Doctoral School in Environmental Engineering

Addressing equity in sustainability assessment: A theoretical framework with applications in the Oil & Gas sector

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Cover photo: Oil rig in Val d'Agri, Basilicata.

(Photograph by Angelo Antolino, National Geographic Italia, October 2010. Available at: http://www.nationalgeographic.it /italia/2010/10/27/foto/fotogalleria_texas_basilicata-129236/1/).

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“Al pellegrino che s’affaccia ai suoi valichi,
a chi scende per la stretta degli Alburni
o fa il cammino delle pecore lungo le coste della Serra,
al nibbio che rompe il filo dell’orizzonte
con un rettile negli artigli, all’emigrante, al soldato,
a chi torna dai santuari o dall’esilio, a chi dorme
negli ovili, al pastore, al mezzadro, al mercante
la Lucania apre le sue lande,
le sue valli dove i fiumi scorrono lenti
come fiumi di polvere.”

(Leonardo Sinisgalli, Nuovi Campi Elisi, 1947)

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Abstract

This thesis explores the concept of equity and proposes methods to make it operational in decision-making focused on promoting sustainability. The conceptual approach developed in the research draws on the recognition that the two notions of equity and sustainability are tightly intertwined in the sustainable development debate. As George (1999) claimed, sustainable development is founded on and fully embodied by intra-generational and inter-generational equity, which might be described as transactions of rights between and across generations, respectively. In spite of this, the implications on equity are still poorly addressed in strategic decisions.
This led to the identification of the three main objectives of this research.

The first objective is to understand the extent to which sustainability issues are addressed in current practice, focusing on Strategic Environmental Assessment (SEA) experiences of spatial planning and Oil & Gas development. To this purpose, a framework is developed to analyse the degree of consideration of sustainability principles in SEA, and demonstrate its application to a sample of SEA of Italian urban plans. This framework links Gibson's (2006) sustainability principles to a number of guidance criteria and eventually to review questions, giving particular emphasis to the key concepts of intra- and inter-generational equity. The framework was applied to review the Environmental Report of a sample of urban plans of major Italian cities. The results of this review shows that, even if sustainability is commonly considered as a pivotal concept, there is still work to be done in order to effectively integrate sustainability principles into SEA. Regarding the proposed framework, the review confirms the significance of clarifying equity concerns in the light of sustainability in view of operationalizing intra- and inter-generational equity in decision-making.

The second objective is to identify criteria and indicators to measure intra- and inter-generational equity, against which present state and future trends can be assessed. A conceptual framework for identifying the different implications related to the use of different values and perceptions on equity is built. Subsequently, a set of equity perspectives to guide the assessment of strategic actions through the lens of intra- and inter-generational equity is

proposed and discussed. This set includes four equity perspectives, compatible with each other with covered significant sustainability issues, and minimizing conflict, namely *opportunity, distributional fairness, distributional fairness across generations* and *justice for an imperfect world*.

The review of equity perspectives allows identifying a set of equity criteria that might be useful in focusing assessment on crucial and integrative sustainability issues. These criteria are reasonably inclusive of essential general intra- and inter-generational equity considerations that account for sustainability over space and time.

However, criteria need to be specific to the context of analysis. This is addressed in this study by selecting a specific sector of investigation that offered significant insights for dealing with sustainability in decision-making. The attention was directed to the Oil & Gas sector for the scope of challenges and positive chances posed to sustainability. For this purpose, the research work specifically fleshes out how current SEA of Oil & Gas sector practice addresses sustainability.

A framework for reviewing SEA practice helped to explore to what extent current SEA for the Oil & Gas sector contributes, procedurally and substantively, to sustainability oriented decisions. 11 case studies related to both off-shore and on-shore Oil & Gas developments are reviewed against this framework. The results show that case studies were more oriented to analyse opportunities derived from Oil & Gas development without fleshing out other potential developmental alternatives. Additionally, even if the SEA reports claim to pursuit a common strategic intent to equally share benefit derived from Oil & Gas development, they do not generally provide a means to tackle this aspect. This part of the investigation allowed also to support the identification and selection of aspects, elements, suggestions and best practise that would assist in defining contest-specific equity criteria and indicators for decision-making in the Oil & Gas sector.

This leads to the third objective of the thesis: testing the applicability of the proposed methods to a case study, dealing with complex decisions at strategic level. A case study on Oil & Gas development in the Basilicata region (Southern Italy) was selected: the Val d'Agri oil field, Western Europe's biggest onshore oil field. Scenario storylines, representing interactions among environmental, social and economic concerns, are constructed and applied against the framework. Specifically, short-term and medium-long term scenarios are developed by

varying geographical scopes, ranging from the regional scale to two nested local areas surrounding the Oil & Gas activities.

Scenarios are then assessed against the set of intra- and inter-generational criteria identified by selecting appropriate indicators adapted to context and available data. Indicators are valued according to a quali-quantitative analysis that assisted in examining and comparing trade-off between human and environmental systems under the different scenarios. The results helped to identify opportunity and risk of different scenarios at strategic level. None of the scenarios provided "the best solution" in term of aggregated equity scores or perfect win-win solutions for each equity perspective. In the long-term, none of the territorial levels (local and regional) seemed to acquire significant increase in equity benefits, not even one at expenses of each other. According to the assumptions, this might suggest that incremental benefits of Oil & Gas development are concentrated outside the three level considered. Nevertheless, the case study shows that approaching to decision with more attention to a sustainable management of the environment and involving institutions at different levels might be a key role in achieving more wide-spread and long-term positive results.

However, scenarios presented possible significant trends in equity criteria, which were affected by restraints in data collected, as well as, simplifications and approximations in analysis. In this exercise, it was assumed that all equity criteria within each temporal dimension receive equal weights and that all three geographical levels were equally weighted too. Introducing participatory mechanisms might be useful for supporting interpretations of implications potentially affecting generations at different temporal and territorial scale, satisfying possible needs of other equity criteria, and establishing priorities in perspectives on equity adopted. In this sense, the equity framework proposed might be a suitable tool for supporting and guiding deliberative processes. Analogously, the spatio-temporal decision matrix, framed through the lens of equity for assessing scenarios against equity criteria, might represent a simple yet flexible framework for analysing and discussing concurrently temporal and spatial implications of plausible storylines.

Chapter 1

Introduction

A sustainable and desirable future is one that respects biophysical boundaries, distributes resources and responsibilities fairly, and adequately values and balances built, human, social and natural capital assets (Costanza, 2012). The two notions of equity and sustainability are tightly intertwined in the sustainable development debate. Sustainable development could be fully conceptualized by the notion of inter-generational and intra-generational equity (George, 1999). Inter-generational equity refers to a transaction of rights across generations, while intra-generational equity refers to a transaction of rights between people of the same generation.

Thus, the links between sustainability and equity are multi-dimensional and mutually reinforcing, demanding for in depth examination of dynamics between human systems and environmental systems under conditions of uncertainty. These interactions are complex and multi-scale, and involve multiple feedbacks and trade-offs that affect both conditions of the environment and its capacity to provide services that contribute to human wellbeing (Clark, 2010).

Correlated complications concern how to evaluate equity in distribution of effects of decisions on present as well as future generations. This requires us to explain better which uses of the natural environment can generate sufficiently large, wide-spread and long term benefits to human well-being (Partidário et al. 2010; Clark, 2010; Kauffman, 2009). But it is not easy to put this combined challenge into practice, since there are numerous and complex relationships involving society, the economy and the environment, involving direct and indirect dependencies, a variety of different interests and beliefs, and various sometimes diverse goals (Munier, 2005). Thus, despite the stated importance of equity, there is still a lack of formal theory for addressing it in planning literature and decision-making processes (Fisher, 2007; Halpern et al., 2013).

1.1 Objectives of the study

This research aims to provide a means of integrating the concept of intra- and inter-generational equity, focusing on strategic decisions related to the environment, through Strategic environmental assessment (SEA) and sustainability assessment. More specifically, the objectives of this study are:

- to understand the extent to which sustainability issues are addressed in current practice, focusing on SEA experiences of spatial planning and Oil & Gas development;
- to identify criteria and indicators to measure intra- and inter-generational equity, against which present state and future trends could be assessed;
- to test the applicability of the proposed methods to a case study, dealing with complex decisions at strategic level. The selected case study deals with Oil & Gas development in ecologically sensitive and biodiversity rich areas.

1.2 Research context

In this section, it is provided a brief outline of the research topics to orientate the reader to better follow the discussion pursued in this thesis. Three points are briefly discussed. The first is over the nexus between sustainability and equity. The second concerns the linkages between strategic actions and sustainability assessment. The last gives a short overview of a specific context for dealing with strategic decision-making.

1.2.1 Equity and Sustainability

The two notions of equity and sustainability are tightly intertwined in the sustainable development debate. Sustainability itself means justice to future generations. In fact, equity is intrinsic and central to the original concept of sustainable development - *development that meets the needs of current generations without compromising the ability of future generations to meet their needs* (WCED, 1987). George (1999) recognizes that sustainable development is founded on and fully embodied by two equity principles, namely inter-generational and intra-generational equity.

Inter-generational equity refers to the need for a fair distribution of gains and losses across generations, while intra-generational equity refers to equity between people of the same generation. In fact, as George (1999) points out, the first principle resembles the above mentioned definition of sustainability, while the second is a necessary condition for development that equitably meet developmental and environmental needs between generations according to the Rio Declaration (United Nations, 1992). Thus, George (1999) argues that inter- and intra-generational equity principles provide a complete definition of the sustainable development concept according to the Stockholm Conference on the Human Environment (UNEP, 1972), where the conflicts between environment and development were first acknowledged (Kates et al., 2005).

Anand and Sen (2000) claim that it is difficult to conceive a situation where a case is made for inter-generational equity while underplaying intra-generational equity. For immediate and long-term integration of sustainable development purposes, Gibson (2006) observes that it is essential that the two equity principles are developed in ways that are at least compatible and preferably mutually reinforcing. Also George (1999) worries about a sustainable development that respect the environment's carrying capacity limits, without being intra-generationally equitable, simply by restricting the numbers of people who benefit from it. As claimed by Padilla (2002), the search for sustainable development is closely linked to the solution of problems of inequity that could endanger sustainability and are against the same concept of development.

Equity for future generations – Inter-generational equity

The principle of inter-generational equity embodies a basic belief that the well-being of future generations is as important as the well-being of present generation (Roemer and Suzumura, 2007). Morrison-Saunders and Pope (2013) noted that: 'Favouring current generations or short-term benefits at the expense of future stakeholders and interests is one type of trade-off that can result during sustainability assessment decision-making'. Inter-generational equity, would then be assumed as a transaction of rights between generations, and the legitimacy of taking only into account the preferences of present generations should be questioned when considering actions that can seriously affect several generations.

For example, as Roemer and Suzumura (2007) point out, it is very clear that global climate change poses a unique externality problem in which many of those who will be most severely affected have not yet been born. Importantly, Beder (2000) notes that it is unfair to presume that technological and research advancements will enable latter generations to solve the problems left them by former generations. The challenge with inter-generational equity though is that future generations cannot be directly represented in assessment processes. George (1999) noted that an important distinction must be made between conserving capital (i.e. for the benefit of future generations) and valuing as the necessary value judgments fall to the present generation to make. Clearly there is a fundamental tension here.

In order to ensure a fair treatment to future generations, an assessment process should recognize and protect their right to enjoy at least the same capacity of economic and ecological resources that present generations enjoy (Padilla, 2002) or as George (1999, p180) puts it, inter-generational equity can be restated as 'the principle of conservation of capital'. Gibson et al. (2005) go further to argue that inter-generational equity should not only refer to the ability to favour options most likely to preserve, but also to enhance opportunities for future generations.

Equity within present generations – Intra-generational equity

Where inter-generational equity is characterised by the maintenance of capital over time, the principle of intra-generational equity is focused on the distribution of, or access to, capital within present generations such that everyone receives a fair share. To deliver on this will require attention be given to both process and substantive elements. While a development that maintains overall capital might be considered to be substantively sustainable (and George 1999 notes that this can be delivered simply by respecting the carrying capacity of the environment), it would fail the principle of intra-generational equity if the distribution of costs and benefits is skewed to favour and/or disadvantage certain groups or individuals within society.

This introduces the key role played by considerations of sociological factors identified by Haughton (1998) such as race, ethnicity, class, culture, and political power in decision-making, whereby minorities and other groups may be systematically disadvantaged. There is also a spatial element and Haughton (1998) points out that it is important to emphasize that intra-

generational equity also covers social inequities across communities, regions and nations within one generation. Gibson et al. (2005) conceive of intra-generational equity as the ability to ensure equity of sufficiency and opportunity for all people of the same generations.

The concept is thus inherently tied up with quality of life. While easily defined, how to deliver intra-generational equity is contested. For example, divergent positions coexist in the literature on how the various dimensions of equity should be interpreted. It leads to intensely moral and potentially endless discussions of equity concerns such as needs, rights, responsibilities, and choice (Gibson, 2006; Haughton, 1998). This research endorses the approach of combining inter- and intra-generational equity principles in order to fully conceptualize the sustainable development notion.

1.2.2 Sustainability assessment and strategic actions

Strategic actions embrace a huge range of decisions and are generally referred to policies, plans or programme (PPP). According to the most cited definition of these terms, a policy is the inspiration and guidance for action, a plan is a set of coordinated and timed objectives for the implementation of the policy, and a programme set of projects in a particular area (Wood and Djeddour, 1992). Thus, strategic decisions taken in policies, planning and programming processes, are defined as frameworks for action. They seek to anticipate new trends, discontinuities, and surprises, enhancing ways of taking advantage of opportunities (Albrechts, 2004). Examples of strategic action include (Therivel, 2010):

- Policy: legislation, policy statements, economic policies, e.g. a national energy policy;
- Spatial plans and programmes, e.g. national, regional, urban;
- Sectoral plans and programmes, e.g. for agriculture, transport, waste.
- Policies, plans or programmes to achieve environmental or social ends, e.g. poverty reduction strategies, policies for improving air quality.

Decisions in planning are considered neither rational nor linear, nor are value-free and only technical (Nelson, 2011). In this context, Fisher (2007) also observes two critical aspects. Firstly, he reaffirms that non-material, cultural and ethical tend to be underrepresented due to utilitarian and economistic views prevailing in planning as claimed more than 20 years earlier by Ortolano (1984). Secondly, he notices that there are still indications that long-term visions of sustainable development and associate and objectives, with time horizons of

between 20 to 30 years, are not consistently followed through PPP making practice. Gibson (2006) recognises that tensions between economy and environment remain unsolved in conventional PPP practice, which seek to balance development with the need to protect the environment. He claims that the genius of the sustainability concept lies in recognizing that social, economic and biophysical objectives must be treated as interdependent factors. Sustainability cannot be achieved by balancing economic, social and ecological ends, but reversing invidious trends in the economic, social and ecological realms together.

However, over the past decade it has been largely recognized that planning for sustainability requires different methods and a changed paradigm from traditional planning (Rotmans et al. 2000). A more strategic-based idea of planning is therefore needed, which is based on new tools as well as rethinking and combining existent approaches in planning, such as the use of scenarios, foresight studies, public participation or debates about sustainability (Martens, 2006; Sheate et al., 2008; Pope and Dalal-Clayton, 2011; Bond and Morrison-Saunders, 2011). The stress on sustainable development has therefore led to the promotion of sustainability-led frameworks to support strategic planning. Integrated methodologies are considered highly suitable for this purpose (Martens, 2006; Gibson, 2006; Morrison-Saunders and Therivel, 2006; Morrison-Saunders et al., 2013). Various observers have express support for a broader assessment process of this kind that explores the impact of human actions on sustainable development issues (Jones et al., 2005).

There is therefore a need for approaches that aid to understand in an integrative way the environmental, economic and societal impacts that strategic decisions can have on sustainability. Highlighting the range of complexities that need to be taken, many authors believe that holistic systems principles can effectively guide the methods, process and context of integrated appraisals. They also recognize that integrated, sustainability-led assessments might facilitate continued or even renewed neglect of traditionally under valued considerations, especially the protection of ecological systems and functions. This problem needs to be addressed thoughtfully in judgements about how integration is to be done. More integrated assessment procedures that can assist in strategic decision-making include tools such as sustainability assessment and strategic environmental assessment.

Sustainability Assessment (SA) is a decision-making tool intended to anticipate the sustainability implications of proposed actions (Pope et al. 2004). SA is considered a strategic

form of assessment that not only aims to evaluate the social, environment and economic implications of actions, but also the interrelations between and among these parameters (Gibson, 2005). Close to SA but more globally widespread, Strategic Environmental Assessment (SEA) is often interpreted as having sustainability goals too (Bond and Morrison-Saunders, 2011). SEA is "a systematic decision support process, aiming to ensure that environmental aspects are considered effectively in PPP making" (Fisher 2007). A typical SEA would include the description of proposal under consideration (scoping), considerations of alternatives, including the no action option, evaluations of impact, proposed mitigation and, enhancement in sustainability-based versions, measures, stakeholder involvement and transparency through consultation and dissemination, communication of decisions, with explanation and justification, proposals for implementation, monitoring and evaluation (Therivel, 2010).

Over the past two decades the substantive purpose and values of SEA has gradually evolved arising a crucial debate related to the possible shift of SEA towards sustainability assessment (Bina et al., 2011). Several scholars claim that, even if SEA deals primarily with the biophysical environment, it provides a useful example for understanding the relationships between strategic tools and decision-making, also addressing economic and social parameters (Dalal-Clayton and Sadler, 2005; Sheate, 2008). It is also necessary to notice that some observers show a sharp contrast with the opportunity of shifting SEA towards sustainability assessment believing in the centrality of biophysical issues (Sheate et al., 2003; Kidd and Fischer, 2007). They mainly argue that SEA has to remain focused on environmental considerations rebalancing the predominance of economic and social issues in decision-making. By the contrary, it is also important to consider that keeping environmental arguments separate avoids the risk that unsustainable environmental consequences are not detected.

Thus, it has progressively agreed that SEA works as an advocate tool, which is supposed to reorient strategic planning processes towards achieving more environmentally sound and sustainable decisions (Fisher, 2007). Moreover, SEA has the potential to become a much stronger tool for challenging the links between quality of life and economic growth (Partidário, 2010). To this purpose, two priority aspects should be considered. Firstly, it demands for shedding light on the nature of the socio-economic, biophysical and ecological systems, their response to human interventions, and the possible implications of proposed new activities (Martens, 2006; Kajikawa, 2008; Ostrom, 2009).

Secondly, it is necessary to redefine decision objectives and criteria that focus attention on the interrelations among the economic, social and environmental dimensions rather than on the three conventional categories separately.

However, in practice, even if we can consider the three pillars relatively separable, they interact to produce outcomes, which in turn feedback and affect one another at different scales in space and time (Ostrom, 2009). In this vision, a strategic action could be sustainable if it is at least acceptable socially, environmentally and economically and without causing significant trade-offs (Gibson, 2006). Such mechanism includes the concept of "net conservation benefits'" or "environmental offsets". Offsets can be considered as a special kind of trade-off, made within a pillar rather than between pillars (Pope and Dalal-Clayton, 2010). This research addresses such approaches, with emphasis on the strategic level of decision-making.

1.2.3 Sustainability challenges in the Oil & Gas sector

The exploitation of Oil & Gas resources poses several challenges to intra- and inter-generational equity. First of all, although it represents a significant business opportunity, economic gains are often distributed unevenly and unwisely, providing short-term gains to selected beneficiaries, at the expenses of a more sustainable economic growth and improvement of social conditions (Norwegian Ministry of Environment, 2009). Secondly, the impacts of Oil & Gas operations are interrelated and largely context-dependent, hence difficult to foresee and be estimated by simply looking at previous experiences (E&P Forum/UNEP, 1997).

Interrelationships across environmental, economic and societal concerns are complex and multiscaled: environmental impacts (e.g. loss of biodiversity) may cause socioeconomic effects on economic activities (e.g. tourism) and on the wellbeing of local communities (e.g. health issues, resettlements). Moreover, there are issues related to the high costs of cleaning-up (e.g. in the case of accidents), and to the long-term consequences of environmental degradation (e.g. climate change). Even if these reflections apparently can be said for any resource development sector, what gives rise to particular attention is the magnitude of the challenges posed by Oil & Gas development.

With regard to sustainability and equity discourse, exploring Oil & Gas development should help in making more evident and glaring obstacles and drawbacks in achieving sustainability. According to the World Bank (http://www.worldbank.org/en/topic/extractiveindustries, last accessed, December 2013) about 3.5 billion people live in countries rich in oil, gas or minerals. Socio-economic and environmental concerns are sensibly amplified. To give an immediate example, impressive and striking disparities are caused by unfair distribution of economic benefits between oil companies and local people.

However, due to the relevance of the business, Oil & Gas sector represents an important source for domestic economy that can potentially support the implementation of development strategies at local and regional level. These strategies could promote balanced development and attract investment, while at the same time enabling regional and local actors to participate in the development of region-specific solutions to development problems (Bachtler and Yuill, 2001). With good governance and transparent management, Oil & Gas sector can have a pivotal and transformational role in reducing poverty and boosting shared prosperity, while respecting community needs and the environment (The World Bank, 2010).

Thus, Oil & Gas development represents a sector for which is particularly important to identify widespread and long-term sustainability goals and objectives and to ensure that a strategic-based assessment is integrated into decision processes from early stages. This requires that decisions related to the management of Oil & Gas activities are taken by involving all stakeholders in assessing this complex network of interrelationships between existing resources, emerging opportunities and constraints in a long-run prospective.

1.3 Research approach and outline of the thesis

I approached the research objectives by structured investigations into two main parts. The first, presented in chapters 2 and 3, regards the development of a theoretical framework for dealing with intra- and inter-generational equity issues. The second, from chapter to 4 to 7, is related to the application of the proposed framework to a case study.

I began this research by reflecting on the potential of SEA in addressing sustainability concerns during policies, plans and programmes, focusing primarily on spatial planning. To this purpose,

I explored an extensive literature concerning sustainability issues, theory and assessment, and following the example of several approaches for operationalizing sustainability principles, I developed a conceptual framework for linking the Gibson's (2006) sustainability principles to a number of guidance criteria and eventually to review questions gathered from literature.
The purpose of this was to identify and select key themes, principles and criteria can aid in interpreting sustainability implications for decision-making. Successively, I adopted the proposed framework for analysing the degree of consideration of sustainability principles in Strategic environmental assessment (SEA). Chapter 2 presents the proposed framework, and demonstrates its application to a sample of SEA of Italian urban plans.

In view of formalizing a practical approach for integrating intra- and inter-generational equity criteria in strategic actions, I completed the theoretical investigation by gathering more understanding on how to deal with the presence in the literature of a variety of positions on how the various dimensions of equity should be interpreted. Thereafter, I fleshed out the multifaceted concept of equity. In particular, I examined in more detail the nexus between a plurality of approaches to sustainability and values and perceptions on equity.
Thus, I framed a conceptual framework for linking the most diffuse interpretations of the sustainability paradigm to equity perspectives and relating general principles that might be considered in strategic decisions. Drawing on the conceptual underpinnings of each equity perspectives, I discussed the possibility to infer a sub-set of equity perspectives to guide the assessment of strategic actions through the lens of intra- and inter-generational equity. The set includes perspectives compatible each other with covers significant sustainability issues, and minimizing conflict.
I concluded this stage by listing a set of criteria for addressing concurrently intra- and inter-generational according to set of equity perspectives selected. I suggested the list as reasonably comprehensive of important general intra- and inter-generational equity considerations that account for sustainability over space and time. Chapter 3 presents the conceptual framework for clarifying the nexus between equity and sustainability, and the steps undertaken for developing a set of general criteria for addressing intra- and inter-generational equity in strategic decisions.

In the second part of my research, I sought to provide and test an approach that helps in explicitly assessing equity consequences of decisions over space and time dealing with

complex decisions, based on the equity approach of Chapter 3. Firstly, I dealt with the fact that although generic criteria might be useful for orienting assessment, they need to be rearranged in relation to the context under examination. In view of testing the applicability of the proposed methods to a case study, I decided to focus on strategic decisions related to Oil & Gas development. I selected this sector according essentially to three insights.
Firstly, this is an emblematic example of complex strategic decision-making. In fact, it may generate important development opportunities as well as critical risks for sustainability. Secondly, there is a growing international awareness about the imperative need to shift planning and impact assessment processes related to Oil & Gas activity towards more strategic and sustainability-based model. Finally, the possibility to apply the equity approach developed in this research to a case study in Italy, which is related to an area, considered the most promising for on-shore oil exploitations in Western Europe.

Thus, I undertook an analysis and comparison of SEA processes applied to Oil & Gas activities in order to gather a wider understanding of the extent to which sustainability issues are addressed in current practice, focusing specifically to the context of Oil & Gas sector.
Firstly, I explored to what extent current SEA practice for the Oil & Gas sector contributes, procedurally and substantively, to more strategic and sustainability-oriented decisions (Chapter 4). To this purpose, I adopted a framework for reviewing SEA practise, based on the strategic model for SEA developed by Partidário et al. (2009), and I applied it to 11 case studies related to both off-shore and on-shore Oil & Gas developments. Secondly, I tested against these case studies a more integrative approach based on Critical Decision Factors (CDFs), presented and discussed in Chapter 5. CDFs are key integrated factors that act as the windows of observation to focus attention on those environmental and sustainability issues that should matter for decision Partidário (2012). The purpose of these investigations was also to support the identification and selection of factors, elements, suggestions and best practise that would assist in better explicating contest-specific equity criteria and indicators for decision-making in the Oil & Gas sector.

Finally, I applied the proposed equity approach to a case study, namely "*Val d'Agri Oil fields*" in Basilicata (Southern Italy). The Basilicata region, an area relevant in terms of environmental value and landscape attractiveness, presents the largest onshore reserves on Western Europe considered to be Europe's most promising onshore development area. The purpose of this case study was twofold: to test the equity approach proposed; and to shed light on how

different development decisions can affect intra- and inter-generational equity issues.
Thus, drawing from the examination I conducted on SEA of Oil & Gas development and desk research for the case-study characteristics, I identified and specified equity criteria indicators to respect the context involved in the analysis. I therefore adopted scenario analysis approach for constructing plausible future scenario storylines, representing composite example of interactions among environmental, social and economic concerns.
Then, I examined the hypothesised scenarios against the set of equity criteria identified by selecting appropriate indicators adapted to data disposability. I adopted a quali-quantitative analysis for valuing indicators. The purpose of this was to use a suitable way to examinee and compare trade-off between human and environmental systems under the different scenarios.

Chapters 6 and 7 are over the case study application, namely Val d'Agri Oil fields. The first describes the case study related to Oil & Gas sector and the construction of possible future storylines for the study area. The second is devoted to testing the theoretical approach proposed. This presents an empirical approach for assessing plausible scenarios against the proposed equity framework and evaluating trade-offs across present and future generations.

In the last section (Chapter 8), the most important results of the research are summarized, and the final conclusions are drawn. Possible directions for future investigations are therefore proposed. Figure 1.1 displays the flowchart of the thesis.

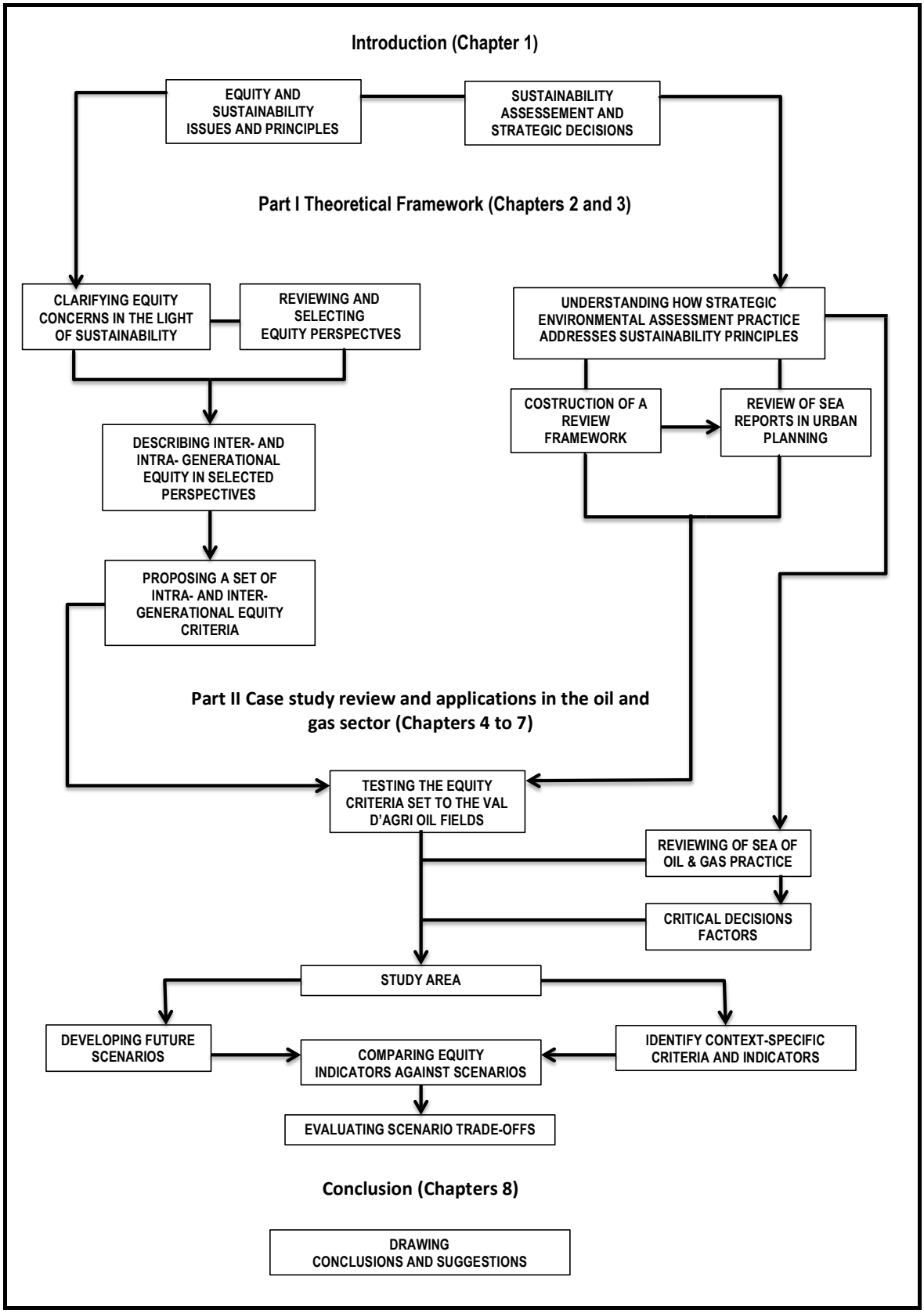

Fig. 1.1 – Flowchart of the thesis

Part I

Theoretical framework

Chapter 2

Sustainability principles for strategic decisions[1]

2.1 Introduction

A strategic action can be considered sustainable if it is at least acceptable socially, environmentally and economically, without causing significant trade-offs (Gibson, 2006). This concept calls for approaches to assess in an integrative way the environmental, economic and societal impacts of decisions, focusing on the interrelations among the economic, social and environmental dimensions, rather than on the three categories separately.

In this regard, a growing interest has been drawn to sustainability assessment (SA) literature in the past decade (Bond et al., 2012). The common pathway followed seemingly is to view 'sustainability assessment' as the third generation of impact assessment (Bond and Morrison-Saunders, 2011). Pope and Sadler (2011) defines sustainability assessment as an ex ante process that seeks to identify the future consequences of a proposed action in a manner that directs planning and decision-making towards sustainability.

Chapter 1 has analogously documented the debate on the shifts of SEA towards sustainability agenda. SEA is often seen as inherently having sustainability goals (Bond and Morrison-Saunders, 2011). A point of distinction between SA and SEA is that SA may be applied at any level of decision-making, from project-specific to strategic level.

Therefore, the extent to which SEA and SA may be considered analogous depends upon the extent to which an SEA process embeds the concept of sustainability (Pope and Sadler, 2011).

Thus, the level of PPP making might be the most interesting and suitable for gathering a wider understanding on how to deal with the sustainability concept in a more integrated, strategic and comprehensive ways. In fact, in my research I will essentially refer to SEA literature and practice.

[1] This chapter is based on: Lamorgese, L., Geneletti, D. Sustainability principles in strategic environmental assessment: A framework for analysis and examples from Italian urban planning. *Environmental Impact Assessment Review 2013;42:116–126.*

The objective of this chapter is to explore to what extent sustainability principles are addressed in SEA. To do this, I will present a framework for analysing the degree of consideration of sustainability principles in strategic decisions. The framework seeks to provide a guidance to convert widely accepted principles (Gibson et al., 2005) into operative questions, with the purpose of assessing tangible contribution of SEA to sustainability.

Then, I will demonstrate its application to a sample of SEA of Italian urban plans. In this chapter, I will focus on SEA of urban planning moving from the basic and consolidated idea that cities are privileged contexts for providing solutions for sustainability. As Taylor (2012) claims, they possess the three major attributes necessary for successful sustainability: financial capital, human capital, and social capital. In particular, urban sustainability has meant to various scholars a strictly social dimension, incorporating notions of equity, empowerment, accessibility, and participation (e.g. Brandon and Lombardi 2010; Basiago, 1999).

Finally, I will describe and discuss results drawing out implications and insights for sustainability as well as equity agenda. In the debate on sustainability, crucial issues are related to equity considerations in the evaluations of likely outcomes on present and future generations (George, 1999). For this reason, the framework gives emphasis on the inclusion of key concepts, such as intra-generational and inter-generational equity, and on the associated analysis of trade-offs through time and space.

2.2 Construction of the review framework

The concept of sustainability derives from the well-known notion of sustainable development, the “development that meets the needs of current generations without compromising the ability of future generations to meet their needs” (World Commission on Environment and Development, 1987). However, there is no unanimous consensus on how this definition should be put into practice. Due to the elusiveness of the definition, many theoretical formulations of the concept of sustainability have been proposed, and consequently many versions of sustainability-based decision principles and criteria have been proposed.

Following the example of several approaches for operationalizing sustainability principles, a framework was developed in order to evaluate policy-making and planning against sustainability criteria. The framework adapted Morrison-Saunders and Hodgson's approach (2009), which in turn converted the sustainability principles proposed by Gibson (2006) into

guidance statements. The original structure proposed by these authors has been partly modified, and largely integrated with other relevant criteria and questions gathered from an extensive literature review. Criteria and questions have a wide-ranging nature to allow the application of the framework to different SEA contexts.

The framework is based on the following seven principles, described in detail in Tables 2.1 to 2.7:

- socio-ecological system integrity;
- intra-generational equity;
- inter-generational equity;
- cost-effectiveness, efficiency and resource maintenance;
- prudence and precaution;
- democratic governance; and
- immediate and long-term integration issues.

In these tables, the first column reports Gibson's principles, the second shows the criteria that interpret them, and the last contains questions that allow evaluating systematically to what extent sustainability principles are addressed in policy-making and planning. The number of questions attached to each principle varies from 5 to 20. The total number of questions is 71.

Tab. 2.1 – Criteria and questions proposed for Principle 1 (precaution and adaptation).

PRINCIPLE [a]	CRITERIA	QUESTIONS
1 – Precaution and adaptation Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise and manage for adaptation.	▪ err on the side of caution in contentious or uncertain aspects of development proposals; [b, f, g, h, i] ▪ seriously consider 'not proceeding' as an option where there is too much scientific uncertainty about particular aspects of a proposal or where the negative consequences of the proposal outweigh the benefits; [b, f] ▪ clearly demonstrated how negative impacts of a proposed development would be managed. [b]	Does the proposal: ▪ err on the side of caution in contentious or uncertain aspects of development proposals? [b, f, g, h, i] ▪ seriously consider 'not proceeding' as an option where there is too much scientific uncertainty about particular aspects of a proposal or where the negative consequences of the proposal outweigh the benefits? [b, f, i] ▪ clearly demonstrate how negative impacts of a proposed development would be managed? [b] Does the development scheme for the area take into account the maintenance of available capital of non-renewable resources in the long term? [c, d, f, g, h, i] Are environmental standards or limits defined? [e] [also targets or ranges]

[a] Gibson (2006).
[b] Morrison-Saunders and Hodgson (2009).
[c] Brandon and Lombardi (2010).
[d] George (1999).
[e] Therivel et al. (2009).
[f] Howarth (1995).
[g] Padilla (2002).
[h] Daly (1990).
[i] Clarke (2002).

