential contribution of business to development cooperation is clearly complementary to other existing competencies. The differential capacities of business are widely recognised: the capacity for innovation, efficiency and effectiveness, productive and organisational capacity, etc. These skills can be used by the system of cooperation for development, but in order to do so requires making it more flexible and able to adopt new approaches and ideas that, like any innovation, conflict with the traditional way of managing its activity. To this end, the Partnerships for Development are being promoted as tools that can help combine the capabilities of actors from different sectors and focus them towards a common goal of human development. The work of advocacy and mediation to facilitate rapprochement between sectors is essential (Tennyson, 2003).

Currently, there are various factors in want of improvement, such as the need for changes in the system of cooperation and the evolution of Corporate Social Responsibility (CSR), moving from social action towards a more integrated and approach, aligned with the policies and strategies of each company.

## THE TERRITORIES OF BUSINESS AND OF DEVELOPMENT

As already noted, business has played an important role in channelling ODA, through the realisation of business projects, purchase of goods or payment for services, and it is expected that in the coming years this situation will continue or increase, establishing new relationships with other actors (agencies, development banks, NGDO, etc.) focused on the procurement of services, selling products and other forms of collaboration within the framework of ODA.

However, there are other areas of growing convergence of business and cooperation that, although they may not always represent large flows of ODA, have a significant qualitative importance in shaping the system, especially in its current reshaping.

The following sections will present three prominent "territories" that arise when considering the issue of business and development from varying perspectives: corporate responsibility, the institutional context and, finally, operation (Mataix and Sanchez, 2011). As shown in the figure below, the three territories are interconnected. This point will be developed further in the sections that follow.

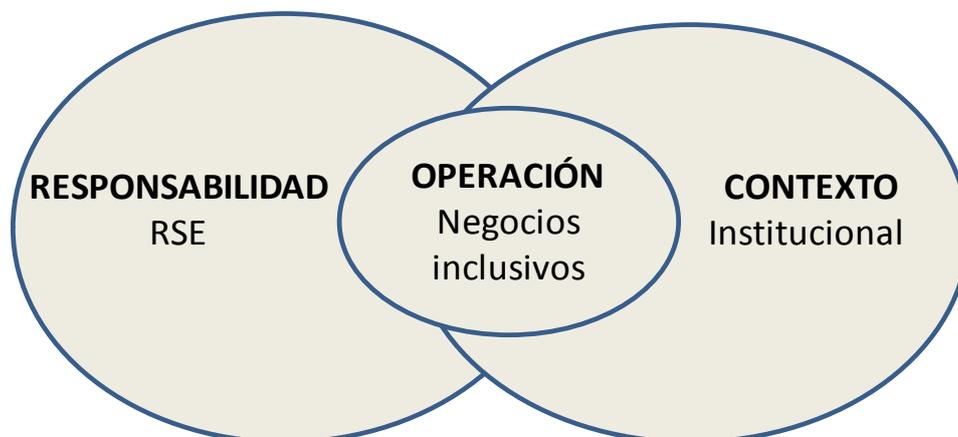


Figure 4 Map of business and development

Recognising which territory a particular initiative is being observed or launched from makes it easier to focus on the numerous debates on the role of business in development and international cooperation that are taking place today, not only in Spain, but also in some of the countries where Spanish cooperation operates.

This module gives an introduction to the 3 territories where business acts in relation to development. Subsequently, in Modules 2 and 3, the actions performed in the territory of social responsibility and operation are developed in more detail.

### The territory of responsibility

Amongst the many definitions of CSR, one of the most recent is that from the European Commission (2011), which, in its renewed policy on Corporate Social Responsibility, defines it as "the responsibility of enterprises for their impact on society." To the CSR Observatory, responsibility is "the way enterprises manage their businesses, taking into account the impact that all aspects of their activities generate on their clients, employees, shareholders, local communities, the environment, and on society at large. This involves compulsory compliance with national and international laws in the social, work-related, environmental field as well as those concerning human rights, and any other voluntary action that the company may undertake to improve the quality of life of its workforce, the community in which it operates, and society at large."