Tab. 2.2 – Criteria and questions proposed for Principle 2 (inter-generational Equity).

PRINCIPLE [a]	CRITERIA	QUESTIONS
2 – Inter-generational equity Favour present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.	▪ demonstrate enduring value for future generations; [b] ▪ clearly outline the future negative impacts (local, regional and cumulative) of the proposal and how they will be managed, and by whom, and how future liability will be managed; [b] ▪ hold proponents accountable for commitments (for example through mechanisms such as development bonds); [b] ▪ demonstrate that the proposal will not impact on the long-term performance of existing significant local or regional land use activities. [b]	▪ Does the proposal demonstrate enduring value for future generations? [b]
		▪ Does the proposal clearly outline the future negative impacts (local, regional and cumulative) of the proposal and how they will be managed, and by whom, and how future liability will be managed? [b]
		▪ Is it demonstrated that the proposal will not impact on the long-term performance of existing significant local or regional land use activities? [b]
		▪ Will a particular development be economically viable in the future? [b]
		▪ Who will have responsibility for managing negative impacts of a development in the future? [b]
		▪ Will commitments by proponents be acted upon in the future? [b]
	▪ adopt a strong sustainability perspective, demonstrating how the proposal biases decisions in favour of not decreasing the level of natural capital passed onto future generations [c] and combines environment, social and economic consideration in a more objective way. [d]	▪ Does the proposal adopt a strong sustainability perspective, demonstrating how the proposal biases decisions in favour of not decreasing the level of natural capital passed onto future generations [c] and combines environment, social and economic consideration in a more objective way [d]
		▪ Does the proposal identify positive and negative effects and the duration of effects? [e]
		▪ Does the proposal identify who is affected by the impacts and when? [f]
	▪ demonstrate how the proposal biases decisions against irreversible choices. [h]	▪ How does the proposal undertake climate change adaptation and mitigation measures? [d, f, g]

[a] Gibson (2006).
[b] Morrison-Saunders and Hodgson (2009).
[c] Beder (2000).
[d] Eales and Sheate (2011).
[e] Therivel et al., (2009).
[f] European Commission (2009a).
[g] Brandon and Lombardi (2010).
[h] Connelly and Richardson (2005).

Tab. 2.3 – Criteria and questions proposed for Principle 3 (ecological integrity and biological diversity).

PRINCIPLE [a]	CRITERIA	QUESTIONS
3 – Ecological integrity and biological diversity Protect biological diversity and maintain essential ecological processes and life-support systems.	▪ prevent destruction of natural assets, reduce overall consumption levels and avoid unnecessary high risk associated; Natural assets cannot be used beyond their natural regenerative capacities; [e] ▪ reduce the indirect and overall, as well as direct and specific, threats to system integrity and life support viability. [c]	How does the proposal:
		▪ maintain the integrity of ecological systems and associated life support functions? [c]; Ethic [d]; Interspecies Equity.[e]
		▪ affect the carrying capacity of the area? [f, g]
		▪ affect the capacity of the local ecosystem to deliver valued ecosystem services reliably into the future (e.g. effects on water and air quality, and wildlife habitat)? [g]
		▪ affect the capacity of national and global ecosystems and socio-ecosystems to deliver valued services reliably into the future (e.g. effects on regional pollution levels, energy sources and transport systems)? [g]
		▪ affect the resilience of local and national socio-ecosystems (including economic options, transportation, food and health systems, water and waste management)? [g]
		▪ affect longer term availability of non-renewable and renewable resources? [f, g]
		▪ take into account relevance and vulnerability of the area which might be affected, with regard to population density, settlement pattern and level of urbanization? [h, i]
	▪ prioritise environmental protection and ecological integrity so that any change in the status quo results in net environmental benefit; [b] ▪ identify residual adverse impacts and considering whether these can and should be offset; [b] ▪ implement biodiversity offsets where unavoidable residual impacts on important species or ecosystems remain following implementation of other forms of mitigation. [b]	How does the proposal:
		▪ prioritise environmental protection and ecological integrity so that any change in the status quo results in net environmental benefit? [b]
		▪ undertake assessment of impacts in term of environmental outcomes or limits rather than inputs. [j] In particular contribute to: - make a negative impact less bad; - have a positive impact; - achieve or make a proportionate contribution to true sustainability.

[a] Gibson (2006).
[b] Morrison-Saunders and Hodgson (2009).
[c] Gibson et al. (2005).
[d] Clarke (2002).
[e] Haughton (1999).
[f] Brandon and Lombardi (2010).
[g] Gaudreau and Gibson (2010).
[h] European Commission, DG ENV (2009).
[i] Boone (2010).
[j] Therivel et al. (2009).

Tab. 2.4 – Criteria and questions proposed for Principle 4 (equity and quality of life).

PRINCIPLE [a]	CRITERIA	QUESTIONS
4 – Intra-generational Equity Ensure equity of opportunity for everyone, particularly the poorest and most vulnerable members of the community and seek to create a good quality of life for everyone.	▪ provide a range of community amenities and services available to all in the community; [b] ▪ ensure that any affordable housing initiatives are provided and protected into the future. [b]	▪ does the proposal provide a range of community amenities and services available to all in the community? [b]
		▪ are proponents held responsible for commitments in the area? [b]
		▪ how the proposal will create a cohesive community, based on issues such as [b]: - the social implications of high-rise developments, likely transport use patterns, and facilities provided for communities
	▪ reduce ecological footprint while improving quality of life; [c] ▪ demonstrate fairness in the distribution of gains and losses; [d] (equity implies fairness no equality) ▪ assure environmental justice. [d, e, f]	How does the proposal:
		▪ assure acceptable quality and standard of living? [d]
		▪ assure equivalent living conditions? [d]
		▪ narrow the gap between the most deprived areas and the rest of the city so that no-one is seriously disadvantaged by where they live? [g]
		▪ identify all groups or individuals affected by the plan? [h]
		▪ demonstrate how needs, values and expectations of stakeholders are taken into account? [i]
		▪ operate without ignoring external impacts of decisions? (from the neighbourhood level to the global) Geographical Equity [i]
		▪ build up community and regions, 'sense of place' and heritage protection? [c]
		▪ promote social inclusion? [j]
		▪ explicitly assess distributional consequences? [k, l, m]
		▪ guarantee access to transport and services and other facilities? (accessibility and mobility) [n]
		▪ assure no resettlement of local population? [n]
		▪ assure no permanent disruption to the livelihood of the local population? [n]
		▪ reduce the need to travel?
		▪ guarantee open space /access to natural greenspace? [n]
		▪ demonstrate fairness in the distribution of gains and losses? [d] (equity implies fairness no equality)
		▪ guarantee proportionate distribution of environmental goods and bads? [d, f] • equity of exposure, which requires the presence of a level playing field to allow groups an equal chance of being targeted for significant environmental change. [e] • avoid iniquities in the distribution of exposition to health risk. [d] • equity of impact, in which groups should experience a proportionate share of the costs and benefits of such change after it occurs. [e] • avoid inequities in the impacts of environmental policies, differences in regulatory enforcement (e.g. sectors of communities who are imposed additional costs; increasing the price of certain goods. [d, k]
		▪ biases decisions in favour of offering special protection to those who are especially vulnerable to our actions and choices? [k, m]
		▪ take into account human exposure to harm and the differential sensitivity of social group to harm and differences in adaptive capacities to respond or "bounce back" after the harm occurs? [m]

[a] Gibson (2006).
[b] Morrison-Saunders and Hodgson (2009).
[c] Pope et al. (2004).
[d] Beder (2000).
[e] Maschewsky (2005).
[f] Agyeman et al. (2002)
[g] Mitchell and Dorling (2003).
[h] Walker (2010).
[i] Haughton (1999).
[j] European Commission (2009a).
[k] Connelly and Richardson (2005).
[l] Walker (2007).
[m] Cutter, 2003 in Boone (2010).
[n] ODPM (2005).

Tab. 2.5 – Criteria and questions proposed for Principle 5 (Efficiency).

PRINCIPLE [a]	CRITERIA [b]	QUESTIONS [c, d, e, f, g, h]
5 – Efficiency Reduce overall material and energy demands on social and ecological systems.	▪ demonstrate how the proposal is based on energy efficient design; ▪ demonstrate how the proposal will promote local employment and mixed use (i.e. creating sustainable social environments that avoid or minimise the need for people to travel long distances to meet their needs); ▪ demonstrate how the proposal will realistically incorporate renewable energy generation and other sustainable resources; ▪ demonstrate that all reasonable and practicable measures have been taken to minimise the generation of waste and its discharge into the environment.	How does the proposal contribute to: ▪ minimise environmental footprint? ▪ zero discharge of oil/chemicals to land, surface water or groundwater? ▪ minimise emissions? ▪ minimise energy and resource use? ▪ minimise production of waste? ▪ maximise re-use of displaced materials? ▪ no net loss of sensitive habitat? ▪ restoration of habitats and hydrological regimes?

[a] Gibson (2006).
[b] Morrison-Saunders and Hodgson (2009).
[c] European Commission (2009a).
[d] Page (1997).
[e] York et al. (2003).
[f] Rees (1992).
[g] Newman (2006).
[h] Agyeman and Evans (2003).

Tab. 2.6 – Criteria and questions proposed for Principle 6 (democracy and governance).

PRINCIPLE [a]	CRITERIA [b]	QUESTIONS
6 – Democracy and governance Ensure that proposals are developed through active public participation in transparent decision-making processes.	▪ genuinely engage the affected community (local, regional or national as appropriate) in the future vision, planning and development of the proposal area; ▪ undertake an independent community engagement process, rather than a process solely conducted by the proponent; ▪ honour the results of previously conducted consultation processes.	How does the proposal contribute to: ▪ assure social acceptability applying fair-share principles? [c] ▪ avoid inequities in people's ability to influence decisions affecting their environment? [d] ▪ promote direct representation of the interests of disadvantaged groups? [e, f] ▪ undertake rights of access to information and participation into public decision-making processes? [g] ▪ engage with stakeholders in the assessment procedure? [g, h] ▪ guarantee that the SEA/SA report is publish and made readily available to all members of the public? [f] ▪ assure that all members of the public have the opportunity to comment on the proposals, and having their views be taken into account before a decision is made? [f, h]

[a] Gibson (2006).
[b] Morrison-Saunders and Hodgson (2009).
[c] Agyeman et al. (2002).
[d] Beder (2000).
[e] Connelly and Richardson (2005).
[f] George (1999).
[g] Haughton (1999).
[h] Johnson (1999).

Tab. 2.7 – Criteria and questions proposed for Principle 7: immediate and long-term integration.

PRINCIPLE [a]	CRITERIA [b]	QUESTIONS
7 – Immediate and long-term integration Decision-making processes should reflect the equal importance of each principle of sustainability, and mutually supportive benefits should be sought without compromising any individual principle.	▪ demonstrate that all of the principles of sustainability are being met and that there will be a net benefit.	Does the proposal:
		▪ clearly identify the core strategy duration? [c]
		▪ find solutions which results in a more just solution of environmental goods or bads rather than to accepting tradeoffs between social goods and environmental, or viceversa? [d]
		▪ biases decisions against causing harm, as distinct from merely foregoing benefits? [d]
		▪ bias decisions in favour of sustainable rather than one-off benefits? [d]
	▪ where proponents are proposing trade-offs, they should: • avoid significant adverse effects; • maximise net gains; and • explicitly justify all proposed trade-offs through an open process.	Does the proposal consider sustainability decision-making trade-off rules? such as [e]:
		• *Maximum net gains* - any acceptable trade-off must favour achievement of the most positive feasible overall result, while avoiding significant adverse effects.
		• *Burden of argument on trade-off proponent* - the burden of justification falls on the proponent of the trade-off.
		• *Avoidance of significant adverse effects* - a significant adverse effect on any sustainability requirement area cannot be justified unless the alternative is acceptance of an even more significant adverse effect.
		• *Protection of the future* - avoid displacement of a significant adverse effect from the present to the future.
		• *Explicit justification* - all trade-offs must be accompanied by an explicit justification based on openly identified, context specific priorities as well as the sustainability decision criteria and the general trade-off rules.
		• *Open process* - proposed compromises and trade-offs must be addressed and justified through processes that include open and effective involvement of all stakeholders.

[a] Gibson (2006).
[b] Morrison-Saunders and Hodgson (2009).
[c] Bond and Morrison-Saunders (2011).
[d] Connelly and Richardson (2005).
[e] Gibson et al. (2005).

2.3 Application to SEA of spatial planning

The developed framework was applied to analyse how sustainability principles are addressed in Italian SEA practice for urban planning. Italian spatial planning is based on a tiered system, which consists of national Acts, regional and provincial spatial coordination plans, and urban plans at the municipality level (Bragagnolo et al., 2012 and Geneletti et al., 2007). The latter plans contain detailed provisions concerning land uses, zoning, building regulations, etc. We focused on this level because its content goes beyond general statements and objectives, and allow understanding the actual considerations of sustainability issues in decisions.

Transposition of Directive 2001/42/EC occurred in Italy only in 2006, even if the law was amended several times and actually implemented only at the beginning of 2008. However, provisions to perform SEA had been introduced earlier by several regional governments (Diamantini and Geneletti, 2004). 15 environmental reports (ERs) of urban plans were selected, by using the following criteria:

- Representativeness of different regions across Italy;
- Preference accorded to (in this order): regional capital cities, provincial capital cities, largest cities (minimum population: 50,000)
- ER and planning documents available on the web.

The selection of ERs covers a broad range of geographical areas, socio-economic conditions and environmental characteristics. Specifically, four cases refer to regional capitals, nine to provincial capitals and two to municipalities with more than 50,000 inhabitants, as shown in Table 2.8. The ERs were prepared between 2006 and 2011.

Tab. 2.8 – Overview of the selected environmental reports.

ID	CITY	STATUS	INHABITANTS	YEAR
BO	Bologna	Regional capital	380.000	2008
FI	Florence	Regional capital	400.000	2010
GR	Grosseto	Provincial capital	82.000	2011
MAN	Manfredonia	Municipality	57.000	2011
MI	Milan	Regional capital	1.300.000	2009
NU	Nuoro	Provincial capital	37.000	2009
RE	Reggio-Emilia	Provincial capital	165.000	2009
RN	Rimini	Provincial capital	140.000	2011
SA	Salerno	Provincial capital	150.000	2006
SV	Savona	Provincial capital	65.000	2009
SCA	Scafati	Municipality	51.000	2011
TS	Trieste	Regional capital	205.000	2009
UD	Udine	Provincial capital	100.000	2011
VC	Vercelli	Provincial capital	48.000	2007
VR	Verona	Provincial capital	250.000	2007

The ERs were reviewed by checking whether or not they present at least an element that can be connected to each of the proposed questions. If such elements were found, a description was included in the framework, else the relevant cells were left blank. Table 2.9 shows an example of how the documents of the 15 ERs were analysed against the proposed framework.

Tab. 2.9 – Example of the approach adopted to review the environmental reports.

ID	**PRINCIPLE 1 – Precaution and adaptation** **Question: Are environmental standards or limits defined? Therivel et al. (2009). [also targets or ranges]**
BO	The proposal imposes specific targets for the airport regulatory plan. Solutions for the enlargement of the airport infrastructures are allowed only if they assure to slash greenhouse gas emissions by 20% of 1990 levels. Precautionary interventions for human health: passive protections of potential receptors from sources of pollution are considered. e.g. New infrastructures for residential, school and health scopes are allowed provided that at least minimum distances from motorways and local viability are respectively 150 and 100 metres. The maximum allowed increase in housing (8000) and areas for not residential uses (765.000 square metres) are fixed.
FI	Climate change: Adherence to Covenant of Mayors, aiming to meet and exceed the EU 20% CO_2 reduction objective by 2020. The proposal promotes cogeneration power plants at district level, access to incentives for building energy efficiency, use of renewable energy (solar panels)
GR	Imposed restrictions for allowing transformations: respect of permeability index (40% of total surface); CO2 balance control (Carbon sink)
MAN	-
MI	Climate change: Adherence to Covenant of Mayors, Climate Plan adoption, involvement in Sustainable Energy and Climate Protection Campaigns at European level 20% reduction of CO2 emissions by 2020 20% of energy demand covered with renewable resources by 2020 20% reduction energy consumptions adopting efficient energy actions and solutions 15% for the share of cycling in the modal split of trips for the year 2020 (Charter of Bruxelles commitments)
NU	-
RE	-
RN	Precautionary interventions for human health: passive protections of potential receptors from sources of pollution are considered. e.g. New infrastructures for residential, school and health scopes are not allowed provided that at least minimum distances from motorways and local viability are respectively 200 and 100 metres. An environmental belt is also required between the residential area and the road network The maximum allowed increase in housing (5000) is fixed. 20% of energy consumes of new public housing assured with renewable sources
SA	-
SV	-
SCA	-
TS	-
UD	Climate change: Adherence to Covenant of Mayors, Climate Plan adoption, involvement in Sustainable Energy and Climate Protection Campaigns at European level 20% reduction of CO2 emissions by 2020 20% of energy demand covered with renewable resources by 2020 20% reduction energy consumptions adopting efficient energy actions and solutions
VC	-
VR	-

Subsequently, the findings have been re-organized and expressed by percentage as shown in Tables 2.10–2.11 and Figures 2.1–2.2. The purpose of these figures is to distinguish questions not addressed at all from questions that are addressed at least to some extent. The nature of the information gathered from the review is explained in Section 2.5.1, by illustrating exemplary cases.

Additionally, the information extracted from the documents was used to answer five cross-cutting questions:

1. Are sustainability principles explicitly mentioned?
2. Are critical issues identified?
3. Are environmental indicators used?
4. Are environmental standards, target thresholds or ranges defined?
5. Are "not proceeding" options seriously considered?

These aspects were selected according to their tangible role that they may play in putting in practice sustainability. In particular, with reference to question four, environmental thresholds refer to "tipping points" beyond which ecological discontinuities with socially, economically and environmentally unacceptable and possibly irreversible consequences are likely to occur (European Commission, 2009b). Ranges represent a "*danger zone*" outside the safe operating zone, which indicate a high probability and subsequently a high risk to reach the threshold levels (Ecologic Institute and SERI, 2010). Finally, environmental standards are limits that must be respected in order to achieve or maintain the desirable environmental state.

2.4 Results

Table 2.10 provides a summary of the results, showing the questions for which relevant information was found in the ERs. Figure 2.1 presents the results broken down by the seven sustainability principles, whereas Table 2.11 shows the percentages of questions addressed by the different case studies.

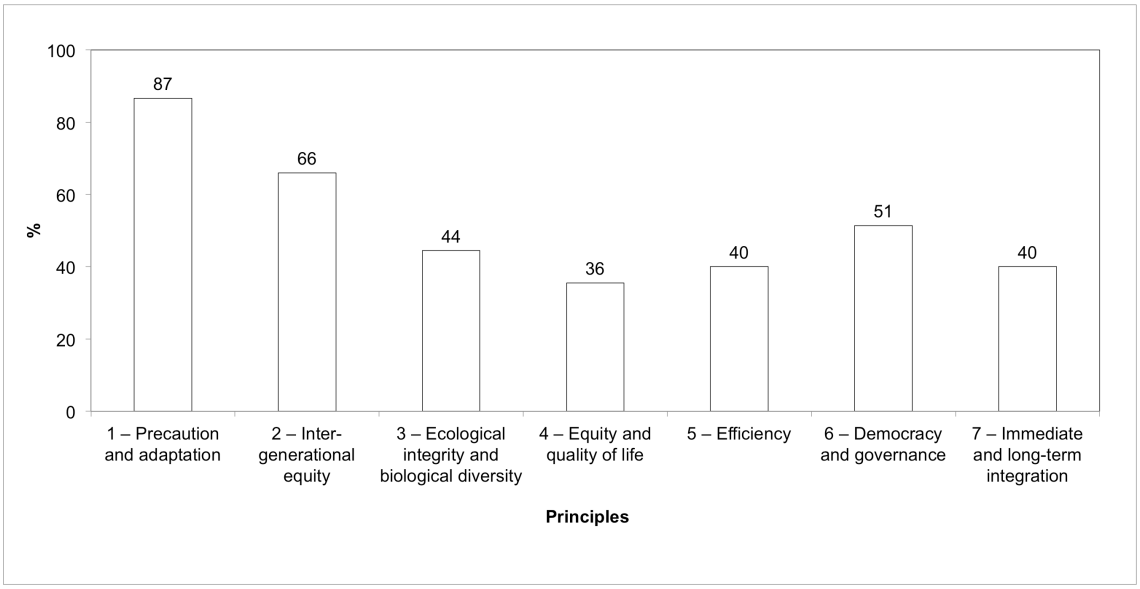

Fig. 2.1 – Overall rate of questions addressed by the ERs, broken down by the seven sustainability principles.

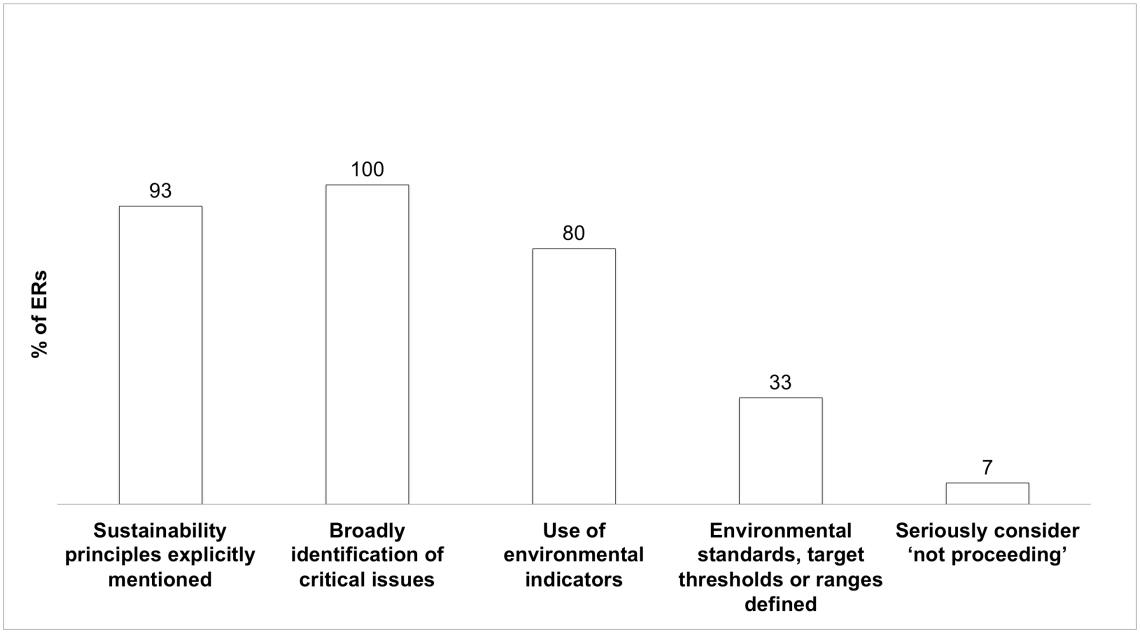

Fig. 2.2 – Cross-cutting findings of the review of the ERs.

In more than 85% of the ERs it was possible to find elements that addressed at least 40% of the questions, while just one case addressed 60% of them. The worst case corresponds to 28 out of 71 questions filled. In 14 out of 15 ERs, sustainability principles are explicitly mentioned.

In all cases there is a broadly identification of critical issues, whereas only 7% of ERs consider "*not proceeding*" as an option, where there is too much scientific uncertainty about particular aspects of a proposal or where the negative consequences of the proposal outweigh the benefits.

Concerning the methodology adopted, 80% of ERs are based on the use of indicators, but only five ERs present examples of environmental standards, limits target or ranges defined. In all ERs, mobility and open space are treated in detail with respect to quality of life, social cohesion and reducing impacts on the environment. Figure 2.2 presents the percentages of ERs that address the five cross- cutting issues described in Section 2.3. The review showed that more specific questions, such as the ones concerning carrying capacity in the long term, net environmental benefits and trade-offs rules were rarely considered. The analysis also revealed that concerns on intra- and inter-generational equity are barely present, as discussed in the following section.

2.5 Discussion

As shown in Table 2.10, in several cases the ERs contain at least a feature referable to the questions proposed in the framework, but that does not necessarily imply exhaustiveness and completeness in addressing the relevant sustainability principles. Hence, the figures displayed in Table 2.10 and Table 2.11 and Figure 2.1 are not illustrative of how adequate ERs are in addressing the sustainability questions proposed.

The study showed that sustainability is often stated as the pivotal concept that guided the assessment. However, for example, even if in all cases there is a broad identification of critical issues, the ERs do not seriously consider 'not proceeding' as an option where there is too much scientific uncertainty about particular aspects of a proposal or where the negative consequences of the proposal outweigh the benefits.
Thus, mitigation and compensation are broadly considered. As a consequence, in more than half of the cases, the ERs show approaches that aim at minimising the negative effects of proposed choices.

Studies are generally based on the use of indicators, but few examples of environmental standards or limits were found in larger municipalities, which are involved in Sustainable Energy and Climate Protection Campaigns at European level (Adherence to Covenant of Mayors, Charter of Aalborg, Aalborg Commitments) or cities that have identified thresholds to control soil sealing.

In the sub-sections that follow, the findings of the review are discussed for each principle. The purpose is to present and discuss the actions connected to sustainability that were detected in the SEA reports, as well as to highlight the main gaps that emerged from the analysis. Examples of how the findings were reconnected to the seven principles of sustainability are also included.

Tab. 2.10 – Summary of the questions addressed in the 15 environmental reports.

	Questionsn	BO	FI	GR	MAN	MI	NU	RE	RN	SA	SV	SCA	TS	UD	VC	VR
PRINCIPLE 1 – Precaution and adaptation	1	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	2	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	3	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	4	⊙		⊙	⊙						⊙			⊙		
	5	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
PRINCIPLE 2 – Inter-generational equity	1	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙	⊙		⊙		⊙	
	2	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙	⊙
	3															
	4		⊙				⊙			⊙						
	5	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	6	⊙		⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙
	7	⊙									⊙					
	8	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙
	9	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙
	10	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙
PRINCIPLE 3 – Ecological integrity and biological diversity	1	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	2	⊙	⊙	⊙	⊙	⊙	⊙				⊙	⊙		⊙	⊙	
	3	⊙						⊙	⊙		⊙	⊙			⊙	
	4															
	5															
	6										⊙					
	7	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙			⊙		⊙		
	8									⊙	⊙					
	9	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
PRINCIPLE 4 – Equity and quality of life (INTRA)	1	⊙					⊙	⊙	⊙	⊙	⊙				⊙	⊙
	2															
	3		⊙													
	4		⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	
	5			⊙		⊙	⊙			⊙		⊙	⊙			⊙
	6	⊙		⊙		⊙				⊙		⊙				
	7	⊙				⊙	⊙			⊙	⊙					⊙
	8		⊙				⊙				⊙	⊙				⊙
	9	⊙		⊙		⊙				⊙				⊙		⊙
	10			⊙		⊙				⊙					⊙	
	11		⊙	⊙		⊙			⊙	⊙				⊙		⊙
	12	⊙		⊙		⊙				⊙	⊙	⊙		⊙		⊙
	13			⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙		⊙	⊙	⊙
	14						⊙									
	15	⊙														
	16	⊙	⊙				⊙	⊙		⊙					⊙	⊙
	17			⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙	⊙	
	18						⊙									
	19	⊙														
	20	⊙	⊙				⊙			⊙						⊙
	21	⊙				⊙								⊙		
PRINCIPLE 5 – Efficiency	1															
	2	⊙								⊙						
	3	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	4	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙	⊙
	5			⊙	⊙						⊙		⊙	⊙		⊙
	6															
	7	⊙								⊙						
	8		⊙	⊙	⊙	⊙	⊙		⊙			⊙		⊙	⊙	
PRINCIPLE 6 – Democracy and governance	1	⊙														
	2															
	3	⊙								⊙						
	4	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		·		⊙	⊙	⊙
	5	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	6	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
	7	⊙	⊙	⊙	⊙	⊙				⊙	⊙	⊙	⊙	⊙		⊙
PRINCIPLE 7 – Immediate and long-term integration	1	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙		⊙	⊙	⊙
	2		⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙		⊙	⊙	⊙
	3	⊙														
	4	⊙					⊙			⊙						
	5	⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙		⊙	⊙	⊙	⊙	⊙	⊙
	6										⊙					
	7			⊙		⊙										
	8															
	9	⊙			⊙					⊙				⊙		
	10	⊙		⊙	⊙	⊙						⊙	⊙	⊙		
	11	⊙	⊙		⊙	⊙						⊙		⊙	⊙	⊙

Key ⊙ = Questions addressed in the ERs

2.5.1 Consideration of the different principles

Principle 1 – precaution and adaptation

Despite the differences in urban and demographic contexts, the urban plans are in favour of improving the built city, rather than expanding it, through renovation, remediation, reuse and substitutions of existing urban areas. One common and widely recognized objective concerns the reduction of land take. Thus, it emerges a substantial awareness that avoiding land take contributes to preserve space for ecosystems regulating water balance and protection against floods. In particular, three ERs set explicit restrictions to limit soil sealing, by imposing a minimum percentage of permeable surface to be maintained. However, even if the plans promote the reduction of urban sprawl and land take, their actual actions often include the expansion of residential areas and associated services and infrastructures.

As noted earlier, ERs broadly identified critical issues, and showed how negative impacts of a proposed development would be managed, but they do not seriously consider 'not proceeding' as an option. Thus, measures of mitigation and compensation are commonly envisaged. Common measures include the enhancement of rainwater reuse, extension of sewage systems in rural areas, application of energy saving certification, specific plan for enhancing remote heating systems, tree plantations and enhancement of wooden areas for greenhouse gas sequestration.

Principle 2 – inter-generational equity

The purpose of preserving environmental assets for future generations is commonly stated by ERs, by referring to sustainability objectives as well as the adherence to international declarations and charts (e.g. Aalborg Commitments). These forethoughts should be taken into account as suitable contribution in view of achieving sustainable development, even if they do not assure that the choices are coherent with the sustainability objectives. In fact, despite the intentions, the temporal dimension is rarely explicitly mentioned in the ERs.

Long-term implications of actions are generally disregarded. ERs identify positive and negative effects, without analysing the duration of effects. In addition all ERs define sustainability concerns only considering the local scale.

Three ERs out of nine address impacts caused on neighbouring regions, outside the planning area. Remarkably, they are in favour of share decisions with surrounding areas rather than merely exploiting resources from them. 60% of ERs include scenario analysis.

The issues analysed are case-specific, but in more than 50% of ERs scenario analyses concern mobility, air quality and demographic growth. Only one ER includes a comprehensive analysis of alternative scenarios, and only one includes qualitative considerations on the probability that the proposed actions are actually implemented. The lack of consideration of different alternatives in different future settings that characterise the reviewed ERs, limits the understanding of how the actions proposed in the plans will affect the quality of life of future generations.

Principle 3 – ecological integrity and biological diversity

All ERs address better management of greenfields, area of natural habitats and rural areas. Most ERs considered biodiversity conservation as a goal of primary importance. In 60% of the reports interventions were planned, such as designing ecological networks at local level, creating greenways and ecological corridors by connecting parks and open space.

Moreover, interventions for preserving ecological integrity are not restricted to urban areas but also include rural areas (e.g. farming practices for the maintenance of ecological integrity and the scenic value of landscapes). 80% of ERs include interventions of mitigation.

Actions are mainly related to restoring fluvial processes, hydrogeological risk control, and greenspace protection through constraints and regulations. The management of rural areas, with the aim of enhancing agricultural best practices, was considered in more than 70% of cases.

Principle 4 – equity and quality of life

The intra-generational equity principle is emerged as the most challenging one. While the review shows that inter-generational equity is present, even though the temporal dimension is often ignored, information on intra-generational equity is very limited. Although the social dimension is addressed in general terms, ERs do not assess planning decisions by exploring their implications for different social groups. Broadly speaking, the social concerns are distinguished on the basis of districts and areas of interventions.

Only in 40% of the documents elements were found referring to equity issues, and only in terms of specific actions (e.g. reducing needs to travel, increasing services and facilities at district level to address the needs of old people, and expanding social housing).

However, in seven documents some actions are explicitly planned for vulnerable areas, such as the creation of buffer zones to screen schools, hospitals and residential areas from air and noise pollutions. Only two cases explicitly identified different groups of people affected by planning decisions. Environmental equity is never addressed explicitly, as none of the ERs include considerations on the distribution of environmental costs and benefits.

Principle 5 – efficiency

Urban plans share the common objective to promote efficiency, reducing overall material and energy demands on social and ecological systems. All ERs illustrate a range of measures to minimise the impacts on the physical environment. Common actions are related to minimise emissions, energy consumptions and resource use, in particular land take.

In almost 90% of the cases, improvement of public transportation network and enhancement of cycling facilities are considered crucial measures of sustainability for reducing impacts on the environment. Promotion of energy efficiency in buildings, as well as the application of sustainable architecture criteria, is also very common.

Principle 6 – democracy and governance

Two different approaches were distinguished for this principle: the involvement of the public and stakeholders, following a legal requirement, and the promotion of initiatives to foster a more active engagement of the public in decision-making (e.g. hearings, dedicated meeting and focus groups, web sites and on-line discussion forum, questionnaires). These initiatives (included by 60% of ERs) are to enhance “procedural equity” (Haughton, 1999), by promoting access to information, effective participation, and transparency.

Principle 7 – immediate and long-term integration

All ERs attempt to show efforts taken to reduce environmental impacts, through actions such as improvement of public transport, creation and restoration of parks, reduction of water consumption, and rain water reuse. Concerning long-term effects, 60% of ERs discuss long-term implications, even though only 40% explicitly refer to a time horizon.

However, such time horizons refer to specific interventions only, rather than to a general strategy. For example, targets for air emissions and green buildings both represent purposeful contributions towards sustainability in the long run. However, the first action includes a time horizon (typically 2020), whereas the second one is more nuanced in the ERs since in most cases it is deprived of a clear reference to time.

Moreover very few cases go further, for instance, discussing how alternative possible future developments may contribute to reducing CO_2 emissions. However, none clearly demonstrates that all of the principles of sustainability are being met and that there will be a net benefit. Two third of ERs take care of avoiding significant adverse effects rather than maximise net gains. In any case trade-offs for the main negative effects are justified. As mentioned before, mitigation and compensation measures are in general broadly addressed.

In particular, these actions are especially contemplated to justify interventions in areas at hydrogeological risk. 10 ERs provide explicit justifications for trade-off based on context specific priorities. In addition, four documents openly observe that some negative impacts will remain without compensation. One of these also pointed out that the proposed sustainability measures are not enough unless a constant monitoring of their effective implementation is assured. Moreover, only 20% of the ERs clearly define rules and action for assuring that the burden of justification falls on the proponent of the trade-off.

Tab. 2.11 – Rate of questions addressed, broken down by sustainability principles and environmental reports.

ER / Principle	Number of questions	Percentage of questions addressed by the ERs														
		BO	FI	GR	MAN	MI	NU	RE	RN	SA	SV	SCA	TS	UD	VC	VR
1 – Precaution and adaptation	5	100	80	100	100	80	80	80	80	80	100	80	80	100	80	80
2 – Inter-generational equity	10	80	70	70	50	70	80	70	70	70	60	60	60	50	70	60
3 – Ecological integrity and biological diversity	9	67	44	44	44	44	44	44	44	33	67	56	22	44	44	22
4 – Equity and quality of life	21	43	29	43	14	52	52	24	19	62	33	38	14	29	29	52
5 – Efficiency	8	50	38	50	50	38	38	25	38	38	38	38	38	50	38	38
6 – Democracy and governance	7	71	57	57	57	57	43	43	43	57	43	43	43	57	43	57
7 – Immediate and long-term integration	11	64	36	45	55	55	36	27	36	27	36	45	18	55	36	27
All Principles	**71**	**62**	**45**	**54**	**44**	**55**	**52**	**39**	**41**	**52**	**48**	**48**	**32**	**48**	**44**	**46**

2.6 Conclusions

By developing a set of criteria for each principle, and a set of questions, the proposed framework can provide a contribution to make the broad principles of sustainability operable on the ground. Tools such as the framework developed here provide guidance for improving (and checking) the sustainability outcomes of decisions, and help overcome the gap between the stated intentions and the actual strategies. The review of SEA practices showed that several sustainability issues are clearly identified and considered in urban planning at the level of principles and objectives, but then disregarded when it comes to actions and decisions.

The review concluded that, even if actions that can contribute to operationalize sustainability are found in ERs, they are far away from exhaustively addressing the seven principles of sustainability. Specifically, issues related to intra-generational and inter-generational equity are mostly disregarded. In particular, it is difficult to capture elements related to the distributional consequences on different social groups of proposed actions. Moreover, ERs seldom address the issue of trade-offs.

This gap represents also a significant limit for the implementation of the democracy and governance principle. In this respect, the review showed that the attention is more focused on assuring rights of access to information and transparency in procedures, rather than openly discuss options and consequences with the involvement of all stakeholders. In the ERs, attention is paid to promote efficiency in particular by proposing measures to minimise resource use and waste production.

Nevertheless, due to the fact that in general strong emphasis is given to mitigation and compensation, the focus is more on how to minimise the negative effects of proposed choices rather than on the attainment of sustainability. Therefore, we conclude that there is still room to enhance the potential for integrating sustainability principles into SEA, and that current practice does not promote sustainability as an organizing concept, according to the set of criteria and questions proposed here.

The findings of this chapter provide several insights for future work. Concerning the review of ERs, it would be interesting to flesh out the discussion by focusing on how they address sustainability in terms of effectiveness of outcomes, and corresponding implications for decision making. In addition, the proposed review framework represents a first step to

identify intra-generational and inter-generational equity metrics that should be explicitly included in strategic environmental and integrative approaches for decision making. In this context, further research is required to clarify equity concerns in the light of the plurality of approaches to sustainability and to frame suitable indicators for operationalizing intra- and inter-generational equity in decision-making.

In the chapter that follows, a set of equity criteria for assessing inter- and intra-generational equity are proposed and discussed.

Chapter 3

Proposing criteria to assess inter- and intra-generational equity in strategic decisions

3.1 Introduction

Broadly speaking, the two notions of intra- and inter-generational equity can be assumed, respectively, as transactions of rights between people of the same generation and across generations. Equity in the distribution of the expected effects of decisions on present and future generations plays a key role in the sustainability debate. Sustainability demands to find development paths that meet "*fundamental human needs while preserving the life-support systems of planet Earth*" (Kates et al., 2001). These complex and multi-scale interactions involve multiple feedbacks and trade-offs that affect both conditions of the environment and its capacity to provide services that contribute to human wellbeing. They should be undertaken enhancing ways of taking advantage of widespread and long-term opportunities and reversing the undesirable trends in the economic, social and ecological domains together.

George (1999) recognizes that such multiscaled and interrelated concerns should be address by reformulating sustainability concerns in term of intra- and inter-generational equity. Anand and Sen (2000) claim that it is difficult to conceive a situation where a case is made for inter-generational equity while underplaying intra-generational equity. Also George (1999) worries about a sustainable development that respect the environment's carrying capacity limits in the log run, without being intra-generationally equitable, simply by restricting the numbers of people who benefit from access to natural resources. Thus, sustainable development can be conceptualised as the attempt to accomplish intra-generational justice under the condition of inter-generational justice (Christen and Schmidt, 2011). As claimed by Padilla (2002), the search for sustainable development is closely linked to the solution of problems of inequity that could endanger sustainability and are against the same concept of development.

However, Halpern et al. (2013) recognize that even if, in many planning processes, there is a strong consciousness of equity issues, rarely is equity incorporated into assessment in a formal way. There are at least two central concerns in framing equity.

The first is essentially related to the fact that the concept of equity is not univocal but reflects a multifaceted variety of ethical beliefs, which affect interpretations of justice as well. Distinguishing between the related concept of equity and justice may in general be problematic, and I do not attempt to make extensive distinctions. In general sense, justice is related to recognition and respect for the rights of others, while equity is the place where to find a proportion between the common good and the individual rights, acting with absolute impartiality (Glasser, 1999). However, Sen (2009) argues that it is not possible achieving a result univocally fair, because we can judge following several principles, all defensible on the base of impartiality, but that conduct to different expressions of fairness. There is no way that can help us resolve this dispute in a universally accepted just manner. Nevertheless, whatever this constitutive idea is declined, as argued by the author, three elements are essential: always considering the centrality of avoiding distortions in our evaluations, taking into account interests of others, and avoiding the influence of personal priorities or prejudices.

The second concerns how to practically formalize in assessment the nexus between equity and sustainability bringing together equity implications along with environmental, societal and economic concerns. Singh et al. (2009) recognize that the most often cited measures of sustainability tend not to include distributional, or other commonplace indicators of equity. Interrelated to this, the third is over how to interpret intra- and inter-generational equity notions and provide a means for addressing them concurrently. Consequently, another critical point is how to achieve a viable way for operationalizing sustainability through intra- and inter-generational equity.

Based on these considerations, the objectives of the present chapter are twofold. The first is to clarify the multifaceted notion of equity in relation to the sustainability paradigm. While, the second is to develop a set of criteria for making intra- and inter-generational equity operable on the ground. My exploration of these questions begins from a briefly overview of the principal approaches to sustainability. Then, I will flash out the nexus between sustainability and equity by classifying the most common and accepted perspectives in equity according to the sustainability approaches reviewed. To this purpose, I will present a

conceptual framework for identifying equity perspectives vis-à-vis sustainability. Thereafter, I will consider some reasons for focusing on a selection of equity perspectives.

In section 3.5, I will describe a proposal for operationalizing the concept of intra- and inter-generational equity. To this purpose, firstly I will flash out notions of intra- and inter-generational equity that synthetize the equity perspectives selected in section 3.3. Subsequently, I will propose a set of general criteria as metric for measuring intra- and inter-generational equity in decision-making. Finally, I will conclude the chapter with a discussion of advantages, limitations and possible application of the equity criteria suggested.

3.2 Reviewing equity perspectives in sustainability

Interpretations of sustainability requirements and commitments to present and future generations are significantly influenced by diversity of perceptions and values on equity.
In order to gain a wider understanding of how differentiations, variants and subtle points on equity affect sustainability, some theoretical bases of approaches to sustainability were reviewed and a conceptual framework for identifying the different implications related to the use of different values and perceptions on equity vis-à-vis sustainability was framed. The conceptual framework aims to systematize the approaches to sustainability gathered from literature according to the equity perspectives that underlie them. Tables 3.1 to 3.4 display the equity perspectives associated according to each of the four dimensions of sustainability considered.

Economic approaches

Economic approaches, moving from welfare economics to environmental economics, stress on the human welfare and well-being maximization within different form of restrictions, shifting from constraints of existing capital stock and technologies to natural capital. Different degree of impositions and constraints are mainly related to the weak versus strong sustainability debate. Economists tend to be “weak sustainabilists”. They are generally more inclined to think that the current generation can leave the future any combination of different capitals as long as the total value of the capital passed on is non-declining (Pearce and Turner, 1990). Given the use of a model where there is a single commodity, this is equivalent to sustainability as maintaining productive potential through time (Perman et al., 1999).

Tab. 3.1 – A conceptual framework for identifying equity perspectives vis-à-vis sustainability: Economic Approaches

EQUITY PERSPECTIVES	DESCRIPTIONS	EQUITY PRINCIPLES
Utilitarian terms	Utilitarianism does not attribute intrinsic value to social and economic equity.	The goodness of equity is judged on the basis of its contribution to an increase in total utility (Tacconi and Bennett, 1995).
	Consider discounting as a concept of inter-generational efficiency (Page, 1997).	Keep intact the resource base, as a whole, over generational time, indefinitely, to assure that each generation is treated equally (Page, 1997).
Consequentiality ethical doctrines	A consequentialist ethical doctrine judges the goodness of policies solely on the basis of the effects that are expected to do (Glasser, 1999).	If the product resulting from the overall growth is equally distributed then marginal need satisfaction is cancelled because no one can improve their position against others.
		Adoption of an intertemporal social welfare function, the maximisation of which leads to a sustainable outcome (Perman et al., 1999).
		Taken into account expanded income measures accounted not only for the returns to labor and physical capital but also changes in natural resource (Arrow et al., 2004).
		It is necessary a comprehensive measure of wealth that could be a way to measure well-being and is the shadow value off all capital assets (Dasgupta, 2009; 2011).
		Application of weak sustainability, considering that development is sustainable if and only adjusted net saving is positive (World Bank, 2006). To achieve Sustainable Development, genuine savings rates must not be persistently negative (Pearce et al., 1996).
Deontological ethics	A deontological (or "Kantian") approach to inter-generational fairness suggests that sustainability criteria should be imposed as prior constraints on the maximization of social preferences concerning the distribution of welfare between present and future generations (Howarth, 1995).	This moral rule implies a bias against actions that generate present benefits but impose the risk of irreversible future losses if the preservation of options would allow for improved decisions as new information became available (Howarth, 1995).
		Imposition of one or more constraints that ensure that a (constrained) maximum of the intertemporal social welfare function will yield a sustainable outcome (Perman et al., 1999).
		There is a limit to the growth of total capital stock due to the absolute scarcity and the unsustainable marginal costs associate to the maintenance of matter-energy throughput (Daly, 1990).
		Incorporating environmental values into decision making will not in itself guarantee sustainability values unless each generation is committed to transferring to the next sufficient reproducible and natural capital to make development sustainable (Perman, 1999).
		A limit to physical economic growth does not necessarily imply a limit to improvements in human welfare or quality of life, which is generated by the fulfilment of a variety of different human needs (Costanza et al., 2007).

However, several ecological economists sustain strong sustainability. They believe that a minimum amount of a number of different types of capital (economic, ecological, social) should be independently maintained, in real physical/biological terms. The major motivation for this insistence is due to the recognition that natural resources are essential inputs in economic production, consumption or welfare that cannot be substituted for by physical or human capital (Norgaard, 2005).

More strong sustainabilists therefore recognize that there is a limit to the growth of total capital stock due to the absolute scarcity and the unsustainable marginal costs associate to the maintenance of matter-energy throughput (Costanza and Daly, 1992). As growth in the physical dimensions of the human economy pushes beyond the optimal scale relative to biosphere, it becomes in truth uneconomic growth, impoverishing rather than enriching (Daly, 1991).

Environmental approaches

With different degree of obligation towards the environment, environmental approaches put emphasis on the respect of the integrity of ecological subsystems. Ecologists bias in favour of focusing on the properties of the biophysical environment, such as resilience, than on human welfare. Nevertheless, several scholars claim that these approaches are anthropocentric and at the level of general objectives should be interpreted as complementary rather than competitive with economics.

On the contrary, more strong ecological positions attribute to nature itself a moral status. Thus, the moral significance of non-humans entities draws on the belief that they possess qualities also possessed by humans and not all instrumental values in nature are anthropocentric (Glasser, 1999; Hargrove, 1989). In light of this standpoint, the land ethic stresses the conception that "a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community, while it is wrong when it tends otherwise" (Leopold, 1949). This perspective implies that human-beings should consider land as a community of which they are citizens. Thus, the land-community deserves respect for each fellow-members and for the community as such (Leopold, 2010). However, it remains an open question how to establish an absolute hierarchy of values between environmental and non-environmental goods and services.

Tab. 3.2 – A conceptual framework for analysing equity vis-à-vis sustainability: Environmental Approaches.

EQUITY PERSPECTIVES	DESCRIPTION	EQUITY PRINCIPLES
Anthropocentric (Humanism)	Nature itself has no independent moral status. However humans depend on the deeply interconnected web of biodiversity for their own survival, and we must protect other species to protect ourselves (Farley, 2012).	Preserve ecosystem integrity and maintain biodiversity (Haughton, 1999) Prevent destruction of natural assets beyond their regenerative capacities by reducing overall consumption levels and to avoid unnecessary high risks associated with some untested technological solutions (Haughton, 1999). The equity between generations needs the respect of ecological critical levels that, if surpassed, may cause instabilities and chain reaction with unpredictable effects (Padilla, 2002).
Interspecies (Land Ethic, Ecocentrism)	The belief that the continued existence and flourishing of ecosystems, species and individual non-humans, by themselves, constitute a significant good in the world (Glasser, 1999). Humans have a moral responsibility to protect non-antropocentric instrumental values (Leopold, 1949)	Employ the perspective of the donor (ecosystem) during the valuation of the different sustainability issues (Gasparatos et al., 2008). Understand the distribution of harms to environment itself (Gandy, 2011). Do not simply have a duty to use nature efficiently, but have obligations to use it with respect, restraint and as eye toward nurturing its capacity for self-healing (Padilla, 2002). Have responsibilities to protect nature even when these efforts can conflict with human wants and even if they create a significant utility loss (Glasser, 1999).

Social approaches

Social approaches are centred on people's overall quality of life, standard of living and wellbeing and focus on distributional consequences of decisions that affect individuals, target groups and communities. The core of the notion of social sustainability is linked to two central concepts: social equity and the 'sustainability of community'.

The former is linked to the notion of social justice, which urges the fair distribution of resources in society in order to allow fair access to jobs, housing and local services. The second dimension is concerned with the continuing viability and functioning of society as a collective entity (Bramley and Dempsey, 2006). Social justice demands attention to social relations, redistribution of rights and resources and discrimination (Colantonio and Lane, 2007). Several schools of thought claim that social sustainability should focus on intra-generational inequality as an important negative influence on well-being (Vercelli and Borghesi, 2005; Pezzey and Toman, 2002). Moreover, Haughton (1999) argues that social justice is intrinsically connected to environmental justice. Agyeman et al. (2002) also claim that environmental despoilation and degradation are almost always linked to questions of social justice, equity, rights and people's quality of life in its widest sense.

Tab. 3.3 – A conceptual framework for analysing equity vis-à-vis sustainability: Social Approaches.

EQUITY PERSPECTIVES	DESCRIPTION	EQUITY PRINCIPLES
Opportunity (Libertarian ethics)	Guarantee the same set of initial options and different outcomes on the base of merit (Chichilnisky, 1997; Vercelli, 2005).	The entitlement of everyone to an acceptable quality and standard of living. Equity of opportunity for everyone, particularly the poorest and most vulnerable (Gibson, 2005).
Distributional fairness	It takes the form of making the worst-off members of the society as well off as possible (Rawls' Theory of justice Vantage for the disadvantages, 1971).	Ensure a fair share or proportionate distribution of benefits and dis-benefits (Maschewsky, 2005).
Condition	Equalities not only in the opportunity but also in the results.	Assuring that people not only have the same starting points but also fair outcomes.
Procedural	Fairness of the processes whereby outcomes are allocated.	This principle holds that regulatory and participatory systems should be devised and applied to ensure that all people are treated openly and fairly (Haughton, 1999).
Geographical Equity	It is related to the notion of territorial social justice that address equity issues both within and beyond their own territorial boundaries (Haughton, 1998).	Embrace considerations of how structural geographical inequities are constructed, including the use of national political boundaries and bounded legal systems to restrict legitimacy to those outside these boundaries (Haughton, 1998).
Capability	Equalities not only in the opportunity but also in the right of freedom of choice (Sen, 2009).	The focus of the capability approach is thus not just on what a person actually ends up doing, but also on what he/she is in fact able to do, whether or not they choose to make use of that opportunity (Sen, 2009).

At least three elements characterize the notion of environmental justice. The first concerns the distributional equity, which means that no social group, especially if already deprived in other socio-economic respects, should suffer a disproportionate burden of negative environmental impacts (Maschewsky, 2005). The second is over the procedural equity, which refers to the need that regulatory and participatory systems should be devised and applied to ensure that all people are treated openly and fairly (Haughton, 1999). The third is related to the concept of geographical equity, which is about how environmental disamenities are distributed without ignoring potential external impacts of decisions from neighbourhood level to the global (Haughton, 1999).

Integrated approaches

Integrated approaches stress on the need to take into account interconnections and interdependencies among the three dimensions, and include transdisciplinarity and holism. To this purpose, it is not only important to evaluate the social, environment and economic implications of actions, but also the interrelations between these parameters promoting at least compatible and preferably mutually reinforcing outcomes (Gibson, 2005). Thus, the key in addressing any sustainability issues is to maximize multiple, mutually reinforcing, fairly distributed, adaptable and lasting contributions to sustainability while avoiding significant adverse effects. While we will surely face trade-offs, the aim is to find ways around or over them wherever possible (Gibson, 2006).

Transdisciplinary and holistic approaches take the integration of disciplines a stage further the interdisciplinary work, where not only does one transcend the boundaries of the disciplines in seeking understanding, but actually generates new concepts and mental structures which subsume and extend the approaches of even an interdisciplinary approach (Proops, 1999; Clark, 2010). There are at least three examples of these approaches such as resilience thinking, adaptive management and ecosystem stewardship. With some degree of differentiations, these approaches address social-ecological sustainability recognizing that people are integral components of social-ecological systems and that people affect and respond to ecosystem processes. Thus, efforts that fail to deal with the synergies and trade-

offs between ecological and societal well-being are unlikely to be successful (Chapin et al., 2010).

Tab. 3.4 – A conceptual framework for analysing equity vis-à-vis sustainability: Integrated Approaches.

EQUITY PERSPECTIVES	DESCRIPTION	EQUITY PRINCIPLES
Distributional fairness across generations (Deontological ethics)	The legitimacy of taking only into account the preferences of present generations should be questioned in order to assure the commitment to equity between generations that sustainability represents (Padilla, 2002).	Access to and value derived from the use of natural resources should be equitable in both space and time (Kuik and Gilbert, 1999).
Justice for an imperfect world	Concentrating on how to make society more just, rather than speculating about the nature and the demands of 'the perfectly just society' (Sen, 2009).	Have critical scrutiny and comparative approach in assessment for identifying the major synergies, conflicts or trade-offs (OECD, 2008; Sen, 2009). Knowledge of the limitations and assumptions of the adopted sustainability assessment tools and a conscious attempt to bring together different ways of knowing through methodological pluralism (Norgaard, 1989; Ravetz, 2006). Efforts that fail to address the synergies and trade-offs between ecological and societal well-being are unlikely to be successful (Chapin et al., 2010).

The implications of this interpretation include changing the focus from seeking optimal states and the determinants of maximum sustainable yield to adaptive resource management, and adaptive governance (Walker et al., 2004).

Literature reveals definitions, themes and descriptions of sustainability reflecting emphasis alternative given to the social, the environmental and the economic dimensions or attempts to take into account interdependences between and across dimensions. The construction of the framework assisted in putting deeply attention on sustainability and equity phrases in view of clarifying intertwined connections between sustainability interpretations and main values and perceptions of equity, disclosing similarities and divergences. These aspects are discussed in detail in the following section.

3.3 Selecting equity perspectives

The analysis of the conceptual framework, shown in section 3.2, guided to focus on a selection of equity perspectives concurrently matched to different approaches to sustainability. This choice was underpinned by several insights.

First of all, it was possible to note that different perspectives do not always conflict each other. Secondly, those perspectives are not mutually exclusive and largely entail others interpretations that can be seen as particular case of the perspectives chosen. In particular, more bonds were found between approaches to sustainability that could be related to deontological theories. They hold that rightness or wrongness depends solely upon the nature of an action (Glasser, 1999). Deontological beliefs are usually opposed to consequentialism. According to consequentialism, the 'rightness' of actions, including rules, acts and policies, should be judged entirely by the goodness of the consequent outcome (Tacconi and Bennett, 1995).

The most important and common belief could be synthetized with the first principle of Rawl's theory of justice, which claims that each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all (Rawls, 1971, p. 250). It means to ensure primary goods, which is goods everybody needs to their plan of life, independent of what the plan is (Rose and Kvernd, 1999). Those primary goods are: liberty, opportunity, material welfare, income and the basis of self-respect (Hermans and Knippenberg, 2006).

This perspective is also consistent with deontological ethics. In this perspective, acts themselves can take on moral significance. Thus, some actions are simply not right regardless of whatever consequences are expected to flow. In intra-generational terms, deontological considerations demand to take into account equity of processes in addition to equity of consequences (Osmani, 2010). Deontological perspective entails remarkably equity of condition and distributional fairness as well. That infers an interrelated basic foundation: pursuing equalities in condition, in other words equity based on fairly results, embraces to not ignore differences in the outcomes likely to be experienced by different segments of the population (Gandy, 2011).

As a consequence, having ensured primary goods, and fair equality of basic needs opportunity for all, social and economic inequalities are to be arranged so that they are to the greatest benefit of the least advantaged (Rawls, 1971). According to these considerations, procedural equity and geographical equity might be seen as specific branches of the distributional fairness perspective.

Analogously, deontological positions also demand for distributional fairness across generations. In fact, in inter-generational terms, a deontological or "Kantian" ethical reasoning implies a strong bias against actions that generate present benefits but impose the risk of irreversible future losses when scientific research would permit the effective resolution of uncertainty over generational time. In particular, one may plausibly assert that each successive generation holds a moral duty to ensure that the expected welfare of its children is no less than its own perceived well-being (Howarth, 1995).

Looking at interspecies equity, anthropocentric foundations for environmental concerns do not necessarily compete with ecocentrism. As Glasser (1999) claims humans can choose to recognise biogeophysical systems value and accord them significance in decision-making procedures. Thus, interspecies equity requires both distributional fairness across generations and justice for an imperfect world perspectives if it is taken the view that a very significant level of environmental protection can be secured solely on the basis of humanistic environmental concerns.

This approach will implicitly need to adopt a deontological perspective as well. It is also related to Leopold's land ethic approach. However, this deontological perspective could be also compatible with a more extensive interpretation of consequentialism as proposed by Sen (1987, p. 76) "*to say that action should be chosen over action y is not statement as that the state of affairs resulting from action x, including action x done, is superior to the state of affairs resulting from action y, including y done"*. Glasser (1999) helps in understanding this vision, explaining that the two crucial insights stressed by Sen are the importance of context and the need to carefully consider how the character of a decision can vary as the boundaries that define the set of "net" consequences are drawn.

Similarly, the acceptance of a deontological standard does not imply a general rejection of the importance of taking consequences into account (Glasser, 1999). A noteworthy evidence that deontological and consequentialist perspectives disclose some interconnections and might be reconciled is provided in relation to ecosystem services. Farley (2012) considers that from the consequentialist perspective, allocation decisions should give greater weight to the preferences of those who depend the most upon ecosystem services, which will generally be the poor, who cannot afford substitutes. This point view also accommodates distributional fairness perspective, whose intent is to ensure vantages for the disadvantages as well.

These reflections might be also recognized into foundations of more integrated approaches that seek to reconcile deontological priorities, such as non-compensatory values, and consequentialism needs. Justice for an imperfect world and comparative judgement perspectives try to resolve conflicts between compensatory and non-compensatory values especially in relation to environmental and social concerns. These perspectives accept the need of models that lie on the realm of feasibility. Given that the impossibility of defining a perfectly just society, a theory of justice for an imperfect world aims at judging whether a certain act or a change contribute to move from a more unjust to a less unjust state (Sen, 2009).

In this perspective, it is not deny that the irreducible plurality of values and reasoning may not always make possible a complete agreement on the relative justness of alternative decisions (Osmani, 2010). But, it is provided a way of acting. What is essential is to operate within a democratic environment and compare between alternatives that differ in their degree of justness with a critical and impartial scrutiny. Sen (2009) claims that the comparative judgement of alternative realizations must be carried out in the framework of 'public reasoning'. In fact, greater access to information and broader scope for public reasoning may reduce the range of incompleteness in judgement. This is anchored to the conviction that arguments if appropriately motivated and justified to others on grounds could not reasonably reject (Scanlon, 1998). Equivalently, an act is wrong if and only if it would be disallowed by any principle that people (motivated by critical scrutiny) could not reasonably reject (Scanlon, 1998).

Two main perspectives were excluded. The first is over utilitarianism. Utilitarianism does not attribute intrinsic value to social and economic equity (Harsanyi, 1985). The goodness of equity is judged on the basis of its contribution to maximise the total utility of members of society. Thus, the main critic is related to the fact that this perspective has no attention for individual rights. In relation to intra-generational equity, Tacconi and Bennett (1995) consider that if it is assumed that all people have the same utility function, which is increasing and concave in income, total utility would be maximised by an exactly equal distribution. However, they also recognise that this case is only hypothetical given the differences that exist in people's preferences.

Sen (1982, chapter 16) notes that individual preferences differ and a utilitarian approach would attribute less income to a person A who receives less utility at any income level than another person B. This distribution would maximise total utility, but A would be worse off than B, because A receives less income than B, and further, obtains less utility from that level of income when compared with B. In this regard, Rose and Kvernd (1999) cite even more immediate as well as brutal example.

Theoretically, from a utilitarianism perspective, killing a healthy person and using his/her organs for save other people may increase the total utility for society even if it represents a violation of individual rights.

Secondly, the capability perspective was excluded for several implementation-based reasons: diffuse critics, recognized also by Sen (2009) who is a strong supporter of the capability approach, hard reconcilability with the other perspectives, recognized difficulties to deal with capability to choose between different achievements and managing trade-offs (Dasgupta, 2013; Qizilbash, 2007).

In relation to sustainability, the analysis led to select four perspectives whose conceptual underpinnings might be fully cover sustainability requirements and commitments for present and future generations. They are accommodated as opportunity, distributional fairness, and distributional fairness across generations, and justice for an imperfect world perspectives.

This approach provides an implementable translation of equity and sustainability, targeting key aspects for use in decision-making.

Figure 3.1 and Table 3.5 show the equity perspectives selected and general principles associated for decision-making.

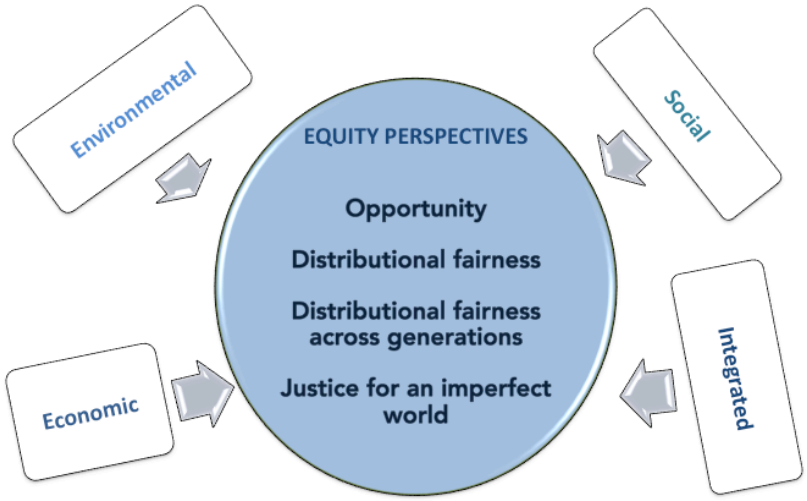

Fig. 3.1 – A selection of compatible equity perspectives to be addressed for operationalizing intra- and inter-generational equity.

Tab. 3.5 – Equity perspective selected.

EQUITY PERSPECTIVE SELECTED	GENERAL PRINCIPLES
OPPORTUNITY	Acceptable **quality and standard of living** for everyone. Equity of **opportunity** for everyone, particularly the poorest and most vulnerable.
DISTRIBUTIONAL FAIRNESS	Fair share or **proportionate distribution** of benefits and dis-benefits.
DISTRIBUTIONAL FAIRNESS ACROSS GENERATIONS	**Access to** and value derived from the use of **natural resources equitable** in both **space and time.**
JUSTICE FOR A IMPERFECT WORLD	Have critical scrutiny and comparative approach in assessment **for identifying the major synergies**, conflicts or **trade-offs.**

3.4 Describing intra- and inter-generational equity in the four perspectives

The proposal for operationalizing the concept of intra- and inter-generational equity is based on the intent of drawing up criteria derived from notions of intra- and inter-generational equity consistent with the equity perspectives and principles selected in section 3.3.

To this purpose, this section presents an overview of conceptions of intra- and inter-generational equity consistent with the select perspectives. Then, Section 3.5 defines a set of intra- and inter-generational equity criteria applicable in decision-making.

The considerations and the derived selection of equity perspectives made in sections 3.2 and 3.3 put attention on the importance of the nexus between intra- and inter-generational equity. As synthetized by Goodland (1999), it is hard to think that inter-generational equity would be achieved sometime in the future without moving towards intra-generational equity in the present.

This emphasis, therefore, upon greater equity as a desirable and just social goal, is intimately linked to a recognition that, unless society strives for a greater level of social and economic equity, both within and between regions, the long-term objective of a more sustainable world is unlikely to be secured (Agyeman et al., 2002). In fact, although equity towards future generations implies sustainability, it does not necessarily cater for fairness between people of the same generation. It means that it is necessary for observers to consider relevant outcomes, or impacts on the quality of life that accompany differential access to resources (e.g. goods and services), experiences, and relationships (Gandy, 2011).

Nevertheless, fairness in the distribution of gains and losses should not disregard the entitlement of everyone to an acceptable quality and standard of living and to equivalent living conditions. This idea of equity derives from a concept of social justice applicable to present and future generations: people within the same generation should have equal rights to benefit from the use of natural resources and from the enjoyment of a clean and healthy environment. Thus, it emerges the need that access to and value derived from the use of natural resources should be equitable in both space and time (Kuik and Gilbert, 1999), by adopting measures to prevent environmental degradation, as well as, avoid iniquities in the distribution of exposition to health risk (Beder, 2000). Agyeman et al. (2002) claims that a truly sustainable society is one where wider questions of social needs and welfare, and economic opportunity, are integrally related to environmental limits imposed by supporting ecosystems.

As asserted by George (1999), environmental conservation even more strongly than carrying capacity should be preserved. Thus, when carrying capacity cannot be defined readily or is in no immediate danger of being exceeded, the environment should be conserved anyway, to

the extent that future generations will want it to be conserved. It is also implicit that available capital of non-renewable resources should be maintained in the long term (Brandon and Lombardi, 2010; Clarke, 2002; Padilla, 2002; George, 1999; Howarth, 1995; Daly, 1990).

Moreover, intra-generational equity demands attention to inequities and discrimination (e.g. factors such as race, age, gender, locations, income, health status, vulnerability, religion etc.). This awareness, therefore, encompass the notion of environmental justice (EJ). EJ focus on the fact that actions, including planning policies and practice, affecting the environment should primarily bring attention to people who were both poor, and racial or ethnic minorities (Gandy, 2010; Walker, 2010; Cutter, 1995). Environmental, societal and economic trade-offs cannot simply be ignored in assessments because it is difficult to remedy inequalities (Mitchell, 2003). It might infer the need for transformation of social relations, redistribution of rights and resources, and policy approaches, which address social inequities.

Decisions are equitable if they support, promote and transmit from one generation to the next the system of cultural and social heritage acquired (McKenzie, 2004). However, Sen (2009) highlights that even if people is not deliberately callous about future generation' interests, they still fail to take adequate care of the environment and the sustainability of the requirements of good life. Thus, to prevent the negative effects, it is indispensable to have critical scrutiny and comparative approach in assessment concentrating on how to make society more just, rather than speculating about the nature and the demands of 'the perfectly just society ' (Sen, 2009).

The comparative judgement of alternatives that differ in their degree of justness should be realized through informed and impartial public reasoning in which critical thinking and free exchange of information and ideas among all individuals can flourish (Osmani, 2010). Moreover, such form of strong democracy disperses power, redistributing it downward so that governance is less susceptible to dominance by special interests (Prugh et al., 2000). An equitably harmonization of the interests of succeeding generations across time would also depend on the success of the planning and transition measures to enhance and protect the legacy left to future generations (Gibson, 2011).

Nevertheless, a net positive contribution towards intra- and inter-generational equity would depend on the preparedness of governments and other institutions to complement monitoring undertaking anticipatory planning, adaptive management and enforcement

(Gibson, 2011; Joint Review Panel, 2009). This is also related to the recognition that knowledge limitations and uncertainties should be overcome by creating opportunities for self-organization, strengthening of local and regional institutions and building cross-scale linkages and problem-solving networks and bridging future development opportunities (e.g. Slootweg and Jones, 2011; Grace, 2010; Berkes, 2007). It is therefore important to notice that follow-up and monitoring are integral to dynamic and continuous focus on environmental and socioeconomic sustainability in the view of achieving adaptive management (Slootweg and Jones, 2011; Walker, 2010).

As mention before, the research endorses the approach of combining inter- and intra-generational equity in order to fully conceptualize the sustainable development notion and, therefore, of finding a metric for operationalizing the two concepts of intra- and inter-generational equity. Thus, having clarified equity concerns in the light of the plurality of approaches to sustainability, a last step forward has been taken for reconnecting intra-generational and inter-generational equity to the equity perspectives selected.

3.5 Defining a set of intra- and inter-generational equity criteria

The literature review on intra- and inter-generational equity helped in converted intra- and inter- generational equity concepts into criteria that accomplish the four equity perspectives selected. Thus, compatible and consistent criteria gathered from an extensive literature were matched with the equity perspectives selected. They seek to assists in evaluating equity in distribution of the expected effects of decisions on present and future generations by addressing the significant equity perspectives identified and minimizing conflict.

Criteria have a wide-ranging nature to allow the application to different decision contexts. Tables from 3.6 to 3.9 present an outline of these general equity criteria by focusing on suitable key points drawn up from them.

In regard to ***opportunity***, essential points are to provide a clean and healthy environment and guarantee access to basic goods (eg. water, decent house, etc.) and to transport and services and other facilities (Hermans and Knippenberg, 2006; ODPM, 2005). In view of ensuring fairness in accessing to and benefiting from the use of natural resources, it is therefore critical

to provide a range of community amenities and services available to all in the community (Morrison-Saunders and Hodgson, 2009). Moreover, it is necessary to address the concept of community and collective values (Turner, 1999) as well as to promote social inclusion by contributing to access to proposal related opportunities for women, people in small and remote communities (Gibson, 2011; EC, 2009).

In addition, it is important to contribute to deliver valuable and lasting overall benefits (Gibson, 2011), making decisions in favour of achieving net gains that improve quality of life (Morrison-Saunders and Pope, 2013; Gibson 2006; Therivel et al., 2009).

Tab. 3.6 – Opportunity Key Points.

GENERAL CRITERIA FOR ADDRESSING INTRA- AND INTER-GENERATIONAL EQUITY ISSUES OPPORTUNITY KEY POINTS
• Provide a clean and healthy environment. • Access to basic goods (e.g. water, decent house, etc.) for all. • Access to transport, services and other facilities for all. • Provide a range of community amenities and services available to all in the community. • Contribute to guarantee opportunities for women, people in small and remote communities. • Address the concept of community and collective values. • Promote social inclusion. • Making decisions in favour of achieving net gains that improve quality of life.

In relation to ***distributional fairness***, for guarantying proportionate distribution of environmental goods and bads (Agyeman 2002; Beder, 2000), it is important to ensure equity of exposure, which requires the presence of a level playing field to allow groups an equal chance of being targeted for significant environmental change, as well as, equity of impact, in which groups should experience a proportionate share of the costs and benefits of such change after it occurs (Maschewsky, 2005). It also implies to avoid inequities in the impacts of environmental policies, differences in regulatory enforcement - e.g. sectors of communities who are imposed additional costs; increasing the price of certain goods (Connelly and Richardson, 2005; Beder, 2000).

Another related point is to avoid iniquities in the distribution of exposition to health risk (Beder, 2000), taking into account human exposure to harm and the differential sensitivity of social group to harm and differences in adaptive capacities to respond or “bounce back” after the harm occurs (Cutter, 2003 in Boone, 2010).

Tab. 3.7 – Distributional fairness key points.

GENERAL CRITERIA FOR ADDRESSING INTRA- AND INTER-GENERATIONAL EQUITY ISSUES DISTRIBUTIONAL FAIRNESS KEY POINTS
• Guarantee proportionate distribution of gains and losses. • Operate without ignoring external impacts of decisions-from the neighbourhood level to the global. • Guarantee an equal chance of being targeted for significant environmental change and proportionate share of the costs and benefits of such change after it occurs. • Avoid iniquities in the distribution of exposition to health risk, taking into account human exposure to harm and the differential sensitivity of social group. • Assure social acceptability. • Avoid inequities in the impacts of environmental policies, and differences in regulatory enforcement. • Avoiding inequities in people's ability to influence decisions affecting their environment. • Promote direct representation of the interests of disadvantaged groups. • Narrow the gap between the most deprived areas and the rest.