The European Commission's communication on the "Renewed EU strategy 2011-2014 for Corporate Social Responsibility" (European Commission, 2011), recognises the multidimensional nature of CSR, which at minimum covers human rights, employment and working practices, the environment, combating corruption, development and community involvement, the integration of disabled groups and the interests of consumers. Furthermore, it identifies certain cross-cutting issues, such as transparency and the social and environmental impact within the supply chain. It is therefore an agenda that has a wide degree of overlap with the agenda of human development and the fight against poverty.

Accordingly, CSR is based on the responsible interaction of the company and its stakeholders, including the environment. In developing countries, companies with international operations can be found operating in contexts that are very different from that in their countries of origin, in relation to poverty, the protection of human rights, the existence of indigenous peoples or legislation, amongst others. It is in these cases when CSR is especially relevant from the perspective of the impact of business on human development.

### The territory of the institutional context

There is a second area where business and development meet once again. In this territory, agencies from donor countries work, through bilateral cooperation, with governments in partner countries, trying to improve the institutional environment in which economic agents operate, reducing failures and imperfections in the markets, and creating conditions for economic development with a broad social basis.

The majority of donors promote initiatives of this type. For example, SIDA, the Swedish cooperation agency, calls it "Private Sector Development" (PSD) and defines it as follows: "Working with partner country governments and other bi- and multilaterals and Development Financial Institutions, to achieve efficient market systems, and create a conducive environment for private investment where business activity can flourish" (SIDA 2004).

In short, the primary purpose of the "institutional territory" is the development of the business sector in poor regions. Therefore, they are usually aimed at creating conditions to improve local small and micro businesses, which are the main source of employment and economic opportunities for the most vulnerable population.

**Table 1** Directives and areas of work of the Economic Growth Strategy and Business Structure Promotion (Source: Economic Growth Strategy and Business Structure Promotion of Spanish Cooperation)

Areas of intervention	Directives	Areas of work
<b>1.- Economic and business structure</b>	1.1. Support economic and social stability	a) Promoting economic stability b) Promoting political and social stability
	1.2. Develop the necessary infrastructure for economic activity	a) Provision and efficiency of infrastructures b) Involving the private sector in the provision and management of infrastructures
	1.3. Improve market coordination and development: policies to promote growth	a) Promoting productive investment b) Improving financial services to companies c) Supporting technological improvement and innovation d) Supporting the processes of opening markets and increasing international presence e) Promoting sustainability
<b>2.- Institutional framework for market development</b>	2.1. Define and protect basic economic rights	a) Defining and defending property rights b) Legal security of contracts c) Promoting and protecting employment rights
	2.2. Promote competition and entrepreneurship	a) Regulatory framework favourable to entrepreneurship b) Promoting a competitive climate in the markets c) Reliable information on markets and consumer protection
<b>3.- Participation of the poorest sectors</b>	3.1. Promote social cohesion	a) Supporting policies that promote social equity and social cohesion b) Supporting equitable regional policy
	3.2. Improve the	a) Services that support business activity

	entrepreneurial capacity of society, especially of the poorest	b) Access to ICT c) Supporting microfinance
	3.3. Support public policies for the promotion of decent work	a) Supporting training for employment b) Developing appropriate regulation of the labour market c) Supporting women to enter the labour market
	3.4. Revise the informal sector	a) Institutional framework that encourages employment formalisation
<b>4.- Spaces for dialogue, coordination and joint action</b>	4.1. Build capacities for joint action and social dialogue	a) Promotion of pacts and social dialogue
	4.2. Supporting Public-Private Partnerships for Development	a) Promotion and support of initiatives that include private sector actors

Most of the initiatives that could be included in the "institutional territory" already have a certain tradition in cooperation systems. In general, the sustainability of these initiatives depends on the injection of public resources as, very often, their sustainability cannot be guaranteed by the market. This is something that is aspired to by the initiatives that take place in the third region, which are explored below.

#### The territory of operation

This is an area in which companies, in collaboration with donors and sometimes also with NGOs, develop organisational and business models that enable them to reconcile their goals of economic expansion and sustainability with development objectives, taking particular care to create decent employment and increase the income of the most disadvantaged groups.