In order to assure social acceptability of decision-making (Agyeman et al., 2002), it is required to avoiding inequities in people's ability to influence decisions affecting their environment (Beder, 2000) by promoting direct representation of the interests of disadvantaged groups (Connelly and Richardson, 2005; George, 1999). It is therefore crucial to narrow the gap between the most deprived areas and the rest so that no-one is seriously disadvantaged by where they live (Brigthon & Hove City Council, 2010). Thus, it is fundamental to operate without ignoring external impacts of decisions - from the neighbourhood level to the global (Haughton, 1999).

Focusing on ***distributional fairness across generations***, it is needed to assess environmental, social and economic effects and their duration (Therivel et al., 2009; Morrison-Saunders and Arts, 2004) so as to preserve the integrity of ecological systems and associated life support functions (Gibson, 2005; Clarke, 2002; Haughton, 1999), and maintain and enhance the resilience of socio-ecological systems (e.g. Walker and Salt, 2006; Gibson et al., 2005). In order to take into account the maintenance of available capital of non-renewable resources in the long term (Brandon and Lombardi, 2010; George, 1999), it is therefore critical to prioritise environmental protection and ecological integrity so that any change in the status quo results in net environmental benefit (Morrison-Saunders and Hodgson, 2009). Thus, it implies to adopt measures that minimise energy and resource use, minimise emissions and production of waste, and maximise the re-use of displaced materials (EC, 2009; Page 1997; Gibson 2006).

Tab. 3.8 – Distributional fairness across generations' key points.

GENERAL CRITERIA FOR ADDRESSING INTRA- AND INTER-GENERATIONAL EQUITY ISSUES DISTRIBUTIONAL FAIRNESS ACROSS GENERATIONS KEY POINTS
• Take into account the maintenance of available capital of non-renewable resources in the long term. • Preserve the integrity of ecological systems and associated life support functions. • Maintain and enhance the resilience of socio-ecological systems. • Assess environmental, social and economic effects and their duration. • Prioritising environmental protection and ecological integrity so that any change in the status quo results in net environmental benefit. • Seriously consider 'not proceeding' as an option where there is too much scientific uncertainty about particular aspects of a proposal or where the negative consequences of the proposal outweigh the benefits. • Adopt measures that minimise energy and resource use, minimise emissions and production of waste, and maximise the re-use of displaced materials. • Adopt the precautionary principle to prevent any group, whether defined spatially, social or over time (i.e. a specific generation), from assuming an unfair and unnecessary burden of environmental change. • Adopt a strong sustainability perspective, avoiding decisions that entail decrease in the level of natural capital passed onto future generations. • Combines environment, social and economic consideration in a more objective way.

Moreover, to seriously consider 'not proceeding' as an option where there is too much scientific uncertainty about particular aspects of a proposal or where the negative consequences of the proposal outweigh the benefits (Morrison-Saunders and Hodgson, 2009). In relation to this point, it is also important to assure equity of change, which requires the application of the precautionary principle to prevent any group, whether defined spatially, social or over time (i.e. a specific generation), from assuming an unfair and unnecessary burden of environmental change (Maschewsky, 2005). Thus, a strong sustainability perspective is needed to avoid decisions that entail decrease in the level of natural capital passed onto future generations (Beder, 2000; George, 1999) and combines environment, social and economic consideration in a more objective way (Eales and Sheate, 2011).

Concerning ***Justice for an imperfect world***, fundamental point is to establish thresholds that demarcate acceptable from unacceptable impacts for managing trade-offs and appropriate processes for justifying and accounting for trade-offs (Gibson, 2006; Seto et al. 2012; Morrison-Saunders and Pope, 2013). Moreover, to undertake climate change adaptation and mitigation measures (Eales and Sheate, 2011; Brandon and Lombardi, 2010; EC, 2009).

Finally, it is crucial to avoid "cognitive dissonance" where there is a mismatch between beliefs and behaviour (Bond and Morrison-Saunders, 2011, citing Rein and Schön, 1993) by building up community and regions, 'sense of place' and heritage protection (Pope et al., 2004), and increasing trust in each other and common sense of responsibility (Wilkinson, 2012).

Tab. 3.9 – Justice for an imperfect world key points.

GENERAL CRITERIA FOR ADDRESSING INTRA- AND INTER-GENERATIONAL EQUITY ISSUES JUSTICE FOR AN IMPERFECT WORLD KEY POINTS
• Establish thresholds that demarcate acceptable from unacceptable impacts. • Justifying and accounting for trade-offs. • Undertake adaptation and mitigation measures. • Avoid "cognitive dissonance" where there is a mismatch between beliefs and behaviour • Build up community and regions, 'sense of place' and heritage protection • Increase trust in each other and common sense of responsibility. • Build a more diverse economic base and manage the pace and scale of development • Contribute to enhance living conditions for future generations.

3.6 Discussion and conclusion

This chapter aimed at offering a set of generally applicable criteria that could be used to operationalizing intra- and inter-generational equity issues in decision-making. To this purpose, following the idea that intra- and inter-generational equity could fully conceptualize sustainability, the chapter sought to deal with two crucial demands. The first was over how sustainability is interrelated to equity within the sustainability literature. The second concerned the idea to identify a consistent and compatible selection of equity perspectives and principles adopted in the sustainability debate, along which criteria for addressing intra- and inter-generational equity issues might be developed.

The proposed approach led to capture four metrics of equity providing a means to make equity concerns more explicit over space and time. Four positive aspects about the approach adopted deserve attention. Firstly, it sought to provide a way for approaching the tightly intertwined notions of equity and sustainability. In fact, the examination of equity perspectives supported in clarifying main aspects related to the distribution of the expected effects of decisions on present and future generations on which sustainability should be

founded. Secondly, the approach helped in revealing synergies and similarity of interpretations of sustainability under the lens of equity, as well as, in focusing on general principles according to which it is possible to prioritise analysis and assessment in decision-making. The third point concerns the widespread recognition that criteria need to be specified to respect the context involved in the analysis (Gibson, 2005). In regard to this point, the general criteria gathered from the review of equity perspectives and sustainability might play a role of guidance statements for specializing criteria according to context-placed and place-based issues.

Another key advantage of using this approach is that it makes possible to undertake assessment by taking into considerations conditions of inter- and intra-generational equity concurrently. It is stressed that both conditions should be simultaneously intrinsically part of the process design, rather than a separate consideration in its own right. Thus, the proposed key to interpreting equity in relation to sustainability might represent a streamlined way for addressing over space and time the social, economic, and ecological dimensions of sustainability. In this regard, for instance, a practical and interesting application of the proposed approach might be possible in strategic planning.

Strategic decisions taken in policies, planning and programming processes, are defined as frameworks for action. Decisions in planning are considered neither rational nor linear, nor are value-free and only technical (Nelson, 2011). They seek to anticipate new trends, discontinuities, and surprises, enhancing ways of taking advantage of opportunities (Albrechts, 2004). Strategic decisions about the environment are undertaken with the aim of producing a more rational organization of activities in space, including the linkages between them; and to balance development with the need to protect the environment (CEC, 1997).

In accordance to this view, the proposed approach might offer a valid support in tackling sustainability issues recognizing that social, economic and biophysical objectives must be treated as interdependent factors (Gibson, 2006). In fact, over the past decade it has been largely recognized that planning for sustainability requires different methods and a changed paradigm from traditional planning (Rotmans et al., 2000).

A pivotal effort of strategic planning is identifying and analysing crucial and contextual factors that might be influence the widespread and long-term success of current decisions (Shearer et al. 2006; van der Heijden, 1996).

The proposed approach might be seen as a first attempt to answer the demand of formal models that link environmental assessments with economic analysis and attention to equity issues. It is recognized that such approaches can play a crucial role on the interface between the short-term and the long-term, the objective and value-laden, the quantitative and qualitative, and the certain and uncertain (Rotmans et al, 2000).

However, there are at least two closely critical aspects of the proposed approach that need to be acknowledged. Firstly, although the four equity perspectives considered are commonly agreed, different points of view evidently exist. It is a matter of personal perceptions.
It is clear that univocal and absolute answer is not possible. Nevertheless, having discussed and reached an agreement on perspectives to be adopted in assessment, the proposed equity framework might be useful for formalizing shared equity perspectives in decision-making by incorporating quantifiable and feasible related criteria.

A second interrelated aspect refers to the selection of general equity criteria. Being aware of the vast interdisciplinary area that links concepts of sustainability and intra- and inter-generational equity, no claims were made to being comprehensive in translating the chosen equity perspectives into general criteria. It is important to point out that this study lays some methodological foundations on how to address equity in strategic assessment, but they might be refined and enriched by other substantive insights. For instance, the most important area of more investigation is over how to establish suitable criteria for better covering social distributional implications across generations.

These findings provide several insights for future research. However, a prior starting point for further work should be to test the applicability of the equity criteria approach designed to a case study. It should be a useful way for verifying limitations and constraints of the method on the ground. In light of the insights emerged from this chapter and the focus of the research, two essential aspects needed to be examined in view of applying the method.
The first concerned the choice of a specific area of investigation. The second was over the need of flashing out this area in view of providing all the elements required for contextualizing the equity criteria.

The attention was directed to the Oil & Gas sector for the challenge posed to sustainability and, consequently, for the efforts required for making decisions at strategic level.

Next chapters will be devoted to describe and discuss the work undertaken for testing the equity criteria method against a case study in the Oil & Gas sector. Specifically, Chapters 4 and 5 will flesh out sustainability in relation to SEA of Oil & Gas practice, while Chapters 6 and 7 will be devoted to on-shore Oil & Gas application to the "Val d'Agri Oil fields" (Southern Basilicata, Italy).

As a note of terminology, from now on, I will use "equity" interchangeable with "inter- and inter- generational equity", given that the set of equity criteria presented in this chapter are suggested for addressing inter- and inter- generational equity concurrently.

Part II

Case study review and applications in the Oil & Gas sector

Chapter 4

Reviewing sustainability assessments of Oil & Gas developments[2]

4.1 Introduction

Oil & Gas development is a controversial source of opportunities and challenges. Given the expected revenues, Oil & Gas developments represent a potentially substantial source of revenue to promote local and regional development. However, unacceptable environmental and societal trade-offs may also be triggered, such as an unfair distribution of economic benefits and environmental burdens. The expansion of Oil & Gas exploitations is hardly sustainable in the long-run, given that these resource are non renewable and their availability is limited (Government of Saskatchewan, 2007).

Oil & Gas production, transport and use can also raise deep environmental and social concerns, which need to be assessed and strategically managed. Potential negative consequences include damage to habitats and biodiversity, water and soil contamination, greenhouse gas emissions, regional air pollution (and connected problems, such as forest degradation and acid rain), and local air pollution, which pose a threat to human health (NORAD and World bank group, 2009). Additionally, the potential environmental implications stemming from Oil & Gas activities can, in turn, generate dangerous ripple effects on other socio-economic sectors.

An emblematic case is offshore oil-spills damaging local activities such as fisheries, tourism and agricultural practice (Norwegian Ministry of Environment, 2009). Moreover, it is generally recognised that locals hardly benefit from the large revenues generated by Oil & Gas activities.

[2] This chapter is based on: Lamorgese, L, Geneletti, D, Partidário, MR. Sustainability principles in strategic environmental assessment: A framework for analysis and examples from Italian urban planning *(currently under review).*

As a result, environmental assessment in the Oil & Gas sector has attracted increasing attention from governments, oil companies, and the general public (The World Bank, 2010). Thus, in the light of a growing international debate about the risks and benefits of Oil & Gas activity, the imperative need to shift planning and impact assessment processes towards more strategic and sustainability-based models is strongly emphasized (Fidler and Noble, 2012; Norwegian Ministry of Environment, 2009).

The reasons above lead to reflect on suitable tools to deal with this complex mix of sustainability challenges. As mention in Chapter 1 and 2, this research recognises and follows the idea that SEA is an important instrument to promote sustainability-driven decision-making. In fact, provided the strategic thinking it enables, and when asking strategic-level questions and concerns in a participatory context, SEA can enhance opportunities for fully integrated and more sustainable decision-making processes and outcomes (Pope and Dalal-Clayton, 2011; Partidário, 2007b; Morrison-Saunders and Therivel, 2006).

This chapter aims at exploring to what extent current SEA for the Oil & Gas sector contributes, procedurally and substantively, to more strategic and sustainability-oriented decisions. To this purpose, I will use a framework for reviewing SEA practise based on the strategic thinking model for SEA developed by Partidário (2012, 2007b) and a review framework proposed by Partidário et al. (2009), and apply it to 11 case studies related to both off-shore and on-shore Oil & Gas developments. In Section 4.2 I will flesh out on relevant issues in SEA of Oil & Gas sector. Then, I will present the review framework and the selection of case studies (Section 4.3 and 4.4). Results are illustrated and discussed in Section 4.5. Finally, Section 4.6 provides some conclusions.

4.2 Sustainability Assessment for the Oil & Gas sector

It has been increasingly recognized that SEA has the potential to address sustainability concerns during policies, plans and programmes making (e.g. Pope and Dalal-Clayton, 2011; Partidário, 2007b; Morrison-Saunders and Therivel, 2006). The contribution of SEA to sustainability can be linked to two intertwined questions: substantively, to what extent SEA is sustainability-oriented by addressing mutually beneficial outcomes, using an integrative approach across the classic environmental, social and economic pillars (Gibson, 2006) and,

procedurally, to what extent SEA is strategic in defining the means useful for pursuing these outcomes (Gardner, 1989).

Concerning the first question, SEA should shift towards a holistic and integrated assessment that aims at maximizing net gains, while avoiding trade-offs that would cause unacceptable impacts (Gibson, 2006, Morrison-Saunders and Pope, 2013). As to the second question, Partidário (2007b) argues that SEA should strive for strategic thinking rather than technical assessment that simply satisfies an assessment process. Strategic-based SEA puts a lot more emphasis on policy contexts, integration and long-term perspectives, strategic options, participation, communication, guidelines for implementation and monitoring (Partidário et al., 2009). For this purpose, a strategic thinking model for SEA should entail technical, process and communication components tailor made to, and well articulated with, the processes of decision-making (Partidário, 2012; 2007b). Acknowledging the two aspects present significant overlaps, it is broadly accepted that sustainability relies on a mixture of substantive and process-oriented assessment (e.g. Morrison-Saunders and Pope, 2013; Partidário, 2007a; Gibson, 2006; Gardner, 1989).

The regulatory framework for SEA in the Oil & Gas sector varies largely across different contexts. In some cases, the general SEA regulations and legislation apply (e.g. countries with consolidated environmental and SEA rules, such as European Union and Australia), whereas others countries developed specific requirements (e.g., Bolivia: Ministerio de Hidrocarburos y Energia, 2011, and Brazil: Teixeria, 2008). At the international level, the World Bank and the Netherlands Commission for Environmental Assessment (NCEA) provided assistance in developing tailor-made Term of References for SEA of Oil & Gas, particularly in Africa and America Latina (Foluke, 2012; NCEA, 2012; 2009).

Other countries, such as Ghana and Mauritania, have developed ToR for SEA of Oil & Gas processes with a view of strengthening their national environmental impact assessment legislation. In fact, specifically for the Oil & Gas sector, SEA is expected to play a central role in dealing with sectoral concerns and regional-scale resource management issues of interest to all stakeholders (Fidler and Noble, 2012; Johnson et al., 2011; CCME, 2009; Harriman and Noble, 2008; Horvath et al., 2004).

By considering the difficulty of evaluating all the elements potentially affected by Oil & Gas development, it is necessary to focus on those aspects that can act as indicators of environmental and societal change, such as Valued Ecosystem Components (VECs) (see Ekanlands and Duinker, 1983) or Critical Decision Factors (CDFs) (see Partidário, 2012; 2007b). Horvath et al. (2004) stress the need to take into adequate consideration cumulative environmental effects of potential full-scale offshore Oil & Gas development over time (e.g. exploration and eventual development in the event that a significant discovery is made) as well as adequate public input into scoping and decision-making.

Analogously, Noble (2008) underlines the limits of practices concentrated on describing the current state of the environment or modelling past and present stressors and responses, rather than helping in projecting trends and discerning desirable future in a long-term perspective. The identification and comparison of alternatives represent a key element to support the discussion of possible future scenarios and the identification of key environmental goals and objectives (Fidler and Noble, 2012; Gunn and Noble, 2011; Fisher, 2007).

SEA of Oil & Gas is also seen as a way to promote the integration of social issues related to Oil & Gas development, in terms of both potential impacts and stakeholder involvement. This is stressed in some of the available guidance documents (e.g. TNEM, 2012; RIM and World Bank, 2011). Assessments for offshore and onshore Oil & Gas development should give strong attention to the expectations of populations, focusing on concrete results in terms of transparency, equitable sharing of the benefits, and compensation for the population negatively affected from an environmental and social perspective (RIM and World Bank, 2011).

Consideration of the effects on indigenous societies is required by several SEA approaches (Ministerio de Hidrocarburos y Energia of Bolivia, 2011; Government of Québec, 2011; Department of State Development Government of Western Australia, 2010). Following the strategic-based model developed by Partidário (2007b), a Brazilian proposal for SEA in Oil & Gas sector (Teixeira, 2008) claims that beyond facilitating transparent and participative processes, a more integrated SEA of Oil & Gas should engender better understanding of environmental constraints and more social control on decisions on Oil & Gas development, as well as reducing potential conflicts in management and use of environmental resources related to Oil & Gas development.

4.3 A framework for reviewing SEA practice

The study adopted, and adapted, a framework used for reviewing SEA practice in Portugal (Partidário et al., 2009), based on an innovative strategic-based model for SEA (Partidário, 2012; 2007). The framework criteria cover focal elements for enhancing SEA practice: adoption of a strategic reference framework, including environmental and sustainability; framework objectives; proactive integration and long-term scope (as opposed to reactive effects-based); clear identification and assessment of alternative strategic options; strong linkage and interactivity of the SEA and planning processes; early community and stakeholders engagement throughout the process; good communication and capacity to influence decision-making; guidelines for implementation rather than mitigation of expected effect; and monitoring and evaluation programme, enabling learning processes.

These criteria are translated in eight assessment parameters (object of assessment, entry point, interactivity, scope of assessment, strategic reference framework, process, participation, proposal for follow-up), some of which divided into sub-parameters, and corresponding key questions.

With respect to the original framework, what we propose here adds one more assessment parameter (findings/outcomes), expands the contents of the process parameter, and integrates the key-questions with other relevant elements coming from the literature review of SEA of Oil & Gas activities: consideration of cumulative effects and uncertainty, long-term perspective, environmental integrity and socio-economic effects, analysis of trade-offs (Table 4.1).

For each question, a set of pre-defined categories has been identified. Each of these categories, with the exception of the parameter techniques, is then classified using a four-level scale: high, good, moderate and poor achievement.

The last column of Table 4.1 shows the distribution and ranking of these categories. “High” indicates that category represents the most significant contribution to more strategic and sustainability-oriented assessment. “Good” indicates categories significant but less than the formers, representing actions and examples that go beyond legal requirements. For instance, category “others” was ranked as good. Categories ranked “moderate” denote modest contribution towards sustainability (e.g. actions in accordance to strict legal fulfilment). Those

ranked “poor” indicate low or no contribution to more strategic requirements in the assessment.

Below there are two illustrative examples of how categories were ranked. For the question “How land use implications were addressed?”, the four possible categories - restriction in use, others (e.g. application of best practise for dealing with waste, wastewater discharges, action that can support precautionary approaches), adoption of mitigation and compensation measures, no - were respectively ranked: high, good, moderate, and poor achievement.

Similarly, for the question “How were alternatives considered?”, the five not necessarily mutually exclusive categories - alternatives in terms of other development options for the area, alternatives in degree of exploitation/intensity of Oil & Gas activities, alternatives in location, “zero alternative”, no alternatives considered - were respectively ranked: high, good, good, moderate, and poor.

Tab. 4.1 – Framework for reviewing SEA practice (adapted and integrated from Partidário et al., 2009).

ASSESSMENT PARAMETER	SUBPARAMETER	KEY QUESTIONS	CATEGORIES	LEVEL OF ACHIEVEMENT
1- Object of assessment		What were the motivations?	Explicitly addressing sustainability	High
			Mainly economic and social with a firm focus on environmental concerns	Good
			Mainly economic and social	Moderate
			Predominantly economic	Poor
2 - Entry point		At what stage of planning did SEA start?	At start-off	High
			Model	Good
			Diagnosis	Moderate
			Development proposals	Poor
3 - Interactivity		What was the degree of integration and feedback between assessment and planning activities?	High	High
			Medium	Good
			Low	Moderate
			Not verifiable	Poor
4 - Scope of assessment		What was the scope of assessment?	Holistic and integrated	High
			Social+biophysic+economic+political	Good
			Physical and territorial	Moderate
5 - Strategic Reference Framework		How was the Strategic Reference Framework defined and used?	A broad set of macro-policies relevant for the assessment settled (including also sustainable development strategies, biodiversity strategies, land-use planning policies, energy policies, climate change related strategies, etc.)	High
			Mainly focused on energy policies and licensing aspects (to prospect, explore and produce hydrocarbons)	Moderate
			Ignored	Poor
6 - Process	Objective	What was the purpose of assessment?	Beyond legal requirements	Good
			Strict legal fulfilment	Moderate
	Consideration of alternatives (in space and time)	How were alternatives considered?	Alternatives in terms of other development options for the area	High
			Alternatives in degree of exploitation /intensity of oil & gas activities	Good
			Alternatives in location	Good
			"zero alternative"	Moderate
			No alternatives considered	Poor
	Environmental issues	How the protection of biological diversity and the maintenance of essential ecological processes and life-support systems were ensured?	Restriction in use and protection of area with presence of higher-valued species	High
			Adoption of environmental thresholds	High
			Evidence of environmental net benefits	High
			Others	Good
			Adoption of mitigation and compensation measures	Moderate
		How land use implications were addressed?	Restriction in use	High
			Others	Good
			Adoption of mitigation and compensation measures	Moderate
			No	Poor
	Socio-economic effects	Were there demonstrated net benefits for local communities?	Yes	High
			Partially addressed	Moderate
			No	Poor
		Was there expressed how needs, values and expectations of stakeholders were taken into account? (Haughton, 1999)	Yes	High
			Partially addressed	Moderate
			No	Poor
		Was there an explicitly consideration of health issues?	Yes	High
			Partially addressed	Moderate
			No	Poor
	Analysis of trade-offs	Was there an explicitly treatment of sustainability trade-offs?	Yes	High
			Partially addressed	Moderate
			No	Poor

Tab. 4.1 – Framework for reviewing SEA practice (continued).

ASSESSMENT PARAMETER	SUBPARAMETER	KEY QUESTIONS	CATEGORIES	LEVEL OF ACHIEVEMENT
6 - Process	Distributional analysis	Was there any assessment of consequences on identified groups or individuals affected by the plan?	Yes	High
			Partially addressed	Moderate
			No	Poor
	Long-term perspective	Were there explicitly analysed benefits and constraints in the long run?	> 25 years	High
			10 – 25 years	Good
			<10 years	Moderate
			Without a temporal scale	Moderate
			No	Poor
	Consideration of cumulative effects	Was there an analysis of cumulative effects?	Quantitative analysis	High
			Qualitative analysis	High
			Partially addressed	Moderate
			No	Poor
	Techniques	What diagnosis and assessment techniques were used?	Analysis of risks and opportunities	
			Cost-benefit analysis	
			Analysis of alternatives	
			Analysis of scenarios	
			Analysis of impacts/effects	
			Use of Indicators	
			Analysis of current situation and trends	
			Others	
	Uncertainty	Was the treatment of uncertainty ensured?	Dealing with uncertainty	High
			Disclosing only gaps	Moderate
			No	Poor
	Compatibility	Was there an analysis of compatibility between strategic objectives?	Yes	High
			No	Poor
	Weighting	Was there any kind of weighting in the assessment?	Yes	High
			No	Poor
7- Participation		What kind of stakeholder engagement was assured?	Extensive community consultation process along all phases of the assessment procedure	High
			Extensive communication strategy	Good
			Strict legal fulfilment	Moderate
			No participation	Poor
		Was the position of less powerful groups taken into account?	Yes	High
			No	Poor
8 - Findings/ outcomes		Were outcomes in line with declared strategic vision and objectives?	Complete overlap	High
			Partially addressed	Moderate
			No	Poor
9 - Proposal for follow-up	Governance framework	Is there a governance framework to ensure responsibility in SEA follow-up?	Yes	High
			Partially addressed	Moderate
			No	Poor
	Guidelines for planning and management	Are there guidelines for follow-up?	Yes	High
			No	Poor
	Monitoring	Is there a monitoring plan?	Yes	High
			No but it is recommended/required	Moderate
			No	Poor

4.4 Review of practice

Case studies were identified through Internet searches of accessible SEA reports in the Oil & Gas sector carried out during the period June/July 2012. SEA reports were searched by using key words such as "*SEA*" and "*Oil & Gas*", "*SEA and Petroleum*", "*SEA and Hydrocarbons*", "*SEA offshore, SEA onshore*", as well as by looking at useful websites identified from literature articles and reports. The search resulted in miscellanea of articles, reports, and papers in the field. Despite this, a limited number of full SEA reports were reviewed. The selection was restricted to documents available in English and covering different geographical areas and economic conditions (e.g. developed/developing countries), as well as including both offshore and onshore experiences. Eventually, this search resulted in 11 case studies concerning assessments at national or regional levels, at different stages of development of Oil & Gas activities (first exploration activities, expansion of Oil & Gas development, realization of production facilities), and related to inland or sea activities (offshore, onshore, or both).

They reflect examples of the broad range of SEA procedures, including also Strategic Environmental and Social Assessment (SESA), Social Impact Assessment (SIA), Strategic Environmental Impact Assessment (SEIA), strategic-based SEA and Regional EA, EIA-based as well as strategic model based SEA.

Fig. 4.1 – Map of country case studies.

The set of case studies resulting from this search was considered adequate for testing the framework and inferring substantive and essential reflections. Table 4.2 provides the list of the 11 SEA reports and the general purpose of proposals to which the SEAs relate.
Their geographical distribution is shown in Figure 4.1.

Tab. 4.2 – Selected SEA reports.

ID	Country	Year	SEA Case Study
AU	AUSTRALIA	2010	Strategic assessment of the Browse Basin liquefied natural gas precinct.
BO	BOLIVIA	2011	Propuesta de Guia de Evaluacion Ambiental Estrategica del Sector Hidrocarburos. (A Proposal for SEA guidance in Oil & Gas Sector)
CA1	CANADA	2003	Strategic Environmental Assessment of Laurentian Subbasin.
CA2	CANADA	2007	The Great Sand Hills Regional Environmental Study: Final Report.
CA3	CANADA	2011	Strategic Environmental Assessment of Oil and Natural Gas Exploration and Development in the Anticosti, Madeleine and Baie des Chaleurs Basins (SEA2).
CI	CIPRO	2008	Strategic Environmental Assessment concerning Hydrocarbon Activities within the Exclusive Economic Zone of the Republic of Cyprus.
GL	GREENLAND	2011	Eastern Baffin Bay - A strategic environmental impact assessment of hydrocarbon activities. Prepared by the Danish Centre for Environment and Energy and the Greenland Institute of Natural Resources.
IL	ICELAND	2007	Oil exploration in the Dreki area on the Jan Mayen Ridge. Proposal for a plan to offer exclusive exploration and production licences for Oil & Gas in the Dreki area (Dragon area) on the Jan Mayen Ridge, northeast of Iceland and a Strategic Environmental Assessment (SEA) of the proposed plan.
MA	MAURITANIA	2011	Strategic Environmental and Social Assessment of Oil & Gas Development in Mauritania.
UK1	UNITED KINGDOM	2009	Strategic Environmental Assessment Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil & Gas and Gas Storage - Environmental Report.
UK2	UNITED KINGDOM	2010	Strategic Environmental Assessment for a 14th – and subsequent –onshore Oil & Gas licensing round.

4.5 Results and discussion

The results, broken down by questions, are presented in Table 4.3. Figure 4.2 summarises the results broken down by SEA reports, by presenting the percentage of high, medium, moderate and poor levels globally achieved for each case study. Figures 4.3 and 4.4 summarise the performance of the SEA reports under the proposed categories to illustrate substantive and procedural key questions, such as environmental issues, socio-economic effects, participation, long-term perspective and findings/outcomes of assessment.

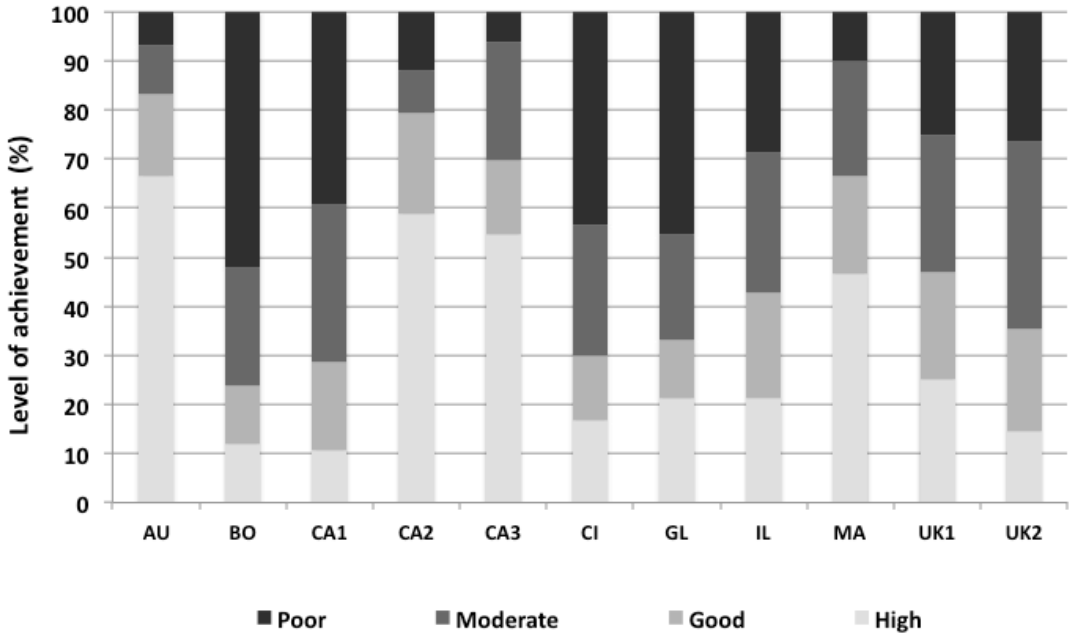

Fig. 4.2 – Performance under the assessments parameters broken down by SEA reports.

In general, the report at least partially addressed the strategic vision and declared objectives. Partial fulfilments are more evident in case studies that pose a firm focus on environmental concerns rather than explicitly include sustainability implications. This may be explained by the fact that addressing sustainability imposes a greater range of cross-cutting considerations that need to be contemplated in comparison with cases that have a firm focus on environmental concerns. A detailed discussion of the results broken down by groups of assessment parameters follows.

Tab. 4.3 – Summary of results.

ASSESSMENT PARAMETERS	KEY QUESTIONS	CATEGORIES	LEVEL OF ACHIEVEMENT	AU	BO	CA1	CA2	CA3	CI	GL	IL	MA	UK1	UK2
1	What were the motivations?	Explicitly addressing sustainability	High	√			√	√				√		
		Mainly economic and social with a firm focus on environmental concerns	Good		√	√			√	√	√		√	√
		Mainly economic and social	Moderate		√									
		Predominantly economic	Poor			√			√	√	√		√	√
2	At what stage of planning did SEA start?	At start-off	High								√			
		Model	Good											
		Diagnosis	Moderate	√			√	√				√		
		Development proposals	Poor		√	√			√	√			√	√
3	What was the degree of integration and feedback between assessment and planning activities?	High	High	√				√			√	√		
		Medium	Good			√								
		Low	Moderate						√	√			√	√
		Not verifiable	Poor		√		√							
4	What was the scope of assessment?	Holistic and integrated	High	√			√	√				√		
		Social+biophysic+economic+political	Good		√	√					√		√	
		Physical and territorial	Moderate						√	√				√
5	How was the Strategic Reference Framework defined and used?	A broad set of macro-policies relevant for the assessment settled (including also sustainable development strategies, biodiversity strategies, land-use planning policies, energy policies, climate change related strategies, etc.)	High	√	√		√	√	√	√	√	√	√	
		Mainly focused on energy policies and licensing aspects (to prospect, explore and produce hydrocarbons)	Moderate			√								√
		Ignored	Poor											
6	What was the purpose of assessment?	Beyond legal requirements	Good	√	√		√	√				√		
		Strict legal fulfilment	Moderate			√			√	√	√		√	√
	How were alternatives considered?	Alternatives in terms of other development options for the area	High				√							
		Alternatives in degree of exploitation /intensity of oil & gas activities	Good	√			√				√	√	√	√
		Alternatives in location	Good	√			√	√	√		√	√	√	√
		"zero alternative"	Moderate								√		√	√
		No alternatives considered	Poor		√					√				
	How the protection of biological diversity and the maintenance of essential ecological processes and life-support systems were ensured?	Restriction in use and protection of area with presence of higher-valued species	High			√	√	√	√	√		√	√	
		Adoption of environmental thresholds	High					√						
		Evidence of environmental net benefits	High	√			√	√						
		Others	Good			√	√	√	√	√	√	√	√	√
		Adoption of mitigation and compensation measures	Moderate	√		√	√	√	√	√		√		√
	How land use implications were addressed?	Restriction in use	HIgh	√			√	√	√	√		√	√	
		Others	Good	√		√	√	√	√	√	√	√	√	√
		Adoption of mitigation and compensation measures	Moderate	√		√	√	√	√	√		√	√	√
		No	Poor											
	Were there demonstrated net benefits for local communities?	Yes	High	√			√							
		Partially addressed	Moderate					√			√	√		
		No	Poor		√	√			√	√			√	√
	Was there expressed how needs, values and expectations of stakeholders were taken into account? (Haughton, 1999)	Yes	High	√			√					√		
		Partially addressed	Moderate		√			√					√	
		No	Poor			√			√	√	√			√
	Was there an explicitly consideration of health issues?	Yes	High	√				√						
		Partially addressed	Moderate									√	√	√
		No	Poor		√	√	√		√	√	√			
	Was there an explicitly treatment of sustainability trade-offs?	Yes	High	√			√	√					√	
		Partially addressed	Moderate			√						√		√
		No	Poor		√				√	√	√			
	Was there any assessment of consequences on identified groups or individuals affected by the plan?	Yes	High	√			√							
		Partially addressed	Moderate					√				√		√
		No	Poor		√	√			√	√	√		√	
	Were there explicitly analysed benefits and constraints in the long run?	> 25 years	High	√			√			√	√			√
		10 – 25 years	Good				√			√		√		√
		<10 years	Moderate		√	√				√		√	√	√
		Without a temporal scale	Moderate					√	√					
		No	Poor		√									

Tab. 4.3 – Summary of results (continued).

ASSESSMENT PARAMETERS	KEY QUESTIONS	CATEGORIES	LEVEL OF ACHIEVEMENT	AU	BO	CA1	CA2	CA3	CI	GL	IL	MA	UK1	UK2
6	Was there an analysis of cumulative effects?	Quantitative analysis	High					√		√				√
		Qualitative analysis	High					√		√				√
		Partially addressed	Moderate	√		√	√	√	√	√	√		√	√
		No	Poor		√									
	What diagnosis and assessment techniques were used?	Analysis of risks and opportunities		√	√		√	√				√	√	
		Cost-benefit analysis												
		Analysis of alternatives		√							√		√	√
		Analysis of scenarios		√		√	√				√	√		√
		Analysis of impacts/effects		√	√	√	√	√	√	√	√	√	√	√
		Use of Indicators			√	√	√	√		√		√	√	√
		Analysis of current situation and trends		√	√	√	√	√	√	√	√	√	√	√
		Others										√	√	
	Was the treatment of uncertainty ensured?	Dealing with uncertainty	High	√		√	√	√	√	√	√	√	√	√
		Disclosing only gaps	Moderate											
		No	Poor		√									
	Was there an analysis of compatibility between strategic objectives?	Yes	High	√			√	√				√		
		No	Poor		√	√			√	√	√		√	√
	Was there any kind of weighting in the assessment?	Yes	High	√			√	√	√	√			√	√
		No	Poor		√	√					√	√		
7	What kind of stakeholder engagement was assured?	Extensive community consultation process along all phases of the assessment procedure	High	√			√	√				√		
		Extensive communication strategy	Good	√			√	√					√	√
		Strict legal fulfilment	Moderate		√	√			√		√		√	√
		No participation	Poor							√				
	Was the position of less powerful groups taken into account?	Yes	High	√	√		√	√				√		
		No	Poor			√			√	√	√		√	√
8	Were outcomes in line with declared strategic vision and objectives?	Complete overlap	High	√			√					√	√	
		Partially addressed	Moderate		√	√		√	√	√	√			√
		No	Poor											
9	Is there a governance framework to ensure responsibility in SEA follow-up?	Yes	High	√			√	√				√	√	√
		Partially addressed	Moderate			√					√			
		No	Poor		√				√	√				
	Are there guidelines for follow-up?	Yes	High	√	√	√	√	√			√	√		
		No	Poor						√	√			√	√
	Is there a monitoring plan?	Yes	High											
		No but it is recommended/required	Moderate	√	√	√	√	√	√	√	√	√	√	√
		No	Poor/No											

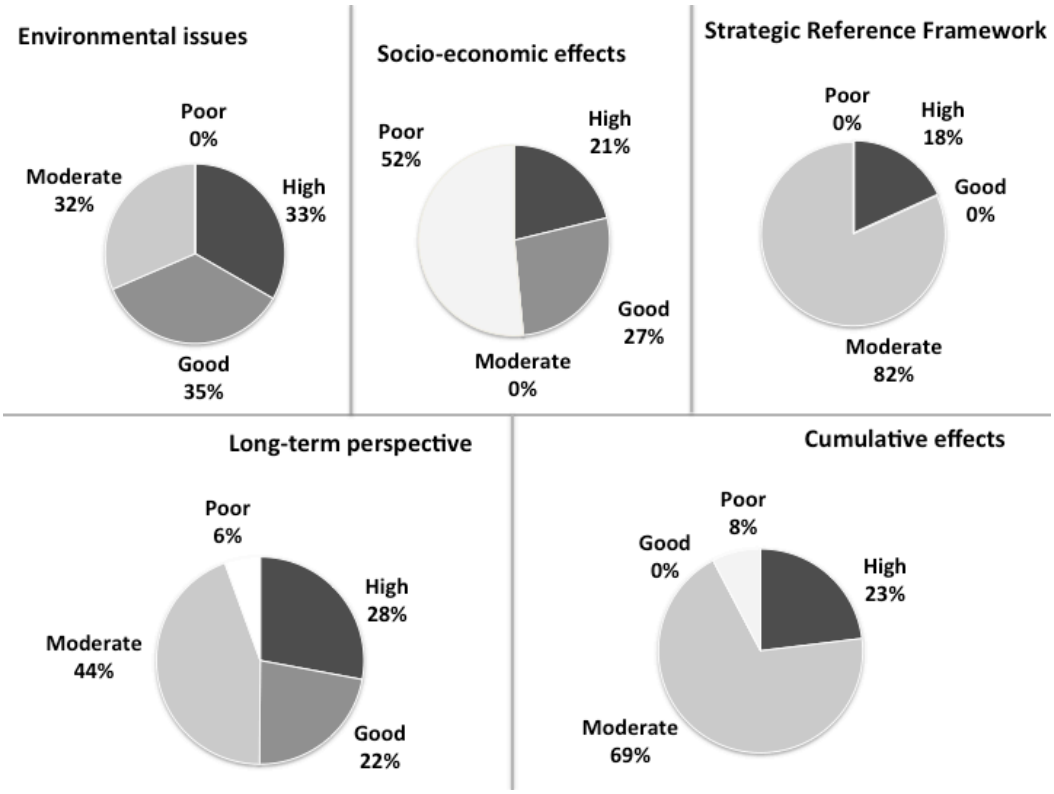

Fig. 4.3 – Performance of the SEAs under the proposed categories that illustrate substantive questions.

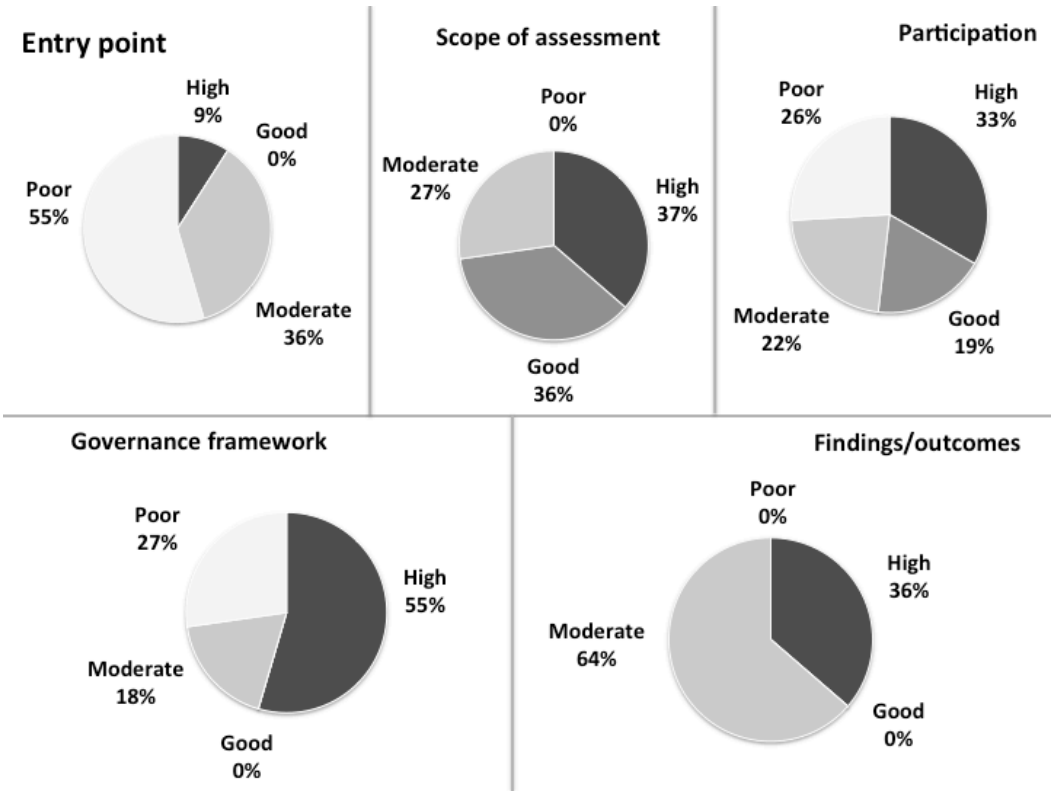

Fig. 4.4 – Performance of the SEAs under the proposed categories that illustrate procedural questions.

Motivations, scope of assessment and interactivity

With respect to motivations, the case studies can be divided into two groups: those that lean towards a predominantly economic justification for the assessment, showing also a firm focus on environmental concerns, and those that explicitly address sustainability.

As shown in Table 4.3, the first group (7 cases) focuses on how to assist competent authorities in determining to what extent hydrocarbons licenses, depending on the specific case for prospecting, exploration or exploitation activities, should be offered in whole or in part for the areas of interest, without compromising biodiversity and ecosystem function, material assets and other users. The second group (4 cases) shows more articulated and integrated goals. The purpose is to provide strategic recommendations to guide activities so that the long-term ecological integrity of the area is maintained, while a corresponding level of environmental, socio-cultural, and economic benefits are realized.

Concerning the scope of the assessment, two different integrated approaches emerge. The first one (e.g. CA2, CA3) is based on the selection of VECs that include not only crucial aspects of the physical and biological environment, but also of the human environment. The second is based on the identification of Critical Decision Factors (MA). The main difference is that the first approach defines the focus of the integrated assessment on the basis of baseline data (especially environmental data), and literature review on hydrocarbons environmental impacts, guidelines and regulations for the sector, while the second approach integrates a broad range of social, environmental and economic issues and embarked on extensive engagement with stakeholders. Even though VECs and CDFs are selected for specific case studies, it is possible to identify common concerns related to biodiversity (marine and terrestrial), water, air emissions, governance, safety and risk management of oil spills. However concerns with, for example, social benefits and community livelihoods is more evident in the CDF approach.

It is interesting to note that, even in cases guided by sustainability motivations, SEA typically starts at the stage of diagnosis or development of proposals. This is mainly the case for SEA of Oil & Gas activities required as part of the permit conversion process, and in anticipation of interest in the area. On the contrary, a direct connection between sustainability motivations and high level of interaction during the procedures cannot be detected. High degree of

integration and feedback between assessment and planning activities is shown in case studies that aim at ensuring a consistent approval process and facilitating the implementation of SEA findings into a coherent policy (e.g. organizations of meetings among the institutions involved, such as committee on oil exploration affairs, editorial committee, and specific working group involving expert on specialized areas). Remarkably, in a specific case (CA3), the relevance of the indications provided by the preliminary SEA report promptly led to adopt an act to prohibit Oil & Gas activities in a portion of the area under examination.

Strategic reference frameworks

The review showed that, irrespective of assessment motivations, a broad set of macro-policies relevant for the assessment were generally referred to. These include:

- country energy policies (especially in terms of security of energy supply) and Oil & Gas licensing and control policies;
- environmental protection policies, at national as well as international level (e.g. environmental protection act, international nature protection conventions, biodiversity, climate change and land-use planning strategies, international conventions and protocols for marine protection).

Specific guidance for environmental management in Oil & Gas exploration and production are also mentioned. However, reports related to developing countries (MA, BO) also highlight a lack of consolidated legal frameworks and the need to elaborate clear methodologies for the whole hydrocarbons sector.

Process and Participation

Moving to process aspects, the review showed a mixture of examples that follow legal requirements and that seek to achieve more integrated assessment. Generally, analyses of alternatives are carried out in terms of location and degree of exploitation/intensity of Oil & Gas activities. Two interesting cases provide examples of more strategic-based approaches. The first one (CA2) considers alternatives in terms of other possible development options for the area beyond the Oil & Gas activities, focusing on limitations and opportunities for the

coexistence of other activities (e.g. agricultural practice, including farming and ranching, recreation).

The second one (AU) describes an articulated site selection process preliminary conducted for selecting the potential best site for the project facilities, based on an extensive consultation process that involved the local community, traditional owners, non-government organisations, and relevant institutions. However, even if participatory aspects are generally taken into considerable account, needs, values and expectations of stakeholders are often only partially addressed or not at all taken into account.

Health issues are mostly missed or partially addressed. In the European examples, existing environmental regulatory controls would be considered quite sufficient to minimise potential effects on human health and communities. AU and CA3 propose specific health impact management strategies, such as informing the general public about risks at all management levels, improving health and social services in the areas interested by the proposal, and environmental monitoring plans targeted at health risk assessment.

Peculiar participatory experiences (AU, MA) include public comments asked at stage of definition of Terms of Reference for the strategic assessment and wide consultation of all stakeholders during the definition of the strategic vision for the exploitation of the hydrocarbons resources. In some cases the public have been involved in scoping exercise focusing on existing biophysical and socio-economic issues. In one experience (MA) training activities on the SEA process have been offered by involving institutions in the process (e.g. brainstorming, group exercises and workshops during the all main stages of the procedure).

A common action for maximizing the benefits of consultation procedures is to set up steering Committees enlarged with representatives of institutions, organizations, NGOs, civil society and community. However, enhancing the involvement of less powerful groups in decision is only related to contexts in which Oil & Gas activities interfere with habits, traditions, customs of indigenous people and traditional owners (e.g. AU, BO, CA3).

Outcomes, uncertainty and governance

The case studies, with different degree of confidence, display some limitations and constraints in fully addressing the strategic vision and objective declared. Generally, the SEAs focus on key factors and analyse potential interactions on the basis of existing knowledge regarding the

potential effects of offshore and onshore activities. Just in few cases some evidences of environmental net benefits are made explicit. For example, as proposed in AU, adopting a single infrastructure for processing Oil & Gas reserves, instead of multiple developments, could help in minimizing the environmental footprint of Oil & Gas processing in the long-run. CA2 also includes a cost opportunity analysis that show how opting for expansion of land area protected, excluded by Oil & Gas future development, could not determine drastic loss of revenues.

All environmental reports disclose gaps of knowledge and the impossibility to anticipate all possible effects on the delicate ecosystems that are often involved in the Oil & Gas activities. Thus, mitigation measures and applicable compliance standards are broadly considered. Recommendations associated with implementation of proposals also include provisions of in-depth analysis. However, some cases, such as CI and IL, provide for more detailed studies to be conducted only at the project-stage, while others, such as AU, CA2 and GL, set up prescriptive requirements, consistently with the precautionary principle (e.g. to subordinate proposals to the effective demonstration of their compatibility).

Management actions that limit disturbing activities usually connected to Oil & Gas activities are considered essential. The SEAs, such as AU and CA2, that seek to deal more effectively with lack of information and uncertainty, recognize that it is not sufficient to adopt best management practices in Oil & Gas activities. The precautionary principle should also be applied to maintain the ecological integrity of the affected areas.

The case studies show different degree of details in providing recommendations of what should be included in monitoring plans behind operative measurements for controlling Oil & Gas operations. For example, AU, MA, CA3 and GL propose a more articulated management framework that requires integrated and coordinated interaction between authorities at different levels. MA, UK1 and IL underline the importance to establish a dedicated spatial information system to assist in the integrated planning of Oil & Gas activities.

4.6 Conclusion

The framework for reviewing SEA practice has assisted in identifying several significant strengths and weaknesses in term of assessment effectiveness.
A key outcome of this review concerns the fact that in most cases outcomes of SEA studies are partially in line with declared strategic vision and objectives posed. When the motivations are in favour of merely matching economic reasons and environmental protection, much of the emphasis of the SEA procedures appears to be directed toward approval of Oil & Gas proposals rather than reflecting on the environmental and social implications and uncertainties that such activities could determine, especially in the long-run.
On the contrary, more comprehensive and strategic approaches pay attention to a broader variety of implications that can arise from Oil & Gas activities and affect local communities, and give emphasis to participatory processes.

The review provides evidences of SEA aspects that play a crucial role in order to recognize more targeted and strategic information on which analysis should be based, as well as, to assist in a better designing of more sustainable-oriented outcomes dealing with Oil & Gas activities. In particular a means of fundamental helping is provided by involvement of stakeholders from early stage of the procedures; identification of key environmental, social and economic factors; analysis of cumulative and synergistic effects in the long-run; fact-based provisions and recommendations for more integrated mitigation and monitoring management strategies for follow up.
However, as disclosed by Figures 4.3 and 4.4, it is important to note that more efforts should be made for enhancing and increasing the adoption of these best practices in SEA processes.

In addition, two important substantive and procedural concerns emerge from this chapter. Firstly, SEA practice often disregards the assessment of environmental and social effects outside the area directly affected by the project activities, which reveals a reduced to absent strategic perspective. In fact actual strategic assessments could play an essential role for ensuring that benefits and constraints associated to Oil & Gas activities were fairly allocated in space and time, and would raise long-range benefits.

In this respect, worthy points might be to ensure direct representation of needs and interests of neighbourhood groups in the assessment and include them in a wider analysis of implications and consequences of proposals in the short and long run. Secondly and more broadly, it should be particularly beneficial to conduct ex post assessments, especially, of those processes more sustainability-oriented. In fact, it could give tangible evidences of how and to what extend their provisions and recommendations contribute to operationalize sustainability.

Next chapter will seek to go further in the discourse about sustainability and SEA by focusing in more detail on the first substantive and procedural concern drawn up from this chapter. To this purpose, a sample of SEA in the Oil & Gas sector will be reviewed by using an approach based on the concept of "*critical decision factors*".

Chapter 5

Critical decision factors for Oil & Gas developments[3]

5.1 Introduction

The perspective of SEA as a proactive tool to integrate sustainability concerns into strategic decision-making emphasises the need of a strategic thinking approach to facilitate decision-making by involving key actors, enabling dialogues towards mutual understanding, and addressing long-term and large scale perspectives (Partidário, 2012; 2007b).
As stated in Chapters 1 and 4, Oil & Gas development is a controversial source of opportunities and challenges, representing a sector for which such an approach in SEA would be strongly advisable. It is particularly important to identify long-term sustainability goals and objectives and to ensure that a strategic-based assessment is integrated into decision processes from early stages.

This chapter aims at contributing to this discussion by exploring to what extent current SEA practices in the Oil & Gas sector address sustainability concerns. To this purpose, I will refer to the strategic and sustainability-oriented SEA approach proposed by Partidário (2012; 2007b), based on the concept of "critical decision factors" (CDFs, described in Section 5.2) defined by the author as the "windows of observation" defined to ensure a strong focus on "environmental and sustainability success factors of a strategic decision, rather than a vague notion on effects over a large environmental broadband" (Partidário, 2012). First, I will propose the identification of key CDFs for Oil & Gas developments based on the review of literature presented in chapter 4, and I will describe how the CDF can be addressed (Section 5.3). Then, I will review the sample of SEA reports listed in Table 4.2, to analyse if and how the CDF were addressed and discuss their contribution to sustainability-oriented SEA (Section 5.4). Finally, recommendations for best practice and conclusions are drawn (Section 5.5).

[3] This chapter is based on: Lamorgese, L, Partidário, MR, Geneletti, D. Critical decision factors in SEA for Oil & Gas developments *(currently under review).*

5.2 The critical decision factors (CDFs) approach

According to Partidário (2007a, 2012), a key condition for SEA to act strategically is to keep a strategic focus on very few, but critical, themes that intertwine relevant biophysical, social, institutional and economic issues. At the core of her proposed strategic-thinking model for SEA the author identifies Critical Decision Factors (CDF) as key integrated factors that act as the windows of observation to focus attention on those environmental and sustainability issues that should matter for decision, and which consequently should be assessed. Founded on the concept of success factors in business strategy, originally advanced by Ronald Daniel in 1961, Partidário (2007a) suggested the use of this form of device – the CDF - to express critical uncertainties and ensure a strategic focus in the assessment of strategic development decisions.

According to the author CDF are determined by priority setting, involving technical interpretation but especially dialogues with relevant stakeholders, to consider multiple points of view and issues of concern. In guidance produced to assist the application of the strategic-thinking model Partidário (2012) recommends the "diamond" approach as a method for CDF identification, represented in Figure 5.1. It departs from a collective dialogue on a vision, linked to future goals and strategic objectives, followed by the consideration of major problems and potentials. The cross-analysis of problems and potentials in face of intended vision and strategic objectives will enable the establishment of priorities that can determine success factors. These are then expressed as CDF, or those factors that will enable the strategy to be successful from environmental and sustainability perspectives.

Partidário (2012) suggests a synthesis effort must be done when identifying CDF in order to limit in number - between three and five, and never more than seven, is recommended - to ensure strategic focus. CDF should be easy to communicate, therefore should be named using simple keyword that are easy to capture and enough to express its integrated meaning (Partidário, 2012).

As an example, in the SEA of the Portuguese Electricity Transport Network Development and Investment Plan (Partidário, 2012), three CDFs were selected: Energy, Fauna and Spatial Planning. These CDFs proved to be enough to address the major strategic issues that mattered: increasing renewable energy sources and the efficiency in energy transportation;

reducing the interference with nature conservation areas, and enhancing electricity distribution, while avoiding conflicts with density populated areas and other natural or human-made obstacles. This way the CDF establish the focus of the SEA, the assessment framework and identify the technical studies for trend analysis to be considered in the assessment of opportunities and risks (Partidário, 2012).

5.3 Identification of critical decision factors

In order to identify CDFs for Oil & Gas development we have followed the diamond approach suggested in Partidário (2012). We have used the available Oil & Gas development literature to explore how we could identify a possible vision, or at least strategic objectives, as well as major issues that could be addressed as problems and opportunities of Oil & Gas development in order to identify what could be success factors in any Oil & Gas development strategy. The following paragraphs describe the findings of the literature and cases review.

It appears from the current literature discourse on Oil & Gas development that possible objectives are to ensure the ecological integrity of the area under concern, while meeting the socio-cultural and economic needs of local community, yet recognizing both existing and new activities that might differently influence land-uses in the short and long run (TNEM, 2012; Gibson, 2011; EPA Ghana, n.a.). In order to pursue such strategic objectives there is a need to evaluate to what extent Oil & Gas activities may ensure environmental integrity, by identifying the potential interaction between these activities, as well as their potential impact on ecological and social components within time and space (RIM and World Bank, 2011; IFC, 2007).

Firstly, particular emphasis should be given to ensuring that development maintains a desired level of environmental quality, by considering both biophysical and socioeconomic aspects, rather than focusing on mitigation of adverse effects only (Harriman and Noble, 2008; Noble, 2008). This requires that the expectations of local communities are taken into account, for example by preserving the environmental and cultural heritage features (e.g. Gobierno de Chile, 2011; RIM (Islamic Republic of Mauritania) and World Bank, 2011; Department of State Development Government of Western Australia, 2010). This is particularly challenging in

offshore developments, due to the complex interactions between physical and biological environments, different sensitiveness of marine areas (e.g. costal zones, open sea), but also for the higher negative implications associated to accidental oils spills (Mosbech et al., 2007).

Secondly, the potential benefits stemming from Oil & Gas development are strictly associated with long-term socio-economic prosperity for the areas and the community involved. A holistic long-term approach should underpin the development of resource management schemes that ensure a strategic vision in view of future Oil & Gas approvals or other potential development derived from Oil & Gas proposals (Norwegian Ministry of Environment, 2009). To this purpose, assessment of cumulative effects related to past, present and future foreseen development activities need to play a crucial role (CCME, 2009; Johnson et al., 2011).
Elvin and Fraser (2012) point out the difficulties in dealing with cumulative effects due to the complex analysis required to overcome unknowns in particular with respect to offshore environments. In this regard, increasing the knowledge about the nature of cumulative effects, identifying limits, targets, and indicators are considered essential requisites to deal with uncertainty and effective assessment in the long-run (Gunn and Noble, 2011).

A relevant outcome of this review shows that good governance plays a crucial role in achieving successful Oil & Gas developments and in preserving the integrity of the natural, social and cultural environments (E&P Forum/UNEP, 1997). It is argued that particularly at local level, sound environmental, social and economic policies, together with established democratic institutions that are responsive to the needs of people, and an enabling environment for investment, are essential underlying factors for a sustainable development (e.g. Norwegian Ministry of Environment, 2009; NORAD and World Bank Group, 2009; Joint Review Panel for the Mackenzie Gas Project, 2009; Ministry of Industry of Iceland; 2007).

In order to take into account this integrated perspective, the expectations of communities affected by Oil & Gas development should be addressed by protecting values as well as ensuring transparent and participative approval processes, in view of equitable sharing of benefits and adequate compensation for negatively affected populations (Foluke, A., 2012; NCEA, 2012, 2009; Joint Review Panel for the Mackenzie Gas Project 2009). Thus, due to the complexity of Oil & Gas implications, follow-up mechanisms tailor made to, and well articulated with, the processes of decision-making are considered essential in SEA of Oil & Gas (Teixeira, 2008).

Based on the above-described issues, apparently stemming out of the existing literature as priorities in the Oil & Gas sector, it is possible to cluster them in four major themes that integrate, through cross-relationship, major environmental and sustainability issues: Heritage Values, Community Benefits, Timescale, and Governance. These are our suggestion of four CDFs that, in our understanding, capture four transdisciplinary and sustainability oriented themes of primary concern for Oil & Gas development.

Heritage Values encapsulates the need to protect high-natural and cultural heritage values as a whole, and ensure both ecological integrity and the preservation of environmental and social features. This CDF aims at helping Oil & Gas developments to focus on ensuring the preservation, and preferably the enhancement of local or regional ecological and socio-cultural features that are highly relevant as heritage values in local contexts. The SEA will pay particular attention to the intended planning and policy measures by Oil & Gas sector activities that will avoid destruction of such values, and likewise the measures that will be undertaken to reinforce the historical identity.

Community benefits relate to the significant potentiality of Oil & Gas sector to act as a powerful leverage for socio-economic development of local communities, and to ensure that in development processes benefits resulting from the exploration of natural resources are shared with the community. The equitable sharing of benefits and adequate compensation for negatively affected populations is one of the most frequent aspects mentioned in the literature. With this CDF the SEA will focus attention to how the Oil & Gas sector activities will develop their business plans to ensure that local communities expectations will be positively addressed, that opportunities will be created so that the local community will be better-off during and after the exploration and production of Oil & Gas, and that there will be a positive legacy for local communities.

Timescale embodies complex and multi-scaled aspects related to potentially negative, but also positive, consequences in the long-run. Long-term implications of adverse impacts assume a critical relevance, particularly, in the case of Oil & Gas development, due to the scope and interconnections of environmental, social and economic concerns that could flow from it. With this CDF the SEA will focus attention to how the Oil & Gas sector activities will address the long-term socio-economic prosperity for the area and for the community

involved, which is another of the most frequent aspects mentioned in the literature. On the other hand, despite recognized in the literature as being difficult, cumulative effects associated to Oil & Gas development will also be captured by this CDF, to ensure Oil & Gas will establish follow-up mechanisms that may increase the knowledge about the nature of cumulative effects, identifying limits, targets, and indicators considered essential to deal with uncertainty and effective assessment in the long-run.

Governance encapsulates the demand for more responsive systems of decision-making and adaptive management in the Oil & Gas development that are able to integrate multi-objectives and multi-levels institutional arrangements and involvements of stakeholders. It is recognized in the literature that sound environmental, social and economic policies that are well established through democratic institutions are critical to create an enabling environment for investment, as well as to respond to the needs of people. Through this CDF the SEA will focus on these essential underlying factors for a sustainable development, which can be considered strategic to preserve the integrity of the natural, social and cultural environments.

Table 5.1 describes the potential contribution of SEA associated to each CDF. These descriptions are used as a reference to review the selected case studies presented in Chapter 4, as described in the next Section.

Tab. 5.1 – CDFs and the associated potential contribution of SEA.

CDF	Potential contribution of SEA
Heritage Values	*Ensuring that Oil & Gas activities do not compromise, and will possibly enhance ecological integrity and natural and cultural heritage values, as well as the preservation of environmental and social features.*
Community Benefits	*Ensuring that Oil & Gas activities generate broadly shared and long-term benefits to local communities.*
Timescale	*Ensuring that limits and uncertainties related to the assessment of possible future negative implications, and cumulative effects, are properly accounted for in the long-run.*
Governance	*Ensuring that Oil & Gas decision-making is carried out by enhancing institutional capacity, stakeholder involvement, systems management and follow-up.*

5.4 Testing practice against CDFs

I review the extent to which the selected case studies have considered, and assessed, the issues described by the four CDFs (Table 5.1). For this study, CDFs were used in an "ex-post" fashion to review current practice, rather than to proactively frame the SEA, as suggested in the original approach by Partidário (2012). The review was directed to identify elements, both substantive and procedural, which can potentially contribute to a more sustainability-oriented assessment, by looking specifically at the four CDFs.

Particular attention was given to aspects of specific concern for the Oil & Gas sector gathered from literature, such as:

- protection of biological diversity and the maintenance of essential ecological processes – e.g. approach for identifying and safeguarding valuable environmental components, degree of involvement of stakeholders in the analysis (mainly relevant for CDF *"Heritage Values"*);
- implications for land-use – e.g. actions and provisions for preventing pollution and dealing with risk of oil spills (mainly relevant for CDF *"Heritage Values"*);
- implications for people involved – e.g. analysis and provisions for taking into account needs, values and expectations of stakeholders and affected people (mainly relevant for CDF *"Heritage Values"*);
- net benefits for local communities – e.g. distributional analysis of losses and gains, considerations or actions oriented towards fair share of benefits in the long-run, treatment of economic, environmental and social trade-offs (mainly relevant for CDF *"Community Benefits"*);
- explicit consideration of health issues – e.g. analysis and/or provisions for dealing with possible health consequences (mainly relevant for CDF "Community Benefits");
- treatment of uncertainty – e.g. management of unknown, analysis of cumulative effects, application of precautionary approaches (mainly relevant for CDF "Timescale");
- stakeholder engagement and follow-up mechanisms – e.g. provisions and requirements for enhancing monitoring effectiveness (mainly relevant for CDF "Governance").

Table 5.2 summarises the number of references to issues found in each case study that relate to the different CDF. Figure 5.1 presents the results clustered in four categories, according to the number of findings. As it can be seen, more than 60% of the cases contain at least two

findings illustrative of sustainability–based assessment for each of the four CDFs. A detailed description of issues per CDF follows.

Tab. 5.2 – Number of elements potentially contributing to sustainability-based SEA, broken down by CDFs and case studies.

CDF	CASE STUDIES										
	AU	BO	CA1	CA2	CA3	CI	GL	IL	MA	UK1	UK2
Heritage Values	5	2	2	5	7	1	1	1	4	3	1
Community Benefit	5	0	1	7	3	1	2	4	5	3	5
Timescale	2	0	2	2	3	2	3	2	1	2	3
Governance	5	2	1	5	5	0	0	1	4	2	2

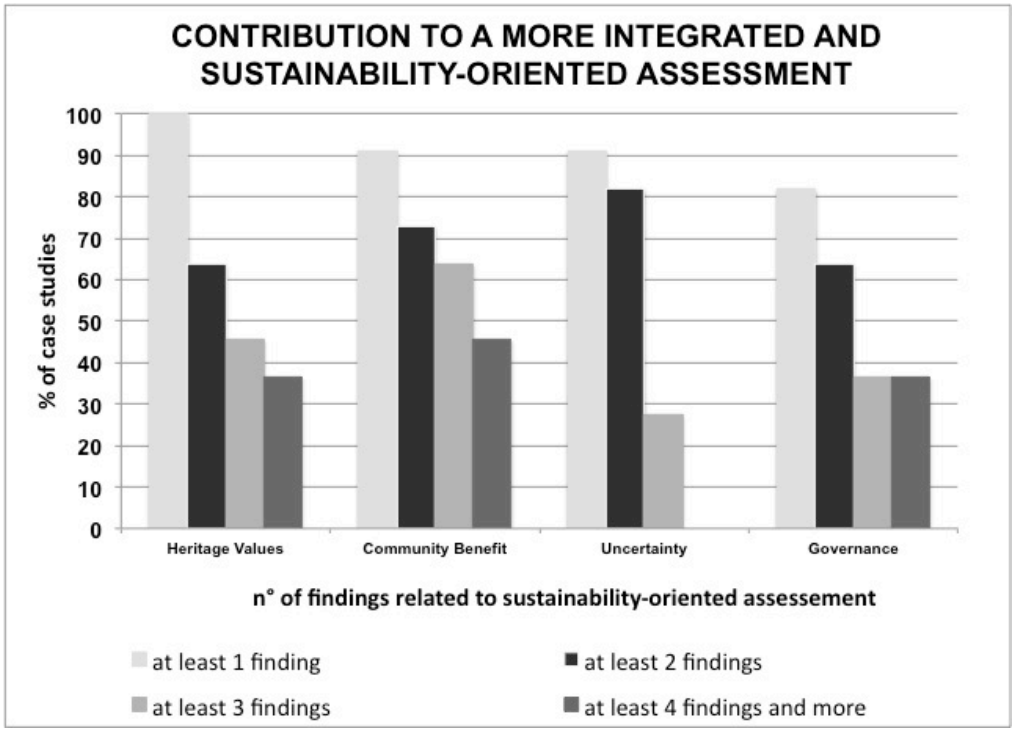

Fig. 5.1 – Case-study contribution to CDFs.

Heritage Values

In terms of Heritage Values, the review shows that it is possible to involve stakeholders at the stage of development of a proposal, for example, by activating site selection procedures for screening plausible and shared locations for Oil & Gas activities, such as in AU. In this example, the site selection procedures involved the general community, traditional owners, non-government organisations, and relevant institutions. According to significant concerns raised with all participants, stakeholders shared the decision of focusing the strategic assessment on an area relatively close to existing infrastructure but remote from the existent wilderness tourist destinations.

This approach provides evidence of the effort of balancing existent ecological, socio/cultural and economic interests with the desire for economic development before irreversible decisions are taken. Commonly, case studies underline that Oil & Gas activities can have significant impacts on the environment and especially on the traditional communities, which live near the perimeters of exploration. A strategic focus is recognisable in SEA reports where approaches are adopted for identifying those components and potential interactions that are of primary concern. Several cases adopt the Valued Ecosystem Components (VECs) approach, such as AU, IL, CA3, GL, while MA implements a CDFs approach. VECs include important flora and fauna, habitats and processes that have a national or international profile, can act as indicators of environmental change, or can be the focus of management or other administrative efforts (see Beanlands and Duinker, 1983).

Similarly to CDFs, VECs approaches equally emphasise that the identification of these valuable components constructively emerges from consultations with key stakeholders. However, in case studies using VECs, discussion are undertaken in relation to specific studies that help in understanding environmental vulnerabilities, especially physical and biophysical (e.g. literature review on environmental impacts of Oil & Gas, previous environmental assessments conducted in relation to other Oil & Gas related projects, studies on existent issues provided by institutions and responsible authorities, etc.). In the example adopting CDFs there is a much greater integrative approach in identifying issues. It is particularly emphasized in the CDF approach that meetings are also organized for understanding the perceptions of stakeholders on environmental quality, community identity and sense of place, quality of life, heritage values, etc. as determined by Oil & Gas activities and other activities.

Even if critical aspects are case-specific, some central issues are commonly considered in the SEA reports, such as the protection of biodiversity (e.g. sensitive habitats, high value species), noise, mainly of seismic origin; solid and liquid discharges; airborne emissions, the presence of the facilities, risk of accidental spills and the management of such risk; employment; potential conflict with tourism industry; royalties; problems in social acceptability of oil activities from indigenous people; in particular for offshore cases, the protection of the fishing industry. For example, more strategic approaches ensure protection of higher-valued species by imposing restriction in use, creation of buffer area, designation of core biodiversity areas, identification of sensitive areas (e.g. AU, CA2) as well as areas that could present specific physical or technical constraints (e.g. CA3, IL). In addition, for the marine environment, some case studies consider fundamental to impose temporal restrictions in sensitive periods to avoid operations when they can create high disturbance to marine bird and mammals (e.g. migration routes, breeding periods etc.). This reveals that a CDF on Heritage Values may well be quite relevant for general Oil & Gas sector development activities.

Community Benefit

In general, case studies are more oriented to analyse opportunities derived from Oil & Gas development without fleshing out other potential developmental alternatives. Some approaches consider alternatives only in terms of degree of exploitation and intensity of Oil & Gas activities, as usual in project's EIA. In a few cases, consultations of local communities, in the form of meetings, training sessions, workshops and interviews, are promoted in view of discussing alternative sustainable future scenarios and key environmental goals and objectives for the area which is intended by the Oil & Gas activities. From an operative point of view, several case studies consider scenario analysis and analysis of cumulative effects for understanding implications in the log-run.

In most cases, scenario analysis are conducted in the view of understanding the possible economic scope of Oil & Gas activities and their potential temporal development in the short and long run. It is particular evident in cases in which Oil & Gas prospectiveness is not very well known, such as in CI, CL. However, CA2 shows an example of an analysis, conducted at the strategic level, which examines a range of potential development scenarios over a time period of 30 years, looking at the potential increase of regional economic resilience offered by introducing Oil & Gas facilities in the area. It takes into account the social changes related to

the proposal, such as increase of population, demand for land and housing, potential impacts and opportunities on social aspects (e.g. services, health facilities, recreation etc.).

Again the review has shown the usefulness of using VECs for assessing cumulative and synergistic effects of Oil & Gas exploration activities and other activities that can concurrently take place. For instance, CA3 considers such analysis particularly important in relation to assure a strategic approach for future approvals of projects directly connected to Oil & Gas development, such as new exploring licenses, construction of services facilities, pipelines, that would implicate land use changes over a long period of time. Even if it does not clearly emerge from the case studies, it should be noted the role that analysis of alternatives, scenario analysis, and cumulative effects could play in disclosing trade-off and eventually environmental net benefits related to possible future scenarios in Oil & Gas activities.

This also reveals that there is a strong linkage between VECs and CDF, since both act as devices for strong focus on aspects that really matter and upon which attention and efforts need to be concentrated. In addition it is possible to highlight SEA case studies that integrates social impact assessment in dealing with implications on affected groups. Although the focus is mostly on indigenous people, some more general features can be stemmed from these case studies; for example, providing for compensation for damage and loss of income, creating new economic opportunities, creating land owner controlled funds for economic development, housing, education and cultural preservation, inform communities and users of exploration and extraction activities (places and dates) and benefits generated by the resources from the Oil & Gas sector as well; involving local people in monitoring activities. On the contrary, even if the SEA reports claim to pursuit a common strategic intent to equally share benefit derived from Oil & Gas development, they do not generally provide a means to tackle this aspect.