In this kind of jungle of new labels and their respective acronyms, the international agencies with most experience in this field have begun to use the name "Business for Development" (B4D).

Once again, SIDA defines B4D as "Cooperation with international and domestic private companies to leverage the positive impact of their core business on development. (...) B4D is thus both at method and an approach to demonstrate how SIDA works in a systematic way in partnerships with the business sector. Engaging with business and encouraging companies to develop new approaches to extend their core business and have a

transformative impact on the lives of the poor can be done in many sectors, Health, Education, Agribusiness, Forestry, Environment, Energy and Infrastructure."

Unlike the previous territory, in which the main focus of attention was on small and micro local businesses, here all types of businesses are incorporated, in particular those enterprises with capabilities for innovation and internationalisation, as a development actor. This is the area most recently "discovered", which is becoming populated with an increasing number of initiatives that are beginning to show the potential that can be activated if, for example, "inclusive" business is cultivated. This refers to economically sustainable business initiatives, which use market mechanisms to increase the level of human development for disadvantaged groups, through their inclusion in the value chain and/or through access to essential goods or services.

It is also the area that raises most doubts, partly due to a lack of awareness surrounding it, and to the difficulties and risks entailed in collaborative work between traditional cooperation partners and the business sector. The number of initiatives and donors involved with this territory is starting to multiply, although even the most advanced of them are still primarily at the learning stage.

Within the territory of operation, there are various methods or tools that can help companies to contribute to human development, including, on account of their special interest: inclusive businesses and those at the Bottom of the Pyramid (BoP), social economy enterprises, fair trade, socially responsible investments, microfinance, or Public-Private Partnerships for Development.

This area covers all those activities carried out by companies that form part of their core business, which, when performed with appropriate criteria and approaches, can contribute to the eradication of poverty. Such is the case, for example, in engineering and consulting projects that integrate social and environmental criteria in the design of infrastructures and services, or extractive industries that take into account the elements of decent employment and the prevention of environmental impacts (amongst others) in the way they conduct their business.

## AREAS WHERE WORK WITH THE BUSINESS SECTOR HAS HIGH POTENTIAL

The relationship of businesses with local communities in developing countries and the impact of their operations in these countries have not been systematically analysed, and are hardly addressed, even indirectly, in the sustainability strategies of companies. Nevertheless, a growing number of firms are internationalising their business and operating in developing countries, where legislation is more lax and, very often, respect for human rights is not sufficiently protected by the State.

There are increasingly more companies that need (reactively) or wish (proactively) to assess how their activities affect the societies in the countries where they operate. The demands of their customers and other interest groups, obtaining a "social license to operate", the motivation of their employees, reputational risk, opportunities for innovation and the possibility of opening new markets, are some of the reasons that have driven private sector interest in understanding and improving the impact their operations and decisions have on local communities.

In recent years, Corporate Social Responsibility strategies are incorporating the notion of "Shared Value", a term coined by Porter and Kramer—renowned authors in the field of business strategy—in an influential article published in 2006. Shared Value is based on the idea that social welfare and business success are intrinsically linked. Businesses need healthy, well-trained workers, a stable government and sustainable resources to be able to survive and compete in the market. At the same time, society needs useful and profitable businesses that generate wealth and create opportunities. The interest in creating Shared Value resides in companies being able to gain competitive advantage by incorporating social aspects into their activities, which in addition benefit society.

Some examples of this already exist and demonstrate that business activities carried out in harmony with the development of surrounding communities have positive implications, both for the people involved and the company itself. To do this, companies must properly orchestrate relationships with local communities, ensuring their involvement in the assessment of impacts and risks and in making decisions on issues that affect them, in addition to promoting their economic and social development.

In the next section, we deal with three interrelated areas where we believe that business activities have considerable potential to act in the fight against poverty and the generation of human development, and where aid agencies can play an important role: the integration of small producers in value chains and inclusive businesses, the development of products and services for the BoP and innovation in the provision of basic services.