However, some studies include analysis of distributional impacts due to Oil & Gas activities on other activities (e.g. tourism, fishing industry, agriculture) and infrastructure settlements. It is therefore recommended to define plans and funds for compensation of land-owners of the affected land and loss of income due to decrease of other land and marine activities (e.g. fisheries, agriculture, hunting). For instance, CA2 evaluates how the economic spin-offs offered by Oil & Gas development lead to an increase in income for individuals and the government, by favouring job creation and regional and industrial development. In this

regard, according to AU, designing a strategic social impact management plan represents potentially a beneficial tool for including and managing measures to enhance opportunities and mitigate and manage impacts identified. Despite these relevant social and economic aspects, aspects connected to environmental equity are not discussed at all which reveals the imitation of this case in terms of sustainability approach.

Timescale

Regarding timescale, the potential of SEA in dealing with uncertainty in the long-run have emerged from the review. Some differences in nature and intentions of actions proposed should be noted. While recognising uncertainties related to Oil & Gas activities, especially in the marine environment, some SEA documents (e.g. CI, CA1) deal with uncertainty by only recommending mitigation and compensation measurements to be defined at project design levels. Whereas others deal with inevitable gaps of knowledge often referred to ecological effects on Oil & Gas activities in the long-run, by stressing on two central and more strategic expectations. Firstly, core sensitive areas need to be excluded from possible site location of Oil & Gas activities (eg. CA2, CA3, AU).

Secondly, mitigation, management and monitoring strategies need to be designed and implemented for managing impacts (e.g. UK1, UK2, IL, CA1). Frequently, strict Health, Safety and Environment (HSE) procedures, application of the Precautionary Principle in combination with Best Environmental Practice (BEP), Best Available Technique (BAT) and international standards are supposed to do much for reducing environmental impacts.
In particular for the marine environment, almost all case studies recognises that the discharge policy, as applied in the Barents Sea, represents an essential contribution to significantly reduce impacts. Behind adoption of best practice in environmental, health and safety management, some case studies recognise that other key planning considerations should be taken into account to effectively reduce or avoid the identified environmental issues and interactions.

In high sensitive contexts, limiting disturbing activities, through the establishment of new conservation areas and expansion of existing ones, and the assurance of best management practices, are imposed as provisions for conserving biological resources and maintaining ecological integrity facing uncertainties according to adaptive management.

For instance, CA3 contemplates an articulated management strategy for identifying cumulative effects; it requires the definition of: management targets, which correspond to the objectives regarding the cumulative effects that the activities studied might have on VECs; management thresholds, which are guidelines or minimal standards that should not be exceeded in the day-to-day management of activities so that the VECs considered are sufficiently protected; management measures which are the means recommended to ensure the achievement of targets and avoid exceeding the required thresholds.

Therefore a monitoring strategy plays a crucial role for assessing effects in the long-run as well as dealing with uncertainties. Contexts with current existing monitoring activity are better equipped to understand the evolution of baseline conditions in respect of contamination, biological and human health effects across the interested areas (e.g. UK1, UK2). However, in order to efficiently assist the management of monitoring Oil & Gas activities, some SEA reports also require dedicated Spatial Information System to be designed and implement (e.g. CA2, CA3).

Governance

According to the positive examples gathered by the review, SEA can give an important contribution to dealing with governance issues and instruments of sustainability concern related to Oil & Gas development. Aspects related to enhancing institutional capacity and stakeholder involvement as well as systems management and follow-up are generally contemplated in the case studies. The need for reinforcing institutional capacity in dealing with Oil & Gas issues is particularly pointed out in development countries reports, which use SEA analysis also for understanding how to fill gaps, such as lack of environmental legislations and environmental institutions, need of coordination between institutions and training for public stakeholders.

Concerning stakeholder involvement, there are also examples of strategic consultations of local communities undertaken at very early stage of SEA procedures (e.g. MA). However, it should be noticed that some failures were reported in the effective involvement of less powerful groups, such as indigenous people (e.g. BO, AU). Moreover, a remarkable example is provided by CA3, where plan information campaigns for local communities and tourists are required to highlight existing impacts of Oil & Gas development activities on the environment.

In addition, upfront approaches detail systems management and follow up in the view of enhancing institutional systems management and extend stakeholder participation at the stage of Oil & Gas planning implementation and follow up. As mentioned before, case studies that aim at integrating sustainability into governance, promote better coordination across the authorities and stakeholders involved at different levels in the Oil & Gas development.

To build and maintain environmental monitoring, SEA reports recommend partnerships between involved users (e.g. institutions, Oil & Gas industry and other industry, agriculture, NGOs) and sources of monitoring expertise (e.g. environmental institutions, centre of research, etc.), and also funding programme for tailor made research and studies on effects of Oil & Gas development. In this regard, an interesting example is the governance model, proposed by CA3, based on the establishment of a devoted advisory committee and a coordination office. The first institution has the responsibility to collaborate in putting in action the recommended activities as well as to foster citizen involvement in the management activities, while the second plays the role of centralizing scientific information related to the industry's activities in order to facilitate access to data essential for decision-making integrating (e.g. study research and company studies relevant for the sector).

More strategic options are also recognizable in social oriented approaches (e.g. AU, BO, MA) that emphasize the need to involve traditional owners and indigenous people in the management of plans and monitoring activities. In addition, a remarkable example for strengthening follow up procedures is provided by AU, which requires the application of specific guidelines for determining significance of residual impacts. This is a crucial aspect to take into account in decision-making towards sustainability.

5.5 Recommendations to improve practice

The results presented in the previous section as well as our reflections from the analysis of case studies, against the literature reviewed, enable us to advance some recommendations that may help to enhance SEA practice for Oil & Gas activities. They are introduced below, structured by CDF.

Heritage Value

- Improve focus on valuable strategic components of the assessment, which extend beyond environmental issues to include community identity, sense of place and stakeholders perceptions;
- Define articulated management strategies that encompasses restriction and mitigation measures and monitoring requirements for maintaining the ecological integrity and sustainability of the area;
- Define management targets and thresholds according to valuable strategic components identified that may enhance heritage values.

Community Benefit

- Incorporate social considerations and shared discussions in terms of equity issues;
- Better focus on the implications for groups or individuals affected by the proposal, particularly on less powerful groups.
- Discuss alternative future scenarios and key environmental goals and objectives also in terms of other development options for the area that may generate community benefits;
- Identify management measures for maximising economic spin-offs for local communities;
- Undertake comprehensive analysis that makes risks-opportunities and trade-offs for local communities explicit, taking account of the significance of residual impacts.

Timescale

- Demonstrate clear links between ecosystem protection, sustainable economic development and social benefit for local communities in the short-medium as well as the long term;
- Undertake comprehensive analyses in the long-term, and consider cumulative and synergistic effects of multiple Oil & Gas activities and others possible concurrently activities across the interested areas;
- Provide recommendations and guidelines for designing dedicated Spatial Information Systems to assist in the management of monitoring Oil & Gas activities.

Governance

- Define a shared strategic vision and objectives to consider as a referential in the assessment, by involving extensive community consultation;
- Assure consistent and transparent approval processes in recognition of the environmental and social values identified;
- Provide recommendations and guidelines that help in implementing effective SEAs and environmental governance systems by clearly identifying tasks and responsibilities, and assure feedback to assist in impact prediction for future SEAs or projects EIAs concerning Oil & Gas development and other activities in the area of interest;
- Identify procedures for dealing with the proposal after its approval that:
    - ⇒ assure permanent link between involved institutions at different levels (e.g. Follow-up Coordination Committee (CSC) for developing relations between stakeholders and their capacity for managing environmental and social issues;
    - ⇒ support systematic communication mechanisms for disseminating environmental and social information relating to proposed Oil & Gas projects;
    - ⇒ include active participation of local communities in particular in monitoring activities;
    - ⇒ promote funding programme for tailor-made research and studies on effects of Oil & Gas development;
    - ⇒ evaluate the human and financial resources needed for effective environmental governance.

5.6 Conclusion

The review confirmed that aspects related to the selected four CDFs: Heritage Values, Community Benefits, Timescale and Governance represent common requisites for SEA practice in the Oil & Gas sector, even where SEA cases may reveal different degrees of integration. That shows that the aspects to which the CDF relate as recognized as relevant.

Moreover, by reviewing the case studies against the proposed CDF assessment framework, it was possible to suggest suitable recommendations in view of enhancing potential strategic contributions of SEA towards more sustainable outcomes in Oil & Gas developments, in terms

of protection of natural, social and cultural values, contribution to local development, management of uncertainty and improved decision-making processes.

It is central to notice that the considered CDFs focus on integrated concerns of primary relevance at local and regional scale. Of course this is not to say that these CDF should always structure all the strategic assessments of Oil & Gas developments in any part of the world. It is important that any SEA should be tailor-made to the particular context-specific aspects, which will need to be reflected in the selected CDF for focused assessment.
It is equally important to underline that CDFs must include cross-scale issues, such as potential conflict between national and local interests in dealing with Oil & Gas development, impacts outside the area directly affected by the activities or dynamics related to Oil & Gas production (e.g. increase in oil supply, implications for oil price, investments in developing technologies, current policy debate about how to effectively limit or reduce oil consumption and greenhouse gas emissions).

More research is needed to categorize convenient CDFs that can be able to synthetize cross-level issues and, consequently, propose a wider picture of SEA potential contribution to sustainability in space and in time. It would be of particularly importance to carry out more specialized and context-specific analysis during early stages of SEA processes.

Consequently, for guiding more sustainability-based assessment, it may help to explicit the contribution towards sustainability expected from SEA assessments, and make that reflect on the set of CDFs to be established for strategic-thinking assessment, for example following the approach we proposed in our framework. In fact, this method may represent a promising attempt in view of designing a streamlined way for fully integrative-based SEA assessments. It proved to be quite useful in helping to keep the focus in our review of the eleven case studies.

Chapter 6

“Val d’Agri Oil fields”: developing future scenarios

The process of investigations for the case study consisted of three principal steps: (1) the construction of a set of scenarios that simulated possible future alternatives related to Oil & Gas development for the study area; (2) the proposal of a set of context-specific and place-based criteria and metrics for the study area derived from the set of equity criteria proposed; (3) the assessment of the scenarios narrative implications against the equity criteria by an empirical analysis based on quali-quantitative data. This chapter is over the first point, while Chapter 7 will examine the other two steps.

6.1 Oil & Gas Development in Basilicata

In order to assess implications over space and time to Oil & Gas development, the case application focused on a study area that includes regional and local scales. The regional scale of investigation regarded the entire Basilicata. Two nested areas, including and surrounding existent and/or potential new Oil & Gas activities, were considered at local scale. The first local area, namely the Upper Val d’Agri, refers to the oldest and most important oil field (the Val d’Agri concession), while the wider area, namely the Val d’Agri, Melandro, Sauro, Camastra District (Comprensorio Val d’Agri, Melandro, Sauro, Camastra) includes the Tempa Rossa oil field (Gorgoglione Concession), which is expected to coming onstream in 2016. In this research the Val d’Agri and Tempa Rossa fields are identified as the “Val d’Agri Oil Fields” (Figure 6.1).

Basilicata is a region in the south of Italy, which covers about 10,000 km^2 (47% mountains), divided into provinces of Potenza and Matera, and including 131 municipalities. The total population is of 578.036 (ISTAT, 2013).

The Basilicata represents the second less density region in Italy with a population density of 57,8 inhabitants to Km^2.

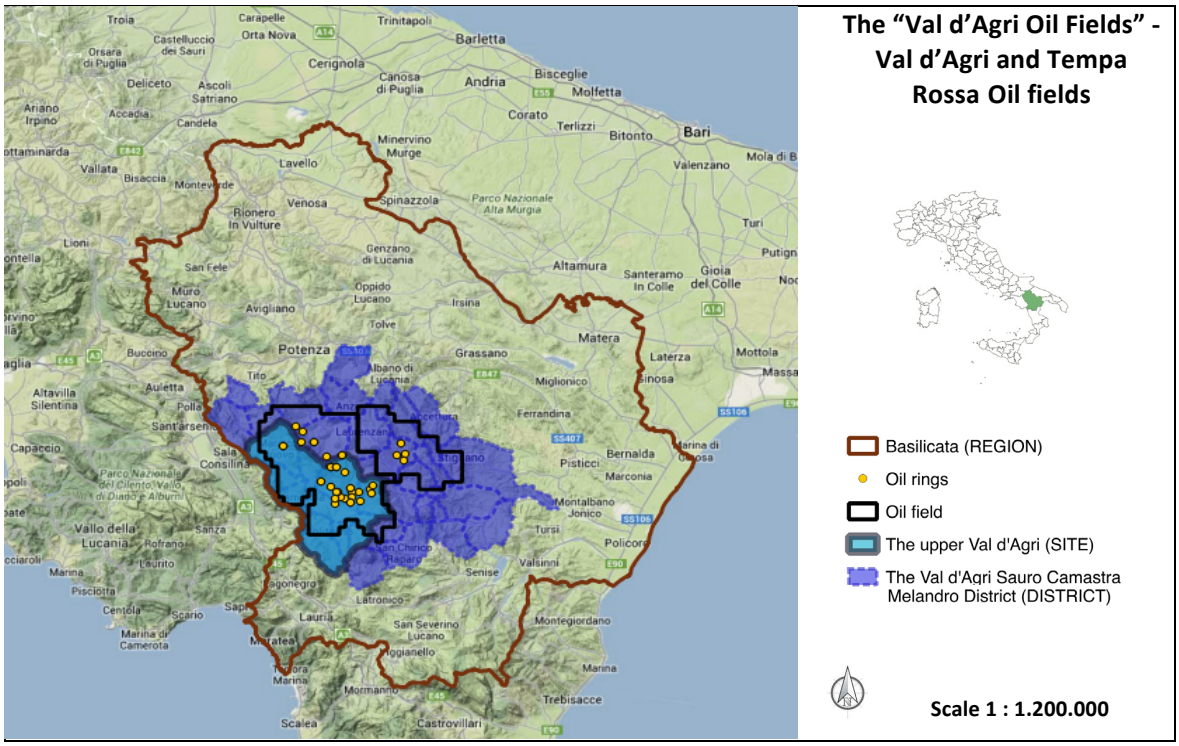

Fig. 6.1 – Study area.

The Basilicata Region presents a natural environment rich of ecologically sensitive and biodiversity-rich areas. It contains a large number of protected areas, which are characterised by exceptional floral and faunal communities. Parks and natural reserves cover about 24% of the region. There are two National Parks: Parco del Pollino, the largest in Italy of about 1926 km^2, located between the Basilicata and Calabria regions, and Parco della Val d'Agri Lagonegrese of about 676 km^2, close to and partially including existent oil rings (Val d'Agri Oil field). There are also two regional parks: Parco delle Chiese Rupestri, an archaeological, historical and natural heritage natural park, and Parco di Gallipoli Cognato-Piccole Dolomiti Lucane, close to existent oil rings (Tempa Rossa Oil field). Another regional park, Parco Naturale Regionale del Vulture, will be instituted in the Northern part of the region. There are also eight state and six regional reserves.

In Basilicata, the Natura 2000 Network, established according to the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, includes 50 Sites of Community Importance (SCIs), and 17 Special Protection Areas (SPAs), covering

17,1% of the regional territory. Figures 6.2 and 6.3 display distribution of parks and natural reserves, and SCIs.

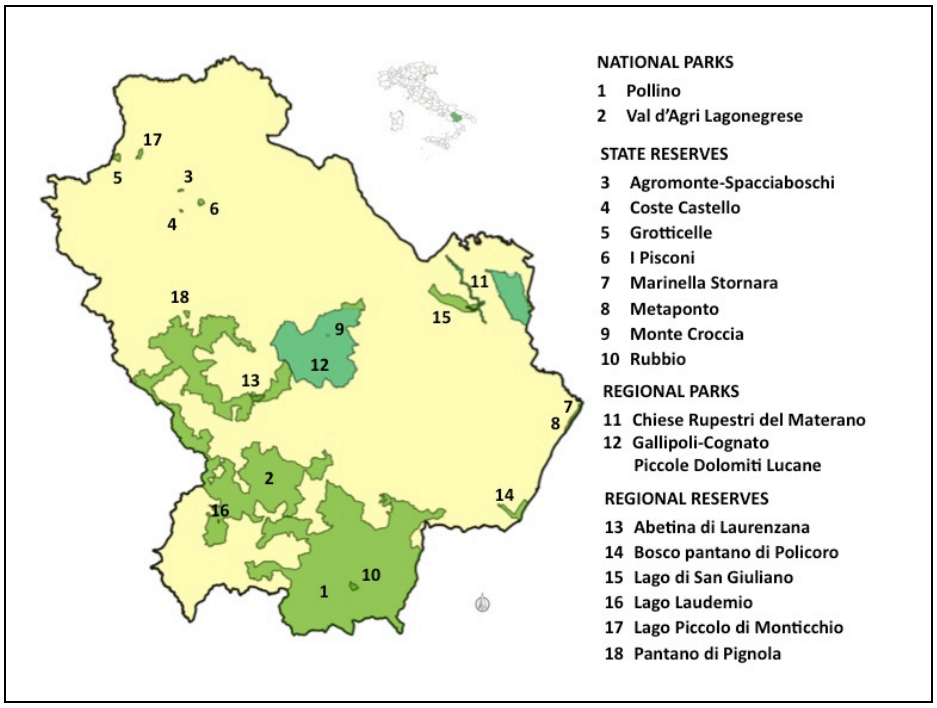

Fig. 6.2 – Map of Protected Areas: Parks and Natural Reserves (source: Regione Basilicata, Rete Natura 2000 website).

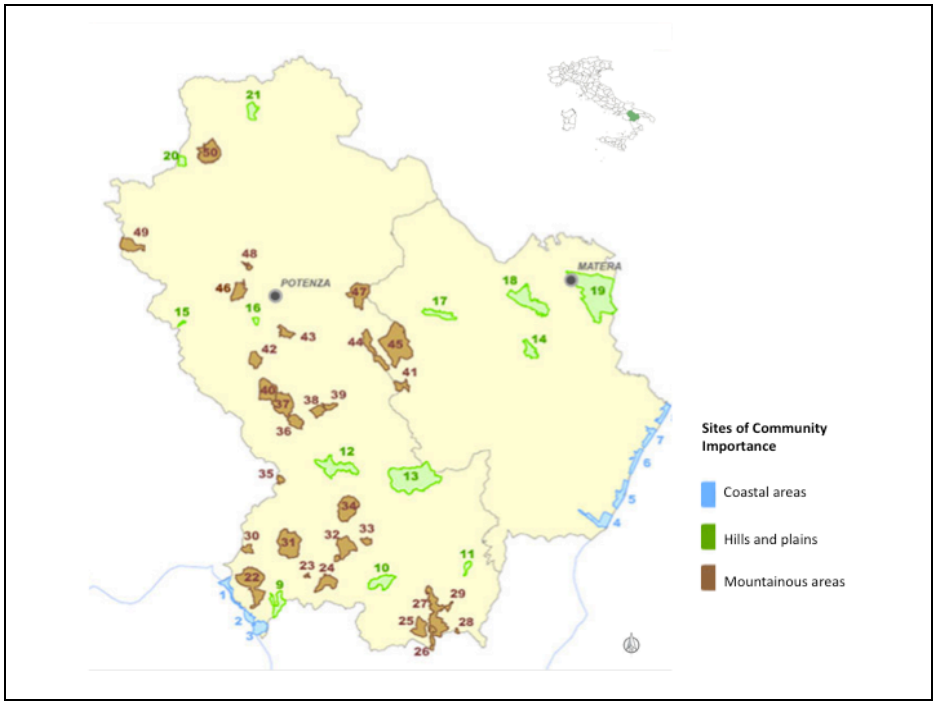

Fig. 6.3 – Map of Protected Areas: Sites of Community Importance (source: Regione Basilicata, Rete Natura 2000 website).

The region is largely devoted to agricultural practises, but is affected by land degradation processes such as diffuse desertification, accelerated soil deterioration and long-term decreases in biological productivity, due principally to inappropriate land management under both cultivated and uncultivated areas and frequent periods of droughts (Basso et al., 2010; Ferrara et al., 2005). Figure 6.4 displays environmental sensitivity to desertification broken down into 8 levels, from not affected to higher critical sensitivity (Regione Basilicata, 2004).

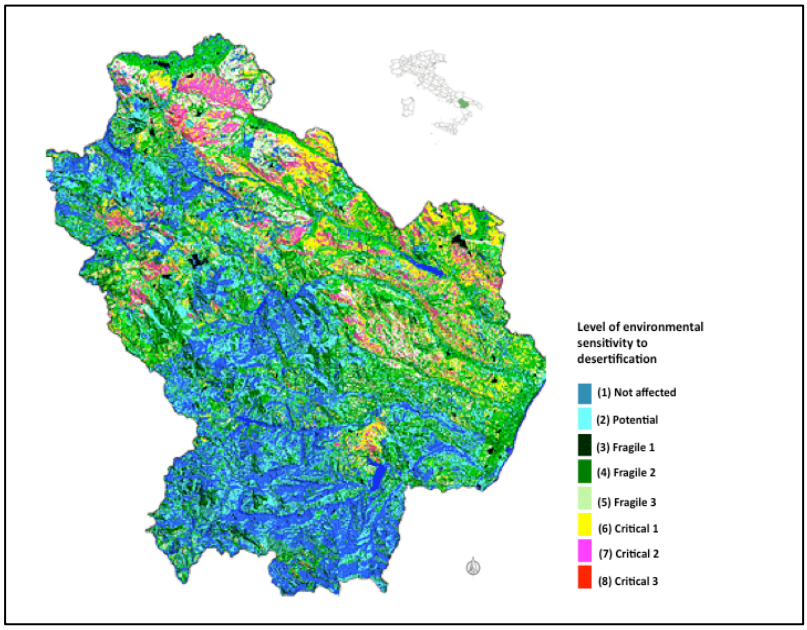

Fig. 6.4 – Map of environmental sensitivity areas to desertification (source: Regione Basilicata, 2004).

In term of socio-economic aspects, Basilicata has been recognized as one of the least favoured areas of Europe and supported by the Regional policy of the European Union for avoiding regional disparities across the Europe. Nevertheless, as Basilicata gross domestic product (GDP) per capita rose above the 75% EU-average, in the current 2007–2013 EU funding period, the Region is phasing out eligibility under Convergence objectives and will receive a transitional "phasing out" support from the EU until 2013. However, according to the index of regional competitiveness (RCI)[4], which shows the strengths and weaknesses of each of the EU

[4] The RCI covers a wide range of issues related to territorial competitiveness including innovation, quality of institutions, infrastructure (including digital networks) and measures of health and human capital (see Annoni and Dijkstra, 2013).

NUTS 2 regions, the Basilicata RCI performed very low in 2012, with a score of 227 out 262 European regional territories in 2012, in other words, solely 35 regional territories performed worse (Annoni and Dijkstra, 2013).

Tab. 6.1 – Overview of key socio-economic characteristics.

Basic Statistics **(sources ISTAT, 2013; 2013a; 2013b; Regione Basilicata et al., 2012).**

Population	Since 1991 a downward trend in residential population. In the period 2001-2011 the region recorded an average annual drop of 3.4 ‰, while at the national level is detected an increase of 4.4 ‰.
Income	14.279 euro per capita in 2011 (about 21% less the national average). -0,8% percentage point compared to 2008.
Employment rate	47,6% of employed persons aged between 15-64 on the total population in the corresponding age group in 2011 (56,9% in Italy).
Poverty	25,8% of population living in households below the poverty line in 2011 (13,6% in Italy).
Deprivation	24% of population affected by severe material deprivation in 2011 (11,1% in Italy). (e.g. people that can't afford a washing machine, can't afford to pay unexpected required expenses, inability to keep home adequately warm, inability to have a proper meal every two days).

A critical attention on this region is due to the presence of several Oil & Gas extractions, the existence of numerous protected areas and the recent creation of a second national Park (Decree of the president of the Italian Republic 8 December 2007), which covers the upper areas of the Agri valley, to protect the wild flora and fauna and manage the use of natural resources over the long term, combined with existent agricultural activities.

The social context of the region is characterised by a close bond of the population with its territory and by a widespread awareness and knowledge of environmental issues. The explorations in Basilicata started with gas concessions conferred in the eastern part of the region and along the Ionian coast in the 60's and extended far into the 90's. These concessions are partially in phasing out[5].

Currently existing 21 production concessions, of which 12 productive, covering about 21% of Basilicata territorial surface (2.071 km^2 out of about 10,000 km^2). Within the regional territory, there are 128 oil & gas wells, of which 47 productive, 79 potential productive, destined to

[5] source Osservatorio Ambientale Val d'Agri, http://www.osservatoriovaldagri.it, last accessed November, 2013.

storage or other uses, two in mining closure. Moreover, it is required to add the 11 licences for explorations and 17 requests for prospections and explorations[6].

Moreover, the new Italian energy strategy pins its hopes on developing Italian onshore and offshore oil fields, especially in the southern regions, with particular attention to Basilicata (MISE, 2012). Due to the high production potential, Basilicata has all the requirements to become the "Italian oil hub" for the next 20-30 with a potential perspective of doubling the actual production. In 2011, it was signed a memorandum agreement between the National government and the Basilicata Region for enhancing the regional development through infrastructural and investments policies related to fossil fuel research and exploitations (Stato Italiano and Regione Basilicata, 2011).

However, recently objections have been strongly raised against possible new regional Oil & Gas prospections and explorations (onshore and offshore) from the regional government as well as groups of local populations. In April 2012, the Regional government signed a moratorium against new requests of prospections and explorations within the Basilicata territory and seacoast (Regional Law 16-2012), which was declared unconstitutional in 2013 (Corte Costituzionale, Sentence n° 117-2013).

Moreover, several municipalities that neighbour the upper Val d'Agri valley as well as in the northeastern part of the region have expressed their firm disapproval of requests of prospections in their territory. In fact, it remains that Oil & Gas activities are perceived as a relevant source of environmental damage rather than a driving force for growth and development for local communities.

The Val d'Agri, Melandro, Sauro, Camastra District (Comprensorio Val d'Agri, Melandro, Sauro, Camastra) is an internal area in the Southern Apennines, representing about 10% of Basilicata territory (Figure 6.5). It presents a large number of protected areas characterised by exceptional floral and faunal communities and it is also devoted to agricultural practises, including 20 SCIs.

The District includes 35 municipalities and a total population of about 73.000 inhabitants. It is also considered a homogenous area according to the Operative Programme Val d'Agri - PO Val

[6] source Ministero dello Sviluppo Economico (MISE), http://www.sviluppoeconomico.gov.it, last accessed March, 2013.

d'Agri, established within the European Regional Development Fund programme for the period 2007-2013 (Regione Basilicata, 2007).

Fig. 6.5 – Map of the District area.

According to the PO Val d'Agri analysis[7], the basic characteristics of the area can therefore be summarized as follows:

- small size of settlements, consisting of micro-communalities, affected by depopulation (out-migration) for economic reasons (particularly acute in the south and in the north of the district);
- socio-economically marginalized, sparsely distributed population; increasingly an ageing population; significant deficiencies in social welfare and health services;
- poor quality of internal interconnections and infrastructural deficiencies in transport network;
- high incidence of the inactive population;
- small and very small productive settlements, concentrated in traditional sectors (construction and supply industry, traditional crafts), and agriculture combined. Moreover Oil & Gas sector under development. Agriculture and animal husbandry also

[7] (source Operative Programme Val d'Agri website, www.povaldagri.basilicata.it, last accessed November, 2013).

generate high-quality and niche production (bean, oil, wine, cheese and other dairy products) that can provide development opportunities for competitive local farms;
- abandonment of marginal land; cultivated area affected by desertification
- presence of significant ecological, archaeological, landscape, cultural resources (the area contains relevant parks and protected area);
- areas classified at high seismic risk;
- high tourism potential but tourism development is still in their infancy due to limitations and deficiencies in tourism-related services and transport systems.

Specifically, this District also includes the most important regional Oil & Gas concessions, namely the Val d'Agri and Tempa Rossa fields. The two concessions are neighbouring, the first lies in the Upper Val d'Agri, the second in the Sauro River Valley. The Sauro river is the most important tributary of the Agri River. While the Tempa Rossa Oil & Gas field is expected to coming onstream in next future (expected by 2016), the Val d'Agri Oil field currently covers over 80% of crude oil Italian production corresponding to 6% of the national energy need (Stato Italiano and Regione Basilicata, 2011). It is considered to be Europe's most promising on-shore development area. Moreover, it is expected that Italy's oil production will increase nearly 40% with the Tempa Rossa production.

The upper Val d'Agri area lies in the north of the district, which is characterized by rural and semi natural habitats with a landscape rich in biodiversity. It embraces 10 communalities and less than 30.000 inhabitants. The Upper region of the valley covers an area of just under 600 km^2 and is dominated by a valley-floor plain above an artificial lake (Lago del Pertusillo), classified as wetland area and included in a sites of community importance area closed to the Oil & Gas activities (Figure 6.6). There are relevant naturalistic, landscape, archaeological and cultural resources. It partly lies in the National Park of Val d'Agri and Lagonegrese and includes 12 Sites of Community Importance (SCIs), 2 Special Protection Areas (SPAs) and an Important Area for Birds (IBA) partially overlapping the national park.

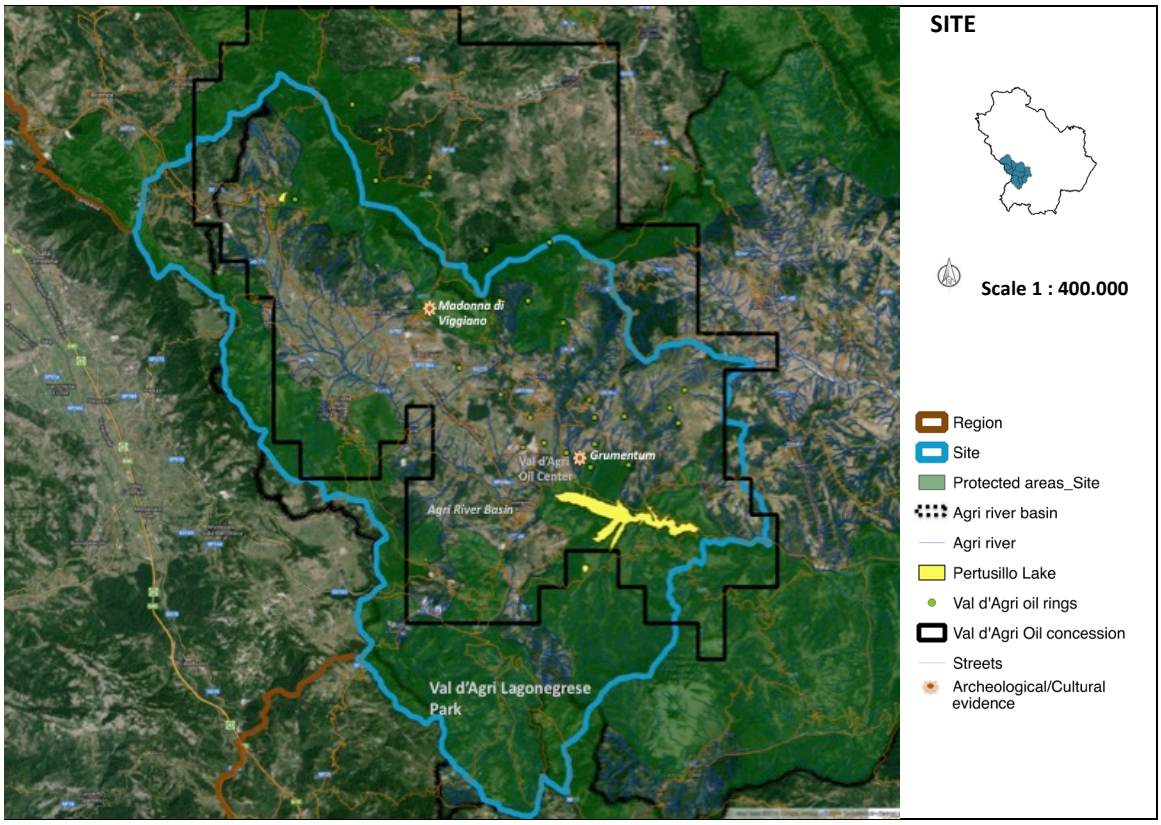

Fig. 6.6– Map of the Upper Val d'Agri area.

Currently, the most of Val d'Agri concession oil rings and related services infrastructures lies in the upper Val d'Agri. In particular, the Val d'Agri Oil & Gas reserves are estimated at around 600 million barrels of oil equivalent (including oil and associated natural gas), representing the Western Europe's biggest onshore oil field. Table 6.2 gives an overview of the main characteristics of the two existent and potential Oil & Gas developments.

As a note of terminology, in the subsequent sections *Region, District and Site* stand for Basilicata, the Val d'Agri, Melandro, Sauro, Camastra District, and the Upper Val d'Agri respectively.

Tab. 6.2 – Main characteristics of the two existing and potential Oil & Gas development.

Val d'Agri Oil field	Discovered in 1988, located in the upper valley of Agri river.
Production	Started in 1996. Current production is about 83 thousand bopd (barrels of oil per day) (ENI, 2012).
Area concession	660 km^2
Oil & Gas reserves	The fields account for a combined 600 million barrels of oil equivalent (boe). Associated gas forms around 7% of the total (Oil & Gas Journal, 2000).
Oil wells	48 wells, 39 completed (MISE, http://www.sviluppoeconomico.gov.it, last accessed March, 2013).
Oil centre for upstream treatment	COVA (Centro Oli Val d'Agri) with four lines of treatment opened in 2001, after the revamping of the first original oil centre opened in 1996 (Osservatorio Val d'Agri, http://www www.osservatoriovaldagri; last accessed November, 2013).
Pipeline for downstream treatment	A 150-km buried pipeline (Monte Alpi pipeline), with a capacity of 150,000 bopd, to transfer the oil to the Taranto refinery and marine terminal.
Recent advancement	A new programme for optimizations of Val d'Agri Oil development was approved in 2012 to rise production to 104 thousand bopd . (Ministerial Decree 23.01.2012). It also include drilling 9 wells (3 exploration wells and 6 productions wells), pipelines for the connection of existing and future wells and a new revamping the COVA with the realization of the fifth production line.
Tempa Rossa Oil field	Discovered in 1989, located in the upper valley of Sauro river, tributary of the Agri river.
Production	Expected to coming onstream in 2016. 50,000 bopd at plateau, along with 230,000 cubic meters of natural gas and 240 metric tons of liquefied petroleum gas (LPG) per day (Total, http://www.total.com; last accessed November, 2013).
Area concession	290 km^2
Oil & Gas reserves	The fields account for a combined 200 million barrels of oil equivalent (boe).
Oil wells	8 wells, 6 completed (Total, http://www.total.com; last accessed November, 2013).
Oil centre for upstream treatment	Oil Centre Tempa Rossa with one line of treatment.
Pipeline for downstream treatment	A 7 km pipeline for connecting the Oil Centre Tempa Rossa to the existent Monte Alpi pipeline (Val d'Agri Oil concession).

6.2 Developing plausible future scenarios

Several definitions of scenario emerge in literature. With the words of Rotmans et al. (2000), scenarios are archetypal descriptions of alternative images of the future, created from mental maps or models that reflect different perspectives on past, present and future developments. Whatever the definition of scenario is adopted, the important commonality is the idea that scenario-building does not focus on making predictions or forecasts, but rather on describing

images of the future that challenge current assumptions and broaden perspectives (Duinker and Greig, 2007).

Scenarios are commonly clustered into two main categories:

- normative answering the question - How can a specific target be reached? ; and
- explorative answering the question - What can happen?

Normative scenarios are anticipatory scenarios that start with a prescribed vision of the future (either optimistic, pessimistic, or neutral) and then work backwards in time to visualise how this future could emerge (Alcamo and Henrichs, 2008).
Explorative scenarios start in the present (i.e. with an initial situation) on the base of a set of assumptions of policies, measures and key driving forces (Alcamo et al., 2008). Explorative scenarios are thus explorations of what might happen in the future, regardless of beliefs of what is likely to happen or opinions of what is desirable.
Essentially explorative scenarios consist of states, driving forces, events, consequences and actions which are causally related (Rotmans et al., 2000). Each stories describes a plausible, but not necessarily, path of key variable such as population, economic activity and energy use (de Vries, 2013).

This category is further divided into external and strategic scenarios (Börjeson et al., 2006):

- external scenarios respond to the user's question: What can happen to the development of external factors?
- strategic scenarios respond to the question: What can happen if we act in a certain way?

For the purposes of this research, strategic scenarios were of particular interest. Strategic scenarios focus on internal factors (i.e. factors it is possible to affect), and take external aspects into account. The aim of strategic scenarios is to describe a range of possible consequences of strategic decisions. They incorporate policy measures at the hand of the intended scenario user to cope with the issue at stake. In these scenarios, the goals are not absolute but targets are defined.

Different policies are typically tested and their impact on the target variables is studied (Börjeson et al., 2006). These scenarios may be suitable to use not only for reacting but also for acting (Finnveden et al., 2003). It is a way to assess new options for the future and identify

ignored trade-offs (de Vries, 2013). Thus, it is important to notice that such approach could contribute to implement adaptive management schemes, which are increasingly considered as key and pragmatic strategies towards sustainability (e.g. Levin, 2012).

The methodology followed for developing scenarios was clustered into three main steps (modified from Kosow and Gaßner, 2008):

- Identification and analysis of key elements;
- Identification of spatial and temporal boundaries; and
- Scenario generation.

6.2.1 Identification and analysis of key elements

In order to establish a sound theoretical foundation for developing scenarios, a preliminary empirical and theoretical analysis in the form of desk research was carried out. As asserted by de Vries (2013), it represents a crucial step for allowing that required information about key elements could be fed into the scenario process. Particular attention was given to issues and concerns emerged from analysis of state of art, recent regional policies and trend analysis and documents relevant for potential Oil & Gas Development as well as consultation of dedicate institutional and dedicated website. Specifically, Oil & Gas activities state of art in Basilicata was essentially gathered from dedicated websites[8]. Moreover, significant policy documents, such as Basilicata Regional policies for sustainable development strategy and related studies (Boschma et al., 2013; Regione Basilicata, 2007), Italian energy strategy (MISE, 2012; MAP, 2005), Oil & Gas agreement between the Italian Government and the Basilicata Region (Stato Italiano and Regione Basilicata, 2011), and related regional policy measures (Regional Law 16-2012) were reviewed.[9]

Ecological, social and economic aspects and characteristics were gathered from reports undertook by authorities at different level, from European to regional scale (see Annoni and Dijkstra, 2013; Banca d'Italia, 2013; ISTAT, 2013; 2013a; 2013b; ISTAT and CNEL, 2013; MISE, 2013; Regione Basilicata et al., 2012; SVIMEZ, 2012; Annoni and Kozovska, 2010). Potential discontent on Oil & Gas activities in Basilicata was broadly evaluated by considering news

[8] Regione Basilicata, http://www.regione.basilicata.it; Osservatorio Val d'Agri, http://www.osservatoriovaldagri; MISE, http://www.sviluppoeconomico.gov.it; ENI, http://www.eni.com.it; TOTAL, http://www.total.com.

[9] sources: Boschma, 2013; Regione Basilicata, 2007; ISTAT, 2013a; 2013b; Banca d'Italia; Annoni and Dijkstra, 2013; Regione Basilicata et al. 2012; Stato Italiano and Regione Basilicata; 2011; Regione Basilicata, 2007).

related to this issue. By reviewing significant documents, data and information, it was possible to identify instrumental elements that could act as key drivers for the case study. As claimed by van der Heijden (1996), the Swot analysis is a quick way of coming to a scenario agenda.

Table 6.3 summaries key critical aspects for Basilicata's regional development identified by the results of SWOT analysis carried out for the Basilicata Region (Boschma, 2013; Regione Basilicata, 2007). The analysis proved the role that energy sector has interpreted to play for a soundness regional development.

Tab. 6.3 – A SWOT Analysis for Basilicata's regional development (adapted from Regione Basilicata, 2007; Boschma et al., 2013).

SWOT Analysis	
Strengths	**Weaknesses**
Considerable natural (e.g. biodiversity, water resources) and cultural heritage Relevant Oil & Gas reserves High tourism potential	Physical infrastructure – low internal and external connectivity Low coordination at institutional levels and excessive fragmentation of actors Sparsely populated region Depopulation and aging Low knowledge generation and knowledge diffusion (and knowledge base-economy) Peripheral position within Italy and Europe
Threats	**Opportunities**
Economic recession and global crisis Conflicts in reconciling National/Regional Energy policies Desertification Natural resources exploitation and environmental damages	Demands for sustainable green tourism and bio-agriculture productions Energy market if strategically managed

The issues raised from the research desk analysis helped in identifying context-specific ecological, social and economic aspects useful for hypothesizing plausible future storylines for the case study. As argued by Schwartz (1996), the identification of the driving forces and, in particular, slow changing variables are the core of a scenario construction. These variables could be suitably clustered into demographic, economic, social, scientific and technological, institutional, cultural, and environmental (Rothman, 2008).

According to the case study characteristics and the scope of the analysis, the determining combination of drivers was defined as follows:

- *Governance*: political driving forces (e.g. cooperation/conflicts in National/Regional policies and strategies);
- *Demographic aspects*: strong population decreasing/depopulation/emigration (assumed as exogenous variable);
- *Technological and infrastructural aspects*: potential advancement in Oil & Gas technologies, investments and incentives in transport infrastructures and related services;
- *Economic aspects*: increase of demand for Oil & Gas, needs of ensuring affordable energy reducing the dependence on imported fossil fuel; demands for green tourism and biological productions;
- *Environmental aspects*: preserving biodiversity and ecosystem function and contrasting rising emergencies (e.g. desertification, air and water pollutions increasing, nature and heritage conservation, contributing to the achievement of carbon emission reductions and security of energy supply);
- *Social aspects*: increasing/decreasing acceptability (opposition from interest groups, such as farming and tourism environmentalist organization); increase in human health diseases (e.g. cancer diseases).

Subsequently, following a consolidated integrated scenario methodology (see Rotmans et al. 2000), the significant variables were grouped into a selective number of factors, sectors and actors around which to centre each scenario (Figure 6.7).

6.2.2 Identification of spatial and temporal boundaries

Scenarios can be developed varying geographical scopes, ranging from the global scale to supranational areas, to national, to sub-national or regional areas, and finally to local areas (Greeuw et al., 2000; Van Notten, 2003). According to the purpose of this study, geographical scale levels were chosen considering primarily two main geographical points of reference for case-study scenarios: local (site and district, the Upper Val d'Agri and the Val d'Agri, Melandro, Sauro, Camastra District) and regional (Basilicata) levels.

Following Rotmans et al. (2000), the integrations of different levels were supposed to be achieved by observing the two levels in parallel and also including bottom-up and top-down integration across them. In addition the scenario construction took into account potential influences derived from and exerted on national trends affecting and being affected by sub-national and local levels according to the issue-based analysis, primarily the National energy

strategy (Figure 6.7).

Two temporal scales were considered as focal scales for quali-quantitative estimations of the equity criteria against scenarios: a shorter time horizon (a few years) and a medium-long time horizon of about 20 years (focus is through 2030). This choice took also into consideration available information of total proven reserves related to current Oil & Gas exploitations.[10]

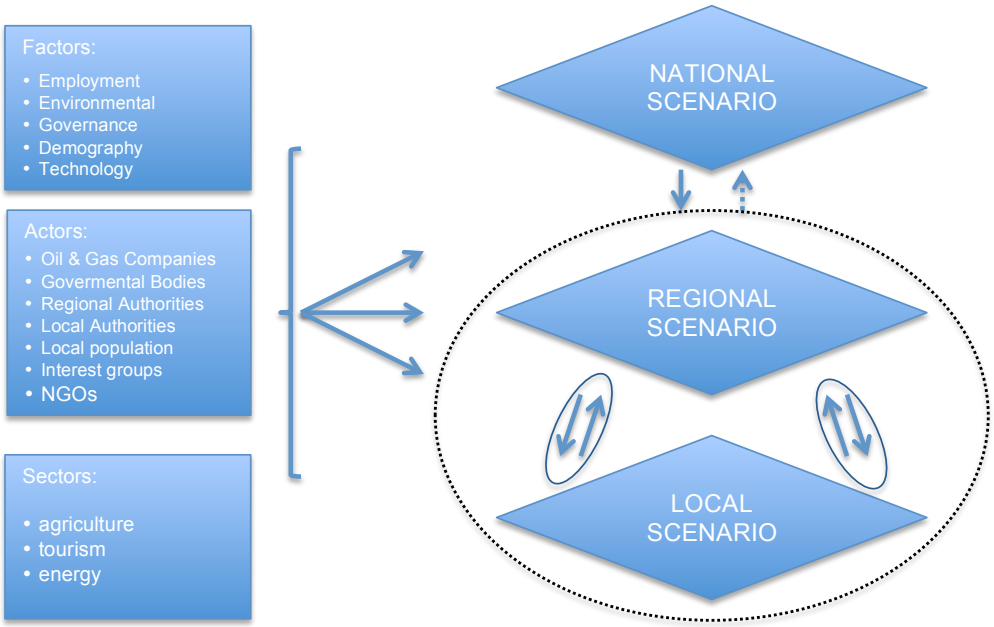

Fig. 6.7 – Key variables for scenario narrative generation (adapted and modified from Rotmans et al. 2000).

Figure 6.7 synthetises the variables chosen and the geographical scale levels of interest considered for constructing case study narrative scenarios. The analysis focused on local and regional scenarios taking into account the external influences due to national governance in the energy sector.

6.2.3 Scenario generation

The design of possible composite scenarios of interactions among environmental, social and economic aspects for this study was descriptive. Possible futures were based on qualitative scenario storylines (narratives) and trends of the most important drivers (Alcamo et al. 2008,

[10] sources: MISE, http://www.sviluppoeconomico.gov.it; Regione Basilicata, http://www.regione.basilicata.it; Osservatorio Val d'Agri, http://www www.osservatoriovaldagri.

Schwartz, 1996). Given that the specific drivers identified, the process to develop scenarios for the case study was based on identifying key relationships by which those drivers might interact. Questions related to pending land use and environmental decisions related to Oil & Gas development framed the examination of possible futures.

To this purpose, following similar approaches adopted in consolidated scenario exercises (e.g. Special Report on Emissions Scenarios (SRES), see Morita et al., 2001; Millennium Ecosystem Assessment, see MA, 2003), the scenario-axes technique was used to facilitated the process of generate scenarios and rendering them into plausible futures (see Eickhout et al., 2007; Van't Klooster and van Asselt, 2006).

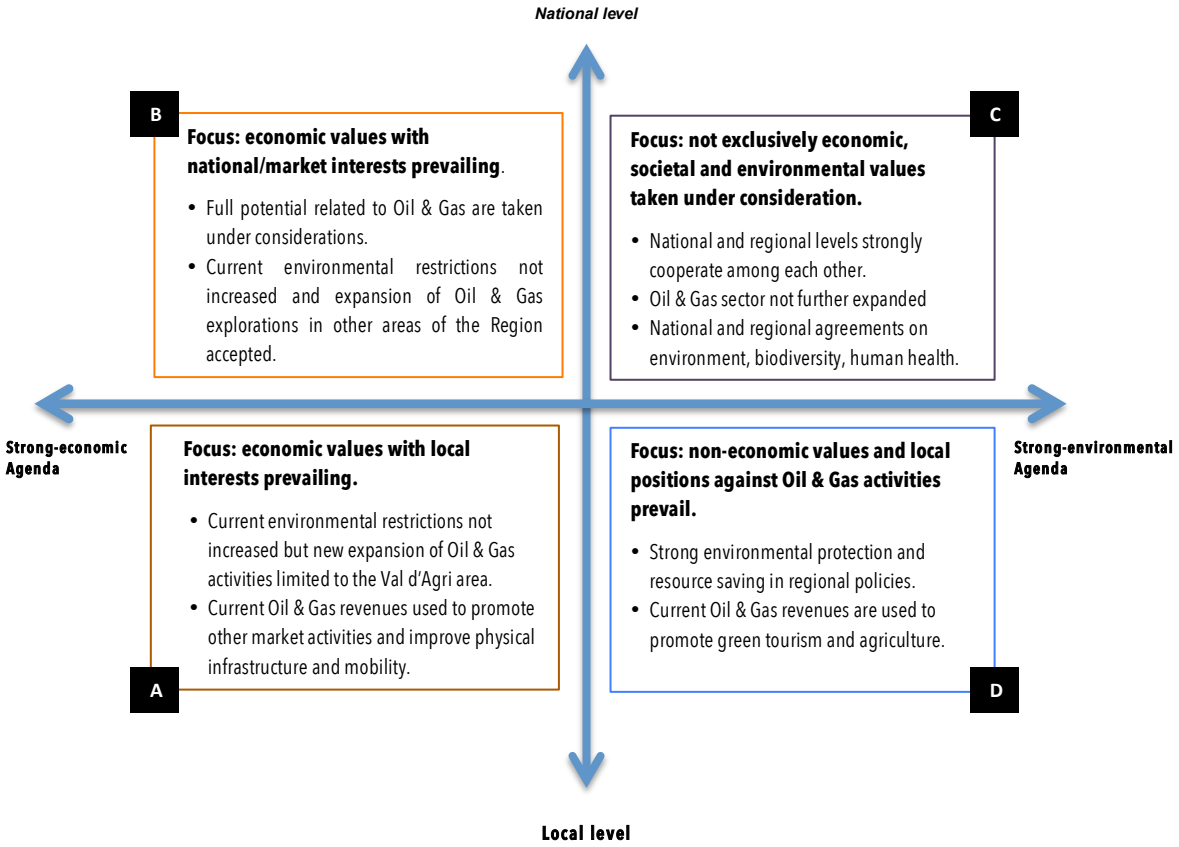

Fig. 6.8 – Scenario axes for constructing possible future storylines.

Two dimensions were used, along which future alternatives might be constructed, which represent two critical uncertain drivers influencing most or all of the others: strong-economic agenda versus strong-environmental agenda and localism/regionalisation against nationalization. One axis characterizes a context that is focused on economic values (strong-

economic agenda) versus one that is focused on social and environmental values (strong-environmental agenda). The other axis characterizes a context in which local prevails versus national level of decision (Figure 6.8). The two axes define four quadrants, namely A, B, C, D, along which scenarios might be hypothesized (Figure 6.8).

As described by Neville et al. (2010) by combining the extreme assumptions of each of the two axes, four scenarios logics emerge that can be used to develop the main stories of the scenarios.

Scenario assumptions and storylines

Each of the four scenario quadrants, plotted using the scenario-axes technique, represented a different perspective on how the future may unfold, that helps in taking into account critical uncertainty. According to the scenario quadrants and taking into account the results of the empirical and theoretical data analysis, it was firstly possible to distinguish specific assumptions related to Oil & Gas development and degree of expansion of Oil & Gas activities (Table 6.4) and, lastly, the related scenario storylines clustered into the key drivers identified (Table 6.5).

Tab. 6.4 – Scenario assumptions.

SCENARIO QUADRANT	POSSIBLE ASSUMPTIONS	DEGREE OF OIL & GAS EXPANSION SELECTED FOR THE ANALYSIS
A	**1A:** expansion limited to the upper Val d'Agri field plus Tempa Rossa field (under realization) according to existent approved concessions.	Increase of Oil & Gas extractions in the Upper Val d'Agri according to approved concession (from current 85.000 barrels/day up to about 104.000 barrels/day) plus the Tempa Rossa field (50.000 barrels/day).
B	**2B:** 1A plus new concessions in neighbouring areas **(**expansion within the Val d'Agri field and the Tempa rossa field areas).	Increase Oil & Gas extractions in the Val d'Agri field (up to about 130.000 barrels/day) plus the Tempa Rossa field (from 50.000 barrels/day up to 100.000. barrels/day).
C	**3C**: Current Oil & Gas production of Val d'Agri field plus the Tempa Rossa field development that is under realization.The focus is on both economic and non-economic values, but regional interests prevail.	The current Oil & Gas extractions in the Val d'Agri field (85.000 barrels/days) plus starting of the Tempa Rossa field (50.000 barrels/day).
D	**4D:** baseline scenario (only Val d'Agri field neither increase in Oil & Gas production nor further expansions in neighbouring areas or in other areas).	The current Val d'Agri field extractions (about 85.000 barrels/day).

Tab. 6.5 – Scenario storylines.

	Scenario storylines			
Key drivers	**A**	**B**	**C**	**D**
Economic	National economic strategies and companies push for increasing exploitations, but there is a general opposition to allow new explorations and exploitations. Companies negotiate agreement with local authorities for achieving the maximum limit of production previously approved. "Local content" agreement between stakeholders (Regional and local authorities, trade unions and companies) for enhancing the regional occupation in the Oil & Gas sector. Revenues are used for socio-economic investments (e.g. infrastructures and facilities).	National economic strategies companies powerfully interested in increasing exploitations in Basilicata. Companies negotiate specific agreement with the Region and communalities for enhancing their economic development (e.g. mechanisms of compensation based on share of gas extracted given to the interested communalities rather than royalties). Oil & Gas revenues are used for socio-economic investments especially related to service infrastructures and facilities.	Even if companies are powerfully interested in increasing exploitations, national and regional economic strategies are direct to improve the current economic situations, focusing on diversification and enhancement of environmental and cultural heritage. Oil & Gas revenues are invested for supporting green tourism, agriculture, service and mobility infrastructures, protection of the environment, biodiversity, and human health safety.	Infrastructural investments for incentivising green tourism and biological productions, as well as, incentives to local farm productions (low intensity) and "bio productions" are promoted.
Governance	Even if the authority to approve Oil & Gas activities is exclusively national, the national government is conditioned by the positions of the regional and local authorities and territories. Regional government is in accord with local administrators and territories to exchange increasing explorations (according to the threshold previously approved) with valuable economic agreements with the national government and the Oil & Gas companies.	Having the exclusive authority to approve Oil & Gas activities, the national government is determined to implement the national strategy related to fossil fuel. Regional government is in accord with the national government for expanding Oil & Gas activities, and local administrators and territories follow the decision to increase explorations. Public institutions and regional authorities trust in Oil & Gas sector as a driving force for growth and development for local communities, by seeking to negotiate valuable economic agreements with the national government and companies.	Even if the authority to approve Oil & Gas activities is exclusively national, the national and regional levels cooperate among each other and with the local level. The national government is in accord with regional government, local administrators and territories that approved Oil & Gas activities are adequate for growth and development for local communities without increasing pressures on the environment.	Conflicts in national/regional policies and strategies. Regional government tries to curb the Oil & Gas activities, and local administrators and territories agree with the decision to put a stop to explorations. Although having the exclusive authority to Oil & Gas authorizations, the national government is forced to change strategies related to own productions of fossil fuel in Basilicata.
Social	Low/progressive decrease in acceptability of Oil & Gas activities. They are still perceived as a relevant source of environmental degradation and human health diseases. The opposition from interest groups (e.g. farming and tourism environmentalist organization) and common citizens especially in other areas interested by research permits coexist with positions of public institutions and regional authorities, which trust in Oil & Gas development, and social demands for facing poverty, deprivation and underdevelopment.	Low/progressive decrease in acceptability of Oil & Gas activities. They are still perceived as a relevant source of environmental degradation and human health diseases. The opposition from interest groups (e.g. farming and tourism environmentalist organization) and common citizens is weakened by the positions of public institutions and regional authorities that trust in Oil & Gas development for facing poverty, deprivation and underdevelopment.	Progressive acceptability of Oil & Gas activities. They are still perceived as a relevant source of environmental degradation and human health diseases, but a systematic program for transparency, consultation and public participations in decision and follow-up is supporting the resolution of conflicts. Active participation of citizens encourages the confidence that multi-level governance could powerfully help in facing poverty, deprivation and underdevelopment.	Strong decreasing acceptability of Oil & Gas activities (e.g. perceptions related to increase in human health diseases and environmental degradations). Strong opposition from interest groups, such as farming and tourism environmentalist organizations.
Environmental	Current environmental restrictions are not increased but expansion of explorations is allowed according to approved concessions in the area even if they could be closed to protected areas, natural parks and sensitive areas.	Current environmental restrictions are not increased and expansion of explorations is promoted even if they could be closed to protected areas, natural parks and sensitive areas included coastal areas.	More stringent environmental restrictions are imposed to existent and under realization activities. Cumulative monitoring programmes are established.	Preserving biodiversity and ecosystem function and contrasting rising emergencies (e.g. desertification, air and water pollutions increasing, nature and heritage conservation, etc.) become the priorities. Sustainable management of natural resources is promoted.
Demographic	Strong population decreasing/depopulation/ emigration	Strong population decreasing/depopulation/ emigration	Demographic aspects: Some signals of population decreasing/depopulation/ emigration reversion	Strong population decreasing/depopulation/emigration
Technological/Infrastructural	Oil & gas technologies maintain the current level of efficiency and technological characteristics, but they need to be adequate to support the increase in barrels production; in particular new infrastructures and service facilities are under construction for the realization of the Tempa Rossa field.	Oil & Gas technologies maintain the current level of efficiency and technological characteristics; they need to be strongly adequate to support the increase in barrels production and new infrastructures and service facilities are realized.	Strong technological advancements are imposed to the Oil & Gas sector not expanded (excepted which are under realization).	The Oil & Gas technologies maintain the current level of efficiency and technological characteristics.

6.3 Discussion and conclusion

The impact of a strategic action, or the relative benefits and disbenefits of different options, depends on variables outside the strategic action's control (Therivel, 2010). Scenario approach offers a power platform for envisioning future outcomes, by helping in recognizing key aspects for future development and analysing the interconnections among them. The adoption of a scenario matrix appears as a valuable visual and logical aid in view of developing scenario qualitative narratives. In fact, after having broadly determined the four scenarios on the basis of the two scenario dimensions defined in the matrix, it was more workable to structure plausible and realistic storylines according to the key drivers identified for the case study.

However, in relation to scenario content characteristics, some reflections on limitations of the study need to be made. It is important to observe that these characteristics essentially accomplish the goal of testing the equity approach, rather than identifying and cope with great uncertainty related to future. Thus, the scenario exercise proposed was more related to *conventional* rather than *alternative* scenarios. According to van Notten et al. (2003), the first typology has the aim to fine-tune current strategy and overlap between the scenarios are possible, while the second describes future that differently from one another with the aim of raising awareness and understanding about new or uncertain issues.

This choice was also conditioned by the method used for collecting information and identifying key aspects and issues, namely, desk research rather than participatory approach. In fact, participatory approaches, which draw on expert and stakeholder inputs (including in particular local inhabitants), are considered crucial for widening the range of possible alternatives and challenging new dynamics and uncertain issues (e.g. Helming and Pérez-soba, 2011; Zhixi et al., 2011; Morris, 2011; van Notten et al. 2003). Either way, undertaking participative techniques, such as surveys, brainstorming workshops and Delphi methods, was outside the scope of this research. Nevertheless, the scenario study tried to achieve a consistent degree of interaction between variables and dynamics across time and spatial scale in relation to equity issues.

In the chapter that follows, I will go into detail about the comparison and assessment of the scenario storylines, developed in this chapter, against a set of equity criteria and indicators identified for the case study according to the equity framework presented in Chapter 3.

Chapter 7

"Val d'Agri Oil fields": Testing the equity criteria set

In this chapter, I will test the equity approach suggested in Chapter 3, by investigating how different decisions involving Oil & Gas development for the case study will affect the distribution of benefits and disbenefits at intra- and inter-generational level. To do this, I will apply a quali-quantitative empirical approach. According to the equity perspectives and the general criteria for addressing equity, previously identified (see Tables 3.6 to 3.9), combined to crucial aspects emerged in Chapters 4 and 5, as well as, concerns gathered from the analysis undertaken in Chapter 6, I will propose a set of context- and place- based equity criteria and corresponding indicators appropriate for the case study. Then, I will apply this metrics against the scenario storylines drawn in Chapter 6. Thereafter, I will examine and compare trade-offs between human and environmental systems under the different scenarios. Finally, suggestions will be provided on how to include in a more comprehensive way equity considerations to support decision-making processes at strategic level.

7.1 Selecting context-specific equity criteria

In Chapter 3, four equity perspectives, and associated principles, were identified (see Table 3.5). As stated in Chapter 4, it is crucial to take into consideration that criteria need to be specified to the context involved in the analysis (Gibson, 2006). Thus, a set of context-specific equity criteria were derive from these perspectives in accordance to the general criteria, listed in Table 3.6 to 3.9, and adapted and/or specified, where needed, for the case study characteristics. Thus, the analysis conducted to identify 19 criteria, which:

- accomplish the general statements considered in Chapter 3;
- are related to Oil & Gas development, and
- find applicability for the case study in relation to place-based issues and data convenience and availability.

For instance, looking at the opportunity perspective, the general criterion of providing a clean and healthy environment was confirmed by referring to the link between air quality and life satisfaction (e.g. Ferreira et al, 2013). It was taken into consideration impact on air quality of the central production facility, so called Oil & Gas center, which gathers and separates the produced fluids (oil, gas and water), once the crude oil reaches the surface. Similarly, the criterion potential for new occupation was related to direct and indirect possible new jobs connected to construction and exercise of Oil & Gas upstream activities (e.g. drilling, exploration, exploitation, crude oil treatments, pipeline maintenance, etc.).

Another specific criterion was over perceived change in standard of living, which focuses on the position of local people about opportunity offered by Oil & Gas development, important issues strongly emerged from SEA of Oil & Gas analysis, as well as, the case study empirical analysis. Potential change in access to environmental assets criterion considers consumption of resources that are withdrawn from other uses.

In terms of distributional fairness, migration from the areas interested by the Oil & Gas activities captures aspects of the potential development that affect life and property and potential change in historical territory vocation (e.g. potential progressive abandonment of agricultural practice). Resource productivity attempts to interpret efficiency in the use of resources by assessing the direct connection between resource use and environmental degradation (e.g. Steinberger and Krausmann, 2010).

In relation to the distributional fairness across generation perspective, *cumulative impact of well pads and associated roads for servicing* is a specific criterion that aim at overarching concerns in relation to sustaining the ecological integrity, particularly in terms of the implications for biodiversity, habitat fragmentation, and the spread of non-native species, due to this significant disturbance associated to Oil & Gas development (e.g. Government of Saskatchewan, 2007).

With regard to the justice for an imperfect world perspective, *contribution to more lasting future options* criterion tries to capture aspects of the intertwined demand of recognizing trade-offs as well as offering more beneficial solutions in the long-run, which is particularly highlighted for Oil & gas development, as discussed in Chapter 4 and 5.

Potential for managing the pace and scale of development criterion reflects on the potential contribution of Oil & Gas development in building a more diverse economic base and enabling leverage effects in the long-run, as stressed by an important sustainability test applied to Oil &

Gas sector in Canada (see Gibson, 2011; Joint Review Panel for the Mackenzie Gas Project, 2009). *Potential for managing conflict between communities* considers efforts undertaken by proponents of developmental initiatives to avoid conflicts due to inequitable distribution and changes in territory development, such as contribution to cultural/recreational activities and compensation measurements.

Table 7.1 presents the proposed set of context-specific equity criteria applicable to the case study.

Tab. 7.1 – Equity criteria identified for the case study.

EQUITY PERSPECTIVE	EQUITY CRITERIA
OPPORTUNITY	Potential for new occupation in the Oil & Gas Sector; Clean and healthy environment; Perceived change in standard of living; Potential change in access to environmental assets; Contribution to reduce the dependence on imported fuel.
DISTRIBUTIONAL FAIRNESS	Migration from the areas interested by the Oil & Gas activities; Economic benefits; Exposure to risk; Acceptability of Oil & Gas activities; Resource productivity.
DISTRIBUTIONAL FAIRNESS ACROSS GENERATIONS	Cumulative impact of well pads and associated roads for servicing infrastructure; Resource impact; Impact on protected areas; Sustainable management of resources; Detrimental effects on land consumptions.
JUSTICE FOR A IMPERFECT WORLD	Contribution to more lasting future options; Potential for managing the pace and scale of development; Potential for managing conflict between communities; Undertaken adaptation and mitigation measures.

7.2 From equity criteria to indicators

In order to allow a quali-quantitative comparison of the scenario narratives against the equity criteria, the criteria proposed in Table 7.2 were applied and analysed in terms of possible corresponding context-specific indicators tailor-made for the case study. Measurable equity indicators were identified and subdivided into the four groups of equity criteria proposed. Indicators were largely populated by quantitative data, some qualitative data were used for measuring some of *the justice for an imperfect world* parameters. Thus, implications entailed in the four hypothesised scenarios for intra- and inter-generational equity were empirically measured throughout the equity criteria and corresponding indicators and measures.
Table 7.2 summarises the equity indicators adopted.

The selection of indicators was closely linked to the equity criteria according to issue-based as well as area-based elements derived from the preliminary empirical and theoretical analysis undertaken in Chapter 6, as well as insights drawn from the investigations in Chapters 4 and 5.

The 23 indicators proposed were determined by considering the following benchmarks:

i) derived by existent list of sustainability indicators (e.g. MA, 2003; EEA website, http://www.eea.europa.eu/data-and-maps/indicators; Sensor, 2008);
ii) sensitivity to scenarios in relation to Oil & Gas issues;
iii) data availability and operability.

Regarding methodological aspects, the proposed indicators needed to be adapted to data availability. Thus, it was necessary to rethink some indicators originally hypothesized. For example, the indicator "*resettlements*" preliminary chosen for the criteria "*migration from the areas interested by the Oil & Gas activities*", was transformed to the indicator "*migration rate"* related to demographic statistics on changes of place of residence, since it was no possible to draw information specifically related to migrations caused by the Oil & Gas activities. Either way, undertaking a dedicated survey for such an issue was outside the scope of the research.

Tab. 7.2 – Equity indicators for the case study.

EQUITY PERSPECTIVES	EQUITY CRITERIA	ID	INDICATOR	DESCRIPTION
OPPORTUNITY	Potential for new occupation in the Oil & Gas Sector	1	Employment opportunity for local workers	Number of local workers occupied in the Oil & Gas sector (directly and indirectly)
	Clean and healthy environment	2	Emissions due to Oil & Gas activities	ton of $S0_2$
	Perceived change in standard of living	3	Young people incidence on total population	Proportion of population aged 0-14 – percentage
	Potential change in access to environmental assets	4	Water consumptions due to Oil & Gas activities	m^3 of water
	Contribution to reduce the dependence on imported fuel	5	Proportion of the national energy need provided: oil	Mtep provided / Mtep Oil & Gas Italian needs
		6	Proportion of the national energy need provided: gas	
DISTRIBUTIONAL FAIRNESS	Migration from the areas interested by the oil & gas activities	7	Migration rate	Population cancelled due to change of place of residence / Total population cancelled from the population register – percentage
	Economic benefits	8	Economic benefit between the regional and local territorial governments:	Revenue from Oil & Gas development – Meuro
		9	Direct economic benefit for population	Hydrocarbon bonus benefit – Meuro
	Exposure to risk	10	Disturbance on sensitive social group	Number of schools within 5 km from areas interested by developmental activities / Total number within the territory
	Acceptability of oil & gas activities	11	Municipalities protesting and opposed to current Oil & Gas activity management	Number municipalities protesting / Total municipalities – percentage
	Resource productivity	12	Effective use of Oil & Gas resources	Value Added / yearly total crude Oil & Gas production * (Meuro /kBoe – percentage)
DISTRIBUTIONAL FAIRNESS ACROSS GENERATIONS	Cumulative impact of well pads and associated roads for servicing infrastructure	13	Anthropogenic surface disturbance of native habitat	Km / Km^2 of roads and trails
	Resource impact	14	Environmental damage and loss of environmental quality	Amount of water re-injected after Oil & Gas upstream treatment – m^3
	Impact on protected areas	15	Proximity of protected areas to areas interested by Oil & Gas activities	Protected area in a buffer of 3000 m from oil & gas field / Territory – percentage
		16	Change of core biodiversity areas	Protected area in a buffer of 3000 m from oil & gas field / Protected area in territory – percentage
	Sustainable management	17	Area of agricultural ecosystems under sustainable management	Land managed with organic method / Territory – percentage
	Detrimental effects on land consumptions	18	Land area covered by Oil & Gas main activities	Land area affected by Oil & Gas activities / Territory – percentage
JUSTICE FOR AN IMPERFECT WORLD	Contribution to more lasting future options	19	Agreements and initiatives for lasting future options	Qualitative assessment**
	Potential for managing the pace and scale of development	20	Investments into Research & Development	Value Added / Expenses in R&D - percentage
	Potential for managing conflict between community (a)	21	Oil & Gas companies contribution for local development (for activities, events, territory promotions)	Meuro
	Potential for managing conflict between communities (b)	22	Other compensation measurements	Qualitative assessment**
	Adaptation and mitigation measures	23	Actions related to system of monitoring and follow–up	Qualitative assessment **

*** Value Added (VA) =** the indicator is defined as the total gross value added per sector for agriculture, industry, constructions and services. In national/regional accounts used in macroeconomics, it refers to the contribution of the factors of production, i.e., capital (e.g., land and capital goods) and labor, to raising the value of a product and corresponds to the incomes received by the owners of these factors. The national/regional value added is shared between capital and labor (as the factors of production), and this sharing gives rise to issues of distribution. This indicator can make the economic impact of a policy more visible than Gross Domestic Product (GDP), especially at regional and local level (Bach et al., 2008).

**** Qualitative assessments =** in case of more actions and/or measurements, the total number was summed without assigning weights.

Nevertheless, it is important to highlight that the review of equity perspectives and the general criteria drawn up from Chapter 3 allowed recognizing suitable proxy indicators. For instance, the criterion "*perceived change in standard of living*" was linked to the indicator "*young people incidence on total population*", taking into consideration that variations in this indicator might reflect changing in well-being perceptions of local population, providing an indirect sign of their propensity to have children and/or remain in their own towns.

7.3 Assessing scenarios using the proposed criteria and indicators

The scenarios were assessed against the equity criteria by measuring the corresponding indicators at short, as well as, medium/long term. As mentioned in Section 6.3.2, the quali-quantitative estimations of the equity criteria against scenarios encompassed a shorter time horizon (a few years) and a medium-long time horizon of about 20 years (focus is through 2030).

In this regard, Table 7.3 summarises indicators metrics and source of baseline data. In Appendix hypotheses and assumptions considered for populating indicators and deriving measures for the four scenarios are detailed. In this regard, it is important to note that Scenario D depicts a baseline status in short term, and business as usual conditions in medium-long term, while Scenario A, B and C represent possible variations of this status at the two temporal scales, according to hypothesized narrative assumption and storylines presented in Chapter 6 (Tables 6.4 and 6.5).

The approach adopted was to compare results at the three nested geographical scales at short as well as medium-term. Thus, where criteria were solely connected to site or/and district values, regional values were coincided to site or district elaborations. An example of this approach is estimations of emissions due to Oil & Gas activities. It is therefore important to note that some criteria present same values at the different geographical scales, because it was assumed that related implications and effects are equally shared at the different scales. For example, due to interconnections in the Basilicata water supply system, water consequences were considered independently of the source of impact.

Same approach was adopted for valuing impacts on groundwater resources. While criteria include data at regional level, they were shared at site and district levels according to corresponding population. For instance, I followed this method for sharing regional revenues at site and district levels.

In this regard, it is essential to refer to the royalty regime. In Italy, Oil & Gas revenues are based on production values and require national government to receive 10% (until 2009, 7%) for oil and about 4% for gas. The share of royalties available to the region is regulated by an agreement between the Italian Government and the Basilicata region.
For oil, the Basilicata region receives 70% of the national royalties, of which 85% is devoted to region for specific activities (such as the operative program Val d'Agri, financing University, etc.) and 15% is directly allocated to interested municipalities. The municipalities are allocated their share on the basis of the presence of infrastructures (extraction wells and oil centers).
For allocation of gas royalties, the region receives 100% of royalties (corresponding to about 4% of production values) that are directly managed by a public utility, set up to raise revenue through gas auctions (Boschma et al. 2013). Moreover, from 2011 the National government has allocated a 3% share of onshore Oil & Gas royalties globally paid in Italy, on a special fund in favour of regions interested by Oil & Gas extractions and regasification activities. The Val d'Agri field provides the majority of resources for this fund, namely "Bonus Idrocarburi". For this reason, Basilicata citizens with a driving licence can directly benefit of an annual discount on purchasing fuel.