### Development of products and services for the BoP

Companies can develop products and services specifically designed to meet the needs of the poorest people, those who find themselves at the bottom of the economic pyramid (BoP). In order to do this, it is necessary to adapt the design of the product, its functionality and business model to the particular context of the area.

In developing countries, products and services targeted at the BoP are the subject of great interest, but also considerable controversy. Not just any product will benefit a given population per se. An innovative design that takes into account the specific circumstances of the local context, together with responsible marketing, are fundamental components for this type of strategy to have a positive impact.

In regard to the conception of the poor as a potential market of buyers of products and services, it is essential to cite the influential work of CK Prahalad "The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits" 2004, which called on companies

(especially large multinationals) to enter into a huge overlooked market of millions of consumers and millions of dollars, the bottom of the economic pyramid, which was apparently being ignored. If these companies were able to develop strategies tailored to these enormous niches then they could, according to Prahalad, help address many needs and at the same time it would be big business; they would make "a fortune".

Prahalad's proposal has caused a great deal of controversy. Firstly, some authors have criticised that the base of the pyramid as defined by its proponents (the population with a purchasing capacity of less than \$8 per day) encompasses a broad segment that, in poor countries, could be considered as middle class, and there would appear to be nothing new, from the perspective of human development, in selling consumer products to the middle classes on a massive scale. Furthermore, it raises serious doubts about the social and environmental impact that the mass sale of consumer products that, in order to be sold at an affordable price, are offered packaged in small amounts and, in many cases, have a lower quality than their equivalents in the "traditional" markets.

In addition, the dilemma arises as to whether these businesses at the bottom of the pyramid provide truly "beneficial" products (e.g. mosquito nets) or rather "aspirational" products (e.g. cosmetics). Confusing perceived needs with real market demands has been a frequent problem when speculation has been directed at the potential of the "bottom of the pyramid". In fact, in a study by the Monitor Group on inclusive markets—one of the most extensive pieces of research carried out to date on this subject—it was observed, in working with groups of clients in rural microfinance institutions in India, that 85% of them chose, when given the option, products that could be considered "aspirational", rather than "beneficial" products that could help meet their basic needs. It must be taken into consideration that the buying behaviour of the poor is guided by psychological and environmental factors which large companies and their marketing departments are often profoundly unaware of. In many cases this makes it difficult to choose and promote products and services that affect the quality of life of the poor. At other times, when companies are aware of these factors, they consciously generate products and services for the BoP, but they do not entail any benefits for the advancement of human development.

Two of the main disciples of Prahalad dealt with many of these criticisms in their work "Next Generation Business Strategies for the Base of the Pyramid" (London and Hart, 2011). There they review and qualify many of Prahalad's core proposals, and acknowledge that the "fortune" that could be made from the base of the pyramid had been overestimated. They also recognise the difficulty that most companies have in understanding the markets in contexts of poverty and, to this end, they propose "doing business with the base of the pyramid" and argue the need to act in partnership with communities, NGOs and the aid system, which they recognise as playing a fundamental role in promoting these initiatives.

Similarly, they note that a large number of what are today presented as successful initiatives, that have achieved financial sustainability whilst making a meaningful contribution to development, originally had some kind of financial and institutional support of public or philanthropic origin. This fact highlights the important role that the cooperation system can

play as a promoter and catalyst for inclusive business. Ultimately, London and Hart accept that the BoP market rarely provides sufficient incentives to solve the large-scale needs of the poorest people and make a call for the creation of organisational "ecosystems" in which the interaction between actors of different nature, working in a collaborative environment with network structures, produce the conditions for the "co-creation" of "disruptive" innovations, both technological and, especially, organisational.

Despite the doubts and controversies, there are products that can bring benefits to the most disadvantaged people, which companies have been able to produce and market and make accessible to a large proportion of the poorest people. Nevertheless, creating and operating particular markets to satisfy basic needs is not always possible, and these initiatives have their limitations.

These cases may present an opportunity for public-private partnership. Indeed, some major partnerships between donors, governments and large companies, whose aim is to make certain markets viable and provide goods and services that are accessible to people with lower incomes, are yielding good results. For example, in recent times, State programs to transfer resources (money or bonds) can contribute to making some services economically viable and sustainable, such as the supply of electricity or the purchase of mosquito nets. In short, these are social spending programmes that seek to increase their effectiveness and scope through schemes based on the creation of protected markets.

### The integration of impoverished groups in supply chains

A supply chain is understood as the series of actors and activities that are necessary to develop a product or service and place it on the market. The generic functions performed in a supply chain are: obtaining raw materials, production, processing, distribution, marketing and waste management. The poorest populations can be integrated, formally or informally, in any of these functions or links in the chain; however, depending on how this incorporation is organised, the impact can be very different. The figure below represents a diagram of a value chain.

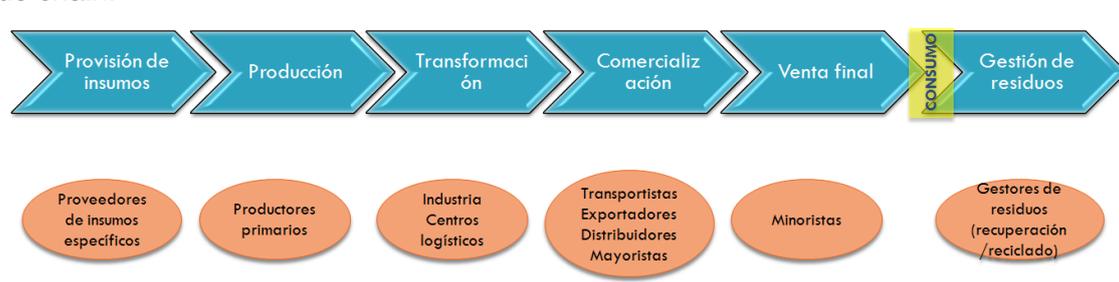


Figure 5 Diagram of a value chain

Low-income populations can perform a wide variety of functions in a supply chain: suppliers of raw materials, producers, distributors, retailers, waste managers, etc. Their inclusion in these structures is feasible, but in order for it to also be beneficial, the conditions of integration must be favourable to the poorest groups. When small farmers and micro-

entrepreneurs in developing countries are included in conditions of transparency and equity, when they are trained to understand and improve their differential contribution to the process, and when they are offered the necessary tools to properly negotiate their commercial transactions, the impact on poverty can be significant.

Conversely, when value chains are not developed based on responsibility and their impact on local businesses, they can create problems of the marginalisation of small suppliers, production centres, traders or waste managers with a weak structure, as the operation of the chain may favour large companies, which have a greater capacity to invest in infrastructure and increase their potential for action.

When it comes to implementing strategies that include low-income populations effectively, it is usually necessary that the company leading a supply chain undertake it as their own objective, that a social enterprise acts as an intermediary to orchestrate this connection and/or an NGDO or other organisation specialised in development cooperation play the role of facilitator in working with communities.

In order to create or improve employment, companies from developing countries and transnational corporations can act in two ways. Firstly, they can directly employ the most vulnerable population. To do so means placing particular importance on creating intensive business models involving low-skilled workers, and also on increasing the employment of women. In both cases, it may be essential to involve public-private partnership and, not infrequently, the participation of NGDOs and other social organisations.

Secondly, the integration of micro, small and medium enterprises in the local supply networks, as suppliers or distributors of its inputs or outputs, is often seen as a valuable opportunity to generate and improve employment and create new economic opportunities for the poorest populations.

### Inclusive Business

This context gives rise to the concept of inclusive business<sup>1</sup> – financially profitable enterprises that are environmentally and socially responsible and that use the market to improve the lives of low income families by through one or a combination of the following practices:

Their inclusion in the value chain, as input suppliers, agents that bring added value to goods or services, or as retailers/distributors of these.

Access to essential services of higher quality or lower price.

Access to goods or services that give them opportunities to do business or improve their socio-economic situation.

In practice there are many barriers to be overcome in order for local producers to guarantee the supply of products that meet the quality, stability and deadlines required by investing

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<sup>1</sup> Definition taken from “Inclusive businesses and markets”. AVINA, 2011.

companies. In this regard, efforts directed at training, the introduction of quality practices and management standards, or the access to markets, are central concepts in the majority of inclusive business programmes.

Often the success of such initiatives, which seek economic self-sustainability and the replication potential to acquire a certain scale, demand highly innovative organisational approaches that require a knowledge of the context and capabilities that companies do not always have. In this sense, an example would be the efforts of Oxfam America to work with companies to analyse the social footprint of their activities, and identify opportunities for improvement ("Poverty Footprint Methodology"). In the same vein, the document "Exploring the links between international business and poverty reduction"<sup>2</sup> presents the work of Oxfam with Coca Cola and SAB Miller (a major manufacturer of glass containers) in the application of this methodology in the supply chain of drinks in Zambia and El Salvador.

The "Inclusive Business Guide" (ENDEVA, 2009) notes that it is necessary to make major changes in order for the implementation of inclusive businesses to succeed. It lists these changes as:

Achieving market conditions that facilitate trade in communities in developing countries.

Reducing the limitations that exist today in five areas: market information, environmental regulations, physical infrastructure, knowledge and skills of participants in the market and access to financial services.

Promote models of financial innovation to keep costs down.

Inclusive businesses also have certain characteristics that must be taken into account when implementing them (ENDEVA, 2009):

New businesses should be developed in close consultation with the target group and other local experts.

The entire implementation process, including a successful pilot test, often requires a much longer time frame and more flexibility in terms of financing and project planning because so many new factors are involved. Cooperation with non-traditional partners like development organisations or the target group itself is usually necessary. Specific skills are thus required of the company.

Inclusive businesses frequently pursue several equally important goals of an economic, social and environmental nature, all at the same time. This requires more extensive performance monitoring and more clear-sighted alignment [...].

Inclusive business is almost the same as business on established [...] because it strives to gain competitive advantage through a clear and attractive value proposition, efficient processes and top-class partners. It is different because tough market conditions and lack of experience hinder business processes and because the partners are unfamiliar.

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<sup>2</sup> Downloadable at [http://www.thecoca-colacompany.com/citizenship/pdf/poverty\\_footprint\\_report.pdf](http://www.thecoca-colacompany.com/citizenship/pdf/poverty_footprint_report.pdf)

### Innovation in the provision of basic services

Innovation in the provision of basic services seeks to develop innovative models of providing essential services (water, sanitation, health, education, energy, access to information, waste collection, etc.) by improving their accessibility and their quality, for the most vulnerable populations.

Innovation for human development is a complex and uncertain territory in which the collaboration between multiple actors (entrepreneurs, businesses, government, social organisations, universities and research centres, investors, etc.) is shown as a decisive factor in creating the right conditions and the incentives for its promotion. Some authors have referred to this as the creation of "innovation ecosystems".

Innovation is, regardless of the adjective that accompanies it—technological, organisational, commercial, social—much more than an invention or a bright idea. Each innovation has to incorporate itself into a particular social context and prove its technical and economic feasibility. Therefore an idea does not become an innovation until it brings about real improvements in the systems that provide essential services. Its integration with the market (taking a broad interpretation of market), its success on the market and its sustainability, are critical factors.

## CONCLUSIONS

Having come to the end of this chapter, we can draw the following conclusions, which relate as much to the debates that will define the role of the company on the development agenda at all levels, as to avenues of exploration for new forms of intervention and learning based on practice:

- The contribution of business has enormous potential in the fight against poverty, but in turn raises a number of uncertainties and risks that should be taken into account when developing a specific intervention.
- The most traditional actors in cooperation for human development have extensive knowledge of how to implement human development projects in which the business sector has a place, and where it can contribute in many ways (not just financially).
- Multi-actor work in the area of Business and Development allows the added value of the various actors involved to be maximised, and guarantees the convergence of objectives and interests with global development challenges.
- The economic activity of the company needs to be compatible with the development problems to be resolved, but it must not be the only or predominant reason for the participation of the business sector.

- The various actors who are part of a multi-stakeholder partnership have a number of responsibilities that they must assume and incorporate into the way they undertake their activities.

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