For the most part, baseline data referred to 2011 statistics. Medium-long term trends related to population were esteemed according to statistical projections elaborated by ISTAT (2013) at 2030, and Italian energy needs according to statistical projections provided by MISE (2005) at 2030.

Tab. 7.3 – Indicators metrics and source of baseline data.

ID	Indicator	Description	Units	Baseline data	Source of data and information
1	**Employment opportunity for local workers**	Number of local workers occupied in the Oil & Gas sector (directly and indirectly)	None	Data Reports	Eni, 2012; Eni 2013; Bubbico, 2013
2	**Emissions due to Oil & Gas activities**	Emissions of SO_2	ton	Data Reports	Eni, 2012; http://www.eni.com
3	**Young people incidence on total population**	Proportion of population aged 0-14	%	Demographic data and projections	ISTAT, 2013; 2013b; http://dati.istat.it
4	**Water consumptions due to Oil & Gas activities**	Consumption of water	m^3	Data Reports	Eni, 2012
5	**Proportion of the national energy need provided: Oil**	Mtep provided/ Mtep Oil & Gas Italian needs	None	Data Reports	MISE, 2013; MAP, 2005
6	**Proportion of the national energy need provided: Gas**	Mtep provided/ Mtep Oil & Gas Italian needs	None	Data Reports	MISE, 2013; MAP, 2005
7	**Migration rate**	Population cancelled due to change of place of residence/ Total population cancelled from the population register	%	Demographic data projections	ISTAT, 2013; 2013b; http://dati.istat.it
8	**Economic benefit for regional and local territorial governments**	Revenue from Oil & Gas development	Meuro	Revenue data	MISE, 2013; MISE, http://www.sviluppoeconomico.gov.it; Regione Basilicata, http://www.regione.basilicata.it; Osservatorio Val d'Agri, http://www.osservatoriovaldagri
9	**Direct economic benefit for population**	Hydrocarbon bonus benefit	Meuro	Revenue data	MISE, 2013; MISE, http://www.sviluppoeconomico.gov.it; Regione Basilicata, http://www.regione.basilicata.it; Osservatorio Val d'Agri, http://www.osservatoriovaldagri
10	**Disturbance on sensitive social group**	Number of schools within 5 km from areas interested by developmental activities/ total number within the territory	None	GIs – data; Maps	Minambiente, Geoportale Nazionale, http://www.pcn.minambiente.it
11	**Municipalities protesting and opposed to current Oil & Gas activity management**	Number municipalities protesting / total municipalities	%	Online news	http://www.basilicatanet.it; http://www.ilquotidianodellabasilicata.com
12	**Effective use of Oil & Gas resources**	Value Added (Meuro) / yearly total crude Oil & Gas production (kBoe)	%	Data Reports	Regione Basilicata et al., 2012; SiGeos - Sistema Geografico Statistico, http://rsdi.regione.basilicata.it; MISE, 2013; MISE, http://www.sviluppoeconomico.gov.it

Tab. 7.3 – Indicators metrics and source of baseline data (continued).

ID	Indicator	Description	Units	Baseline data	Source of data and information
13	**Anthropogenic surface disturbance of native habitat**	km/km^2 of roads and trails	km^{-1}	Data Reports; GIs – data; Maps	Osservatorio Val d'Agri, http://www.osservatoriovaldagri; Minambiente, Geoportale Nazionale, http://www.pcn.minambiente.it; Regione Basilicata, Sistema Geografico Statistico (SiGeos), http://rsdi.regione.basilicata.it/
14	**Environmental damage and loss of environmental quality**	Amount of water re-injected after Oil & Gas upstream treatment	m^3	Data Reports	Eni, 2012; http://www.eni.com
15	**Proximity of protected areas to areas interested by Oil & Gas activities**	Protected area in a buffer of 3000 m from oil & gas field / territory	%	GIs – data; Maps	Minambiente, Geoportale Nazionale, http://www.pcn.minambiente.it; Regione Basilicata, Sistema Geografico Statistico (SiGeos), http://rsdi.regione.basilicata.it/
16	**Change of core biodiversity areas**	Protected area in a buffer of 3000m from oil & gas field / protected area in territory	%	GIs – data; Maps	Minambiente, Geoportale Nazionale, http://www.pcn.minambiente.it; Regione Basilicata, Sistema Geografico Statistico (SiGeos), http://rsdi.regione.basilicata.it/
17	**Area of agricultural ecosystems under sustainable management**	Land managed with organic method/territory	%	Statistic Report	ISTAT, 2013, http://dati.istat.it
18	**Land area covered by Oil & Gas main activities**	Land area affected by Oil & Gas activities/territory – percentage	%	GIs – data; Maps	Minambiente, Geoportale Nazionale, http://www.pcn.minambiente.it; Regione Basilicata, Sistema Geografico Statistico (SiGeos), http://rsdi.regione.basilicata.it/
19	**Agreements and initiatives for lasting future options**	Number of actions	None	Reports	Stato Italiano and Regione Basilicata, 2011; ENI 2012; 2013, http://www.eni.com.it; TOTAL, http://www.total.com
20	**Investments into Research & Development (R&D)**	Value Added / expenses in R&D	%	Statistic Reports	Regione Basilicata et al. 2012, Sistema Geografico Statistico (SiGeos), http://rsdi.regione.basilicata.it
21	**Oil & Gas companies contribution for local development (for activities, events, territory promotions)**	Financial contribution	Meuro	Reports	ENI 2012; 2013, http://www.eni.com.it; TOTAL, http://www.total.com
22	**Other compensation measurements**	Number of actions	None	Reports	ENI 2012; 2013, http://www.eni.com.it; TOTAL, http://www.total.com
23	**Actions related to system of monitoring and follow–up**	Number of actions	None	Reports	ENI 2012; 2013, http://www.eni.com.it; TOTAL, http://www.total.com

Qualitative assessments regarded three of the *just for an imperfect world* criteria, namely, agreements and initiatives for lasting future options (ID19), other compensation measurements (ID22), and actions related to system of monitoring and follow–up (ID23).

The first took into account institutional policies and measures, while the second focused on initiatives proposed by companies beyond legal requirements. The last concerned activities related to monitoring and follow–up for enhancing transparency and accessibility to information. These indicators were valued by summing the number of actions and/or measurements, and, as well as for all the others, corresponding criteria were not weighted. However, given that the main scope of the analysis was testing the feasibility of the equity approach proposed, values hypothesized for all indicators provided broadly estimations of equity criteria, which helped to understanding general trends and to recognize opportunity and risk of different scenarios at strategic level.

To enable the subsequent analysis and scoring, a linear arithmetic normalization procedure was employed using maximum values of the metrics. Value functions were applied to convert scores to a common value range (0-1). Criteria and related indicators 1, 3, 5, 6, 8, 9, 12, 17, 19, 20, 21, 22, 23 were assumed as benefits, while criteria and related indicators 2, 4, 7, 10, 11, 13, 14, 15, 16, 18 were assumed as costs. The following are the formulas of the maximum functions for benefits *(b)* and costs *(c)*: $(b) = \frac{\text{raw score}}{\text{maximum score}}$; $(c) = 1 - \frac{\text{raw score}}{\text{maximum score}}$.

Table from 7.4 to 7.7 show the decision matrixes resulted from the examination of the storylines against the equity criteria and related indicators considered. There are displayed raw and corresponding normalized (norm.) values.

Tab. 7.4 – Decision matrix: Scenario A scores for short and medium-long term.

A	SITE				DISTRICT				REGION			
ID	Short term		Medium/Long term		Short term		Medium/Long term		Short term		Medium/Long term	
	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.
1	380	1,00	249	0,66	1329	1,00	871	0,66	2215	1,00	1453	0,66
2	54	0,94	865	0,00	76	0,93	1107	0,00	76	0,93	1107	0,00
3	13,4	1,00	10,9	0,81	13,4	1,00	10,9	0,81	13,4	1,00	10,9	0,81
4	977.986	0,93	14.235.666	0,00	977.986	0,93	14.235.666	0,00	977.986	0,93	14.235.666	0,00
5	6,18	1,00	5,35	0,87	9,16	1,00	7,92	0,86	9,16	1,00	7,92	0,86
6	1,88	1,00	1,34	0,71	2,11	1,00	1,39	0,66	2,11	1,00	1,39	0,66
7	1,46	0,00	1,19	0,18	1,49	0,00	1,03	0,31	1,41	0,00	0,87	0,38
8	29,0	0,06	463,7	1,00	48,2	0,07	700,5	1,00	324,7	0,07	4725,0	1,00
9	3,2	0,07	46,2	1,00	7,9	0,07	114,4	1,00	62,2	0,07	905,3	1,00
10	0,27	0,02	0,27	0,00	0,17	0,00	0,17	0,00	0,04	0,00	0,04	0,00
11	60	0,00	0	1,00	49	0,14	31	0,46	33	0,06	27	0,23
12	0,76	0,42	0,80	0,45	1,58	0,42	1,66	0,45	14,43	0,42	15,15	0,44
13	0,34	0,00	0,34	0,00	0,34	0,00	0,33	0,03	0,34	0,00	0,33	0,03
14	1.068.767	0,94	17.100.270	0,00	1.502.721	0,93	21.873.760	0,00	1.502.721	0,93	21.873.760	0,00
15	38,34	0,00	38,34	0,00	12,36	0,00	12,36	0,00	2,90	0,00	2,90	0,00
16	77,02	0,00	77,02	0,00	32,01	0,00	32,01	0,00	10,00	0,00	10,00	0,00
17	1,02	0,97	0,74	0,70	3,54	0,97	2,55	0,70	7,52	0,91	8,29	1,00
18	0,15	0,00	0,15	0,00	0,05	0,29	0,07	0,00	0,01	0,50	0,02	0,00
19	0,4	1,00	0,4	1,00	0,4	1,00	0,4	1,00	0,4	1,00	0,4	1,00
20	138,7	0,99	139,7	1,00	117,2	0,97	117,3	0,97	135,8	1,00	135,8	1,00
21	10,6	0,12	85,4	1,00	13,1	0,14	96,2	1,00	24,1	0,13	188,6	1,00
22	0	0,00	0,8	1,00	0	0,00	0,8	1,00	0	0,00	0,4	1,00
23	0,2	1,00	0,2	1,00	0,4	1,00	0,2	0,50	0,4	1,00	0,2	0,50

Tab. 7.5 – Decision matrix: Scenario B scores for short and medium-long term.

B	SITE				DISTRICT				REGION			
ID	Short term		Medium/Long term		Short term		Medium/Long term		Short term		Medium/Long term	
	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.
1	380	1,00	152	0,40	1329	1,00	533	0,40	2215	1,00	888	0,40
2	54	0,94	972	0,00	76	0,94	1323	0,00	76	0,94	1323	0,00
3	13,4	1,00	10,5	0,78	13,4	1,00	10,5	0,78	13,4	1,00	10,5	0,78
4	977.986	0,95	18.430.353	0,00	977.986	0,95	18.430.353	0,00	977.986	0,95	18.430.353	0,00
5	6,18	0,92	6,69	1,00	9,16	0,63	14,64	1,00	9,16	0,63	14,64	1,00
6	1,88	1,00	1,67	0,89	2,11	1,00	2,01	0,95	2,11	1,00	2,01	0,95
7	1,46	0,12	1,65	0,00	1,49	0,00	1,33	0,11	1,41	0,00	0,85	0,40
8	29,0	0,06	520,8	1,00	48,2	0,06	838,2	1,00	324,7	0,06	5648,9	1,00
9	4,5	0,08	55,3	1,00	11,2	0,08	136,7	1,00	88,9	0,08	1082,2	1,00
10	0,27	0,00	0,27	0,00	0,19	0,06	0,20	0,00	0,05	0,00	0,05	0,00
11	60	0,00	60	0,00	49	0,14	49	0,14	33	0,06	33	0,06
12	0,76	0,42	0,56	0,31	1,58	0,42	1,16	0,31	14,43	0,42	10,62	0,31
13	0,34	0,06	0,36	0,00	0,34	0,00	0,31	0,09	0,34	0,00	0,31	0,09
14	1.068.767	0,94	19.206.064	0,00	1.502.721	0,94	26.149.323	0,00	1.502.721	0,94	26.149.323	0,00
15	38,34	0,12	43,40	0,00	12,36	0,12	14,10	0,00	2,90	0,12	3,31	0,00
16	77,02	0,12	87,26	0,00	32,01	0,12	36,55	0,00	10,00	0,12	11,41	0,00
17	1,02	0,97	0,42	0,40	3,54	0,97	1,46	0,40	7,52	0,94	8,03	1,00
18	0,15	0,17	0,18	0,00	0,05	0,38	0,08	0,00	0,01	0,50	0,02	0,00
19	0,4	1,00	0,4	1,00	0,4	1,00	0,4	1,00	0,4	1,00	0,4	1,00
20	138,70	1,00	132,9	0,96	117,2	0,97	111,9	0,93	135,8	1,00	129,8	0,96
21	10,60	0,12	85,4	1,00	13,1	0,14	96,2	1,00	24,1	0,13	188,6	1,00
22	0	0,00	1	1,00	0	0,00	1	1,00	0	0,00	0,6	1,00
23	0,2	1,00	0,2	1,00	0,2	1,00	0,2	1,00	0,2	1,00	0,2	1,00

Tab. 7.6 – Decision matrix: Scenario D scores for short and medium-long term.

D	SITE				DISTRICT				REGION			
ID	Short term		Medium/Long term		Short term		Medium/Long term		Short term		Medium/Long term	
	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.
1	127	1,00	127	1,00	445	1,00	445	1,00	741	1,00	741	1,00
2	39	0,94	624	0,00	39	0,94	624	0,00	39	0,94	624	0,00
3	13,4	1,00	11,4	0,85	13,4	1,00	11,4	0,85	13,4	1,00	11,4	0,85
4	501.638	0,94	8.026.208	0,00	501.638	0,94	8.026.208	0,00	501.638	0,94	8.026.208	0,00
5	4,78	1,00	4,14	0,87	4,78	1,00	4,14	0,87	4,78	1,00	4,14	0,87
6	1,52	1,00	1,08	0,71	1,52	1,00	1,08	0,71	1,52	1,00	1,08	0,71
7	1,46	0,00	0,87	0,40	1,49	0,00	0,92	0,38	1,41	0,00	0,9	0,36
8	20,9	0,06	334,5	1,00	24,6	0,06	393,5	1,00	166,49	0,06	2663,9	1,00
9	1,6	0,06	26,1	1,00	4,0	0,06	64,5	1,00	31,9	0,06	510,4	1,00
10	0,27	0,00	0,27	0,00	0,13	0,00	0,13	0,00	0,03	0,00	0,03	0,00
11	60	0,00	0	1,00	57	0,00	0	1,00	35	0,00	0	1,00
12	1,79	0,98	1,82	1,00	3,72	0,94	3,94	1,00	34,11	0,99	34,49	1,00
13	0,34	0,00	0,34	0,00	0,34	0,00	0,34	0,00	0,34	0,00	0,34	0,00
14	770.790	0,94	12.332.640	0,00	770.790	0,94	12.332.640	0,00	770.790	0,94	12.332.640	0,00
15	38,34	0,00	38,34	0,00	9,67	0,00	9,67	0,00	2,27	0,00	2,27	0,00
16	77,02	0,00	77,02	0,00	25,06	0,00	25,06	0,00	7,83	0,00	7,83	0,00
17	1,05	0,83	1,26	1,00	3,65	0,83	4,38	1,00	7,54	0,83	9,05	1,00
18	0,15	0,00	0,15	0,00	0,04	0,00	0,04	0,00	0,01	0,00	0,01	0,00
19	0	0,00	0,2	1,00	0	0,00	0,2	1,00	0	0,00	0,2	1,00
20	137,5	1,00	126,1	0,92	120,9	1,00	110,9	0,92	134,1	1,00	123,0	0,92
21	5,00	0,06	80,00	1,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0,2	1,00	0,2	1,00	0,2	1,00	0,2	1,00	0,2	1,00	0,2	1,00

Tab. 7.7 – Scenario C scores for short and medium-long term.

C	SITE				DISTRICT				REGION			
ID	Short term		Medium/Long term		Short term		Medium/Long term		Short term		Medium/Long term	
	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.	raw	norm.
1	371	1,00	205	0,55	1298	1,00	719	0,55	2162	1,00	1198	0,55
2	39	0,94	624	0,00	61	0,93	866	0,00	61	0,93	866	0,00
3	13,4	1,00	11,4	0,85	13,4	1,00	11,4	0,85	13,4	1,00	11,4	0,85
4	784.059	0,93	11.132.844	0,00	784.059	0,93	11.132.844	0,00	784.059	0,93	11.132.844	0,00
5	4,78	1,00	4,14	0,87	7,75	1,00	6,71	0,87	7,75	1,00	6,71	0,87
6	1,52	1,00	1,08	0,71	1,75	1,00	1,39	0,79	1,75	1,00	1,39	0,79
7	1,46	0,00	0,70	0,52	1,49	0,00	0,71	0,52	1,41	0,00	0,90	0,36
8	20,9	0,06	334,5	1,00	38,7	0,07	548,2	1,00	260,3	0,07	3695,0	1,00
9	2,5	0,07	36,1	1,00	6,3	0,07	89,5	1,00	49,9	0,07	708,0	1,00
10	0,27	0,00	0,27	0,00	0,17	0,00	0,17	0,00	0,04	0,00	0,04	0,00
11	60	0,00	0	1,00	49	0,14	0	1,00	33	0,06	0	1,00
12	0,95	0,53	0,99	0,55	1,97	0,53	2,06	0,55	18,05	0,53	18,81	0,55
13	0,34	0,00	0,34	0,00	0,34	0,00	0,33	0,03	0,34	0,00	0,33	0,03
14	770.790	0,94	12.332.640	0,00	1.204.744	0,93	17.106.130	0,00	1.204.744	0,93	17.106.130	0,00
15	38,34	0,00	38,34	0,00	9,67	0,22	12,36	0,00	2,27	0,22	2,90	0,00
16	77,02	0,00	77,02	0,00	25,06	0,22	32,01	0,00	7,83	0,22	10,00	0,00
17	1,05	0,91	1,16	1,00	3,65	0,91	4,01	1,00	7,54	0,81	9,30	1,00
18	0,15	0,00	0,15	0,00	0,05	0,29	0,07	0,00	0,01	0,50	0,02	0,00
19	0,2	0,33	0,6	1,00	0,2	0,33	0,6	1,00	0,2	0,50	0,4	1,00
20	138,9	1,00	120,8	0,87	117,3	0,97	102,2	0,85	136,2	1,00	118,3	0,87
21	5,2	0,06	85,4	1,00	6,3	0,07	96,2	1,00	9,8	0,05	188,6	1,00
22	0	0,00	0,2	1,00	0	0,00	0,6	1,00	0	0,00	0,2	1,00
23	0,4	1,00	0,4	1,00	0,6	1,00	0,4	0,67	0,6	1,00	0,4	0,67

7.4 Comparing scenarios

In order to compare the four scenarios against the equity criteria through the corresponding indicators listed in Tables from 7.4 to 7.7, two aggregations of normalized measures were undertaken for each scenario at the diverse geographical and temporal scales. The first was based on the aggregation of all indicators. Thus, according to the linear normalization, the sum of the 23 indicators ranges from 0 to 23. In addition, the second data elaboration focused

on the aggregation of indicators broken down for the four equity perspectives. Thus, for *opportunity*, *distributional fairness*, and *distributional fairness across generation* perspectives, each of which presents 6 indicators, the sum of corresponding equity scores ranges from 0 to 6; while for the perspective justice for an imperfect world, which presents 5 indicators, the sum of corresponding equity scores ranges from 0 to 5. In spite of typical multi-criteria assessment procedures, it is important to note that relative weights were not assigned to equity criteria in this case. This choice was due to the fact that the case study application was essentially direct to have a first evaluation of the equity criteria approach proposed without going in depth of criteria comparison and prioritisation, which require a further step of investigation.

Figures 7.1, 7.2, and 7.3 display the results at the three spatial scales chosen (*Site, District and Region)*, broken down by total aggregation of equity scores and by time. It is possible to notice that trends for scenario C and B are quite similar at site level, while scenario C performs better than the others in the long run at District and Region scale.

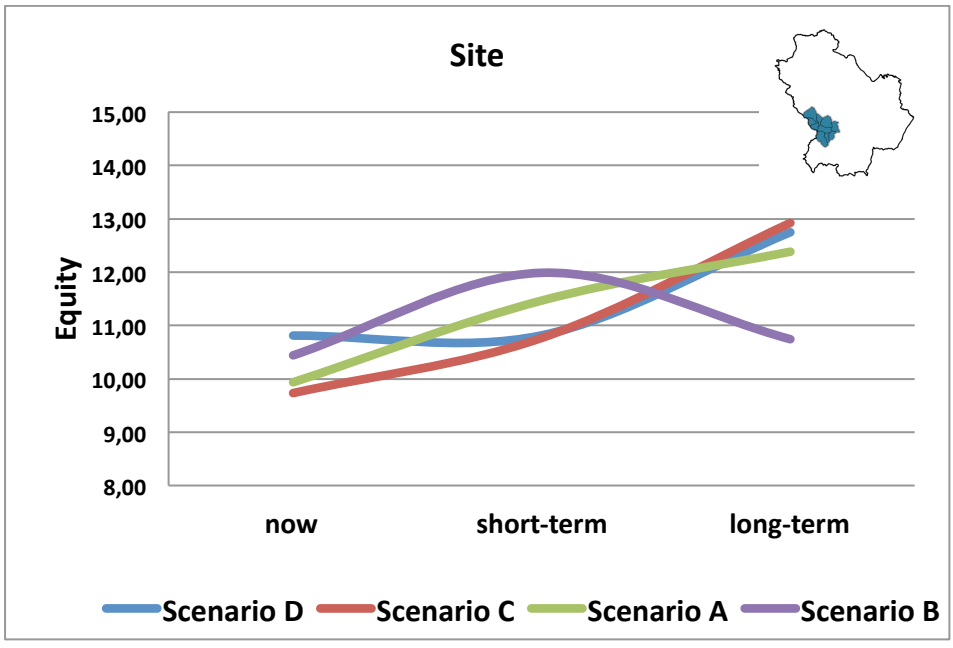

Fig. 7.1 – Scenario aggregated equity scores at Site scale.

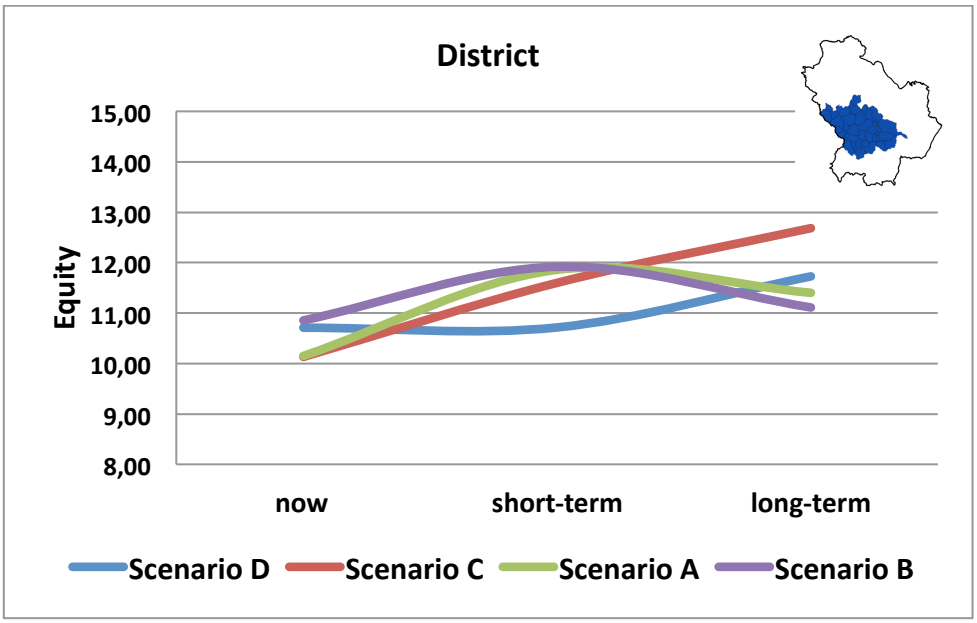

Fig. 7.2 – Scenario aggregated equity scores at District scale.

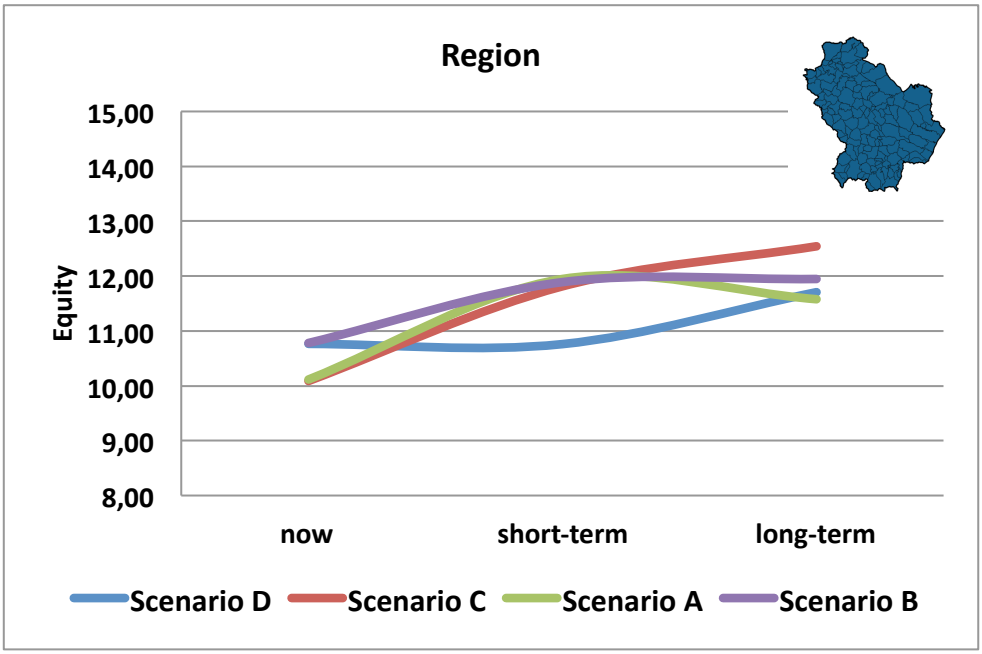

Fig. 7.3 – Scenarios aggregated equity scores at Region scale.

Figures 7.4, 7.5, and 7.6 display that, even if with different degree of equity scores, moving from short to medium-long term at any level, there is an increase of aggregated equity score for scenarios D and C, while a decrease for scenario B. Whereas it is apparent that Scenario A and B perform differently at the different geographical scales.

For Scenario A there is an increase of aggregated equity score in the lung run, while a decrease at District and Regional level. Scenario B performs quite similar at Region level, while shows a decrease in aggregated equity score at district and site level. Scenario B was by far the most negative regarding meeting equity criteria in the log-run for all the geographical scales.

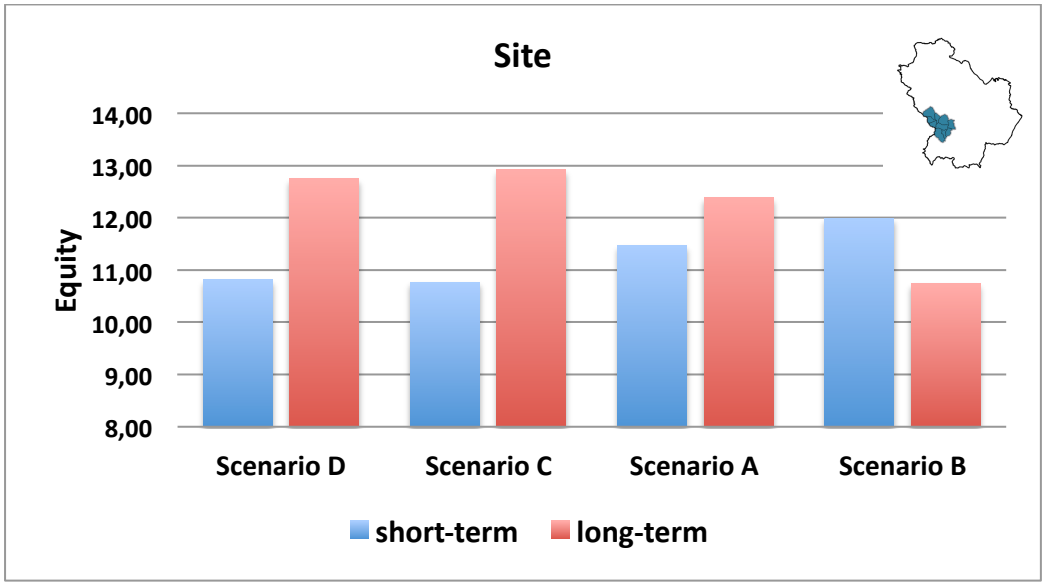

Fig. 7.4 – Scenario performances over time at Site scale.

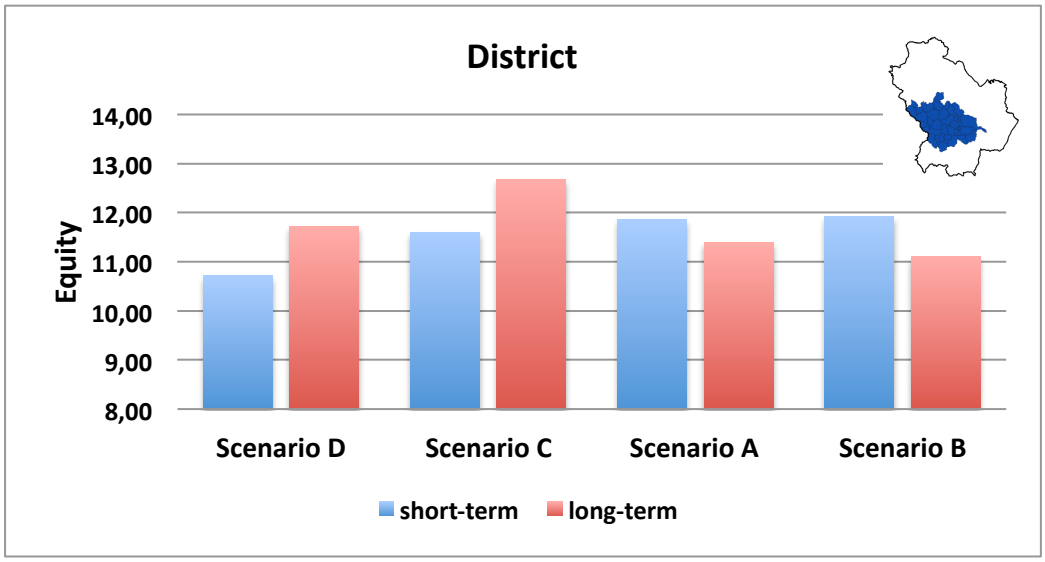

Fig. 7.5 – Scenario performances over time at District scale.

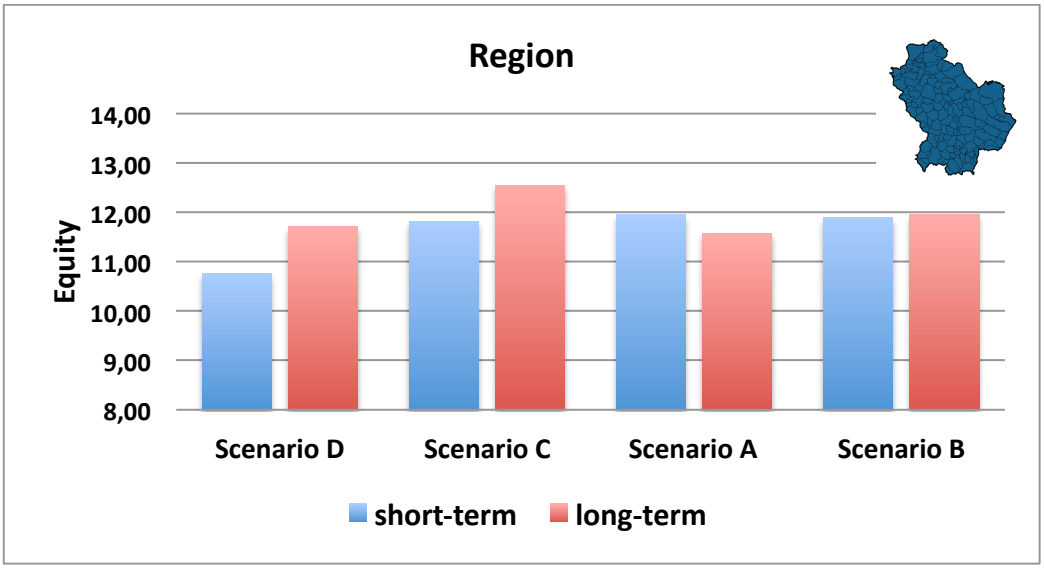

Fig. 7.6 – Scenario performances over time at Region scale.

Subsequently, the analysis was concentrated on the results broken down for the four equity perspectives considered. The empirically-based values are deployed with the help of spider models. In a spider model, scores on each factor chosen are mapped out on an axis starting from the interior towards the outer boundary of the spider, in which the lowest scores are to be found in the centre of the spider (Baycan-Levent et al., 2007).

This tool was useful for capturing strengths and weakness of different scenarios for the four equity perspectives selected. For each perspective the values displayed represent the sum of corresponding indicators' scores. Figure 7.7 compares the spider models' results broken down by temporal and geographical scale.

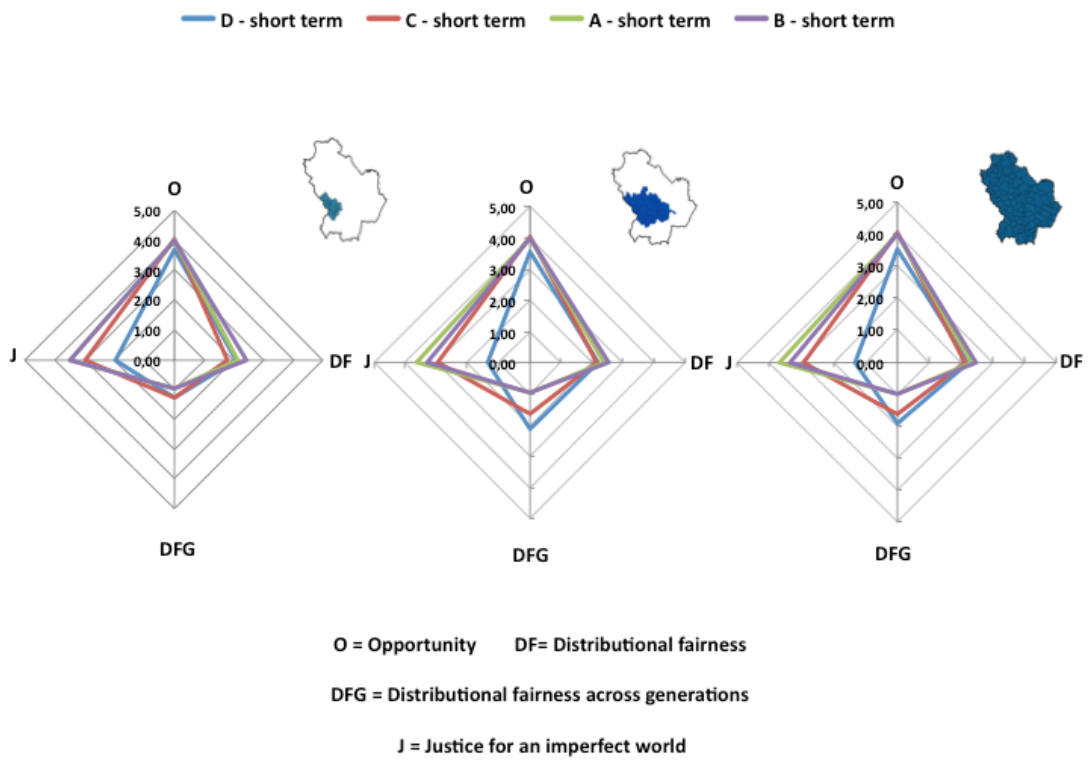

Fig. 7.7 – Equity perspectives comparison at short term scenarios.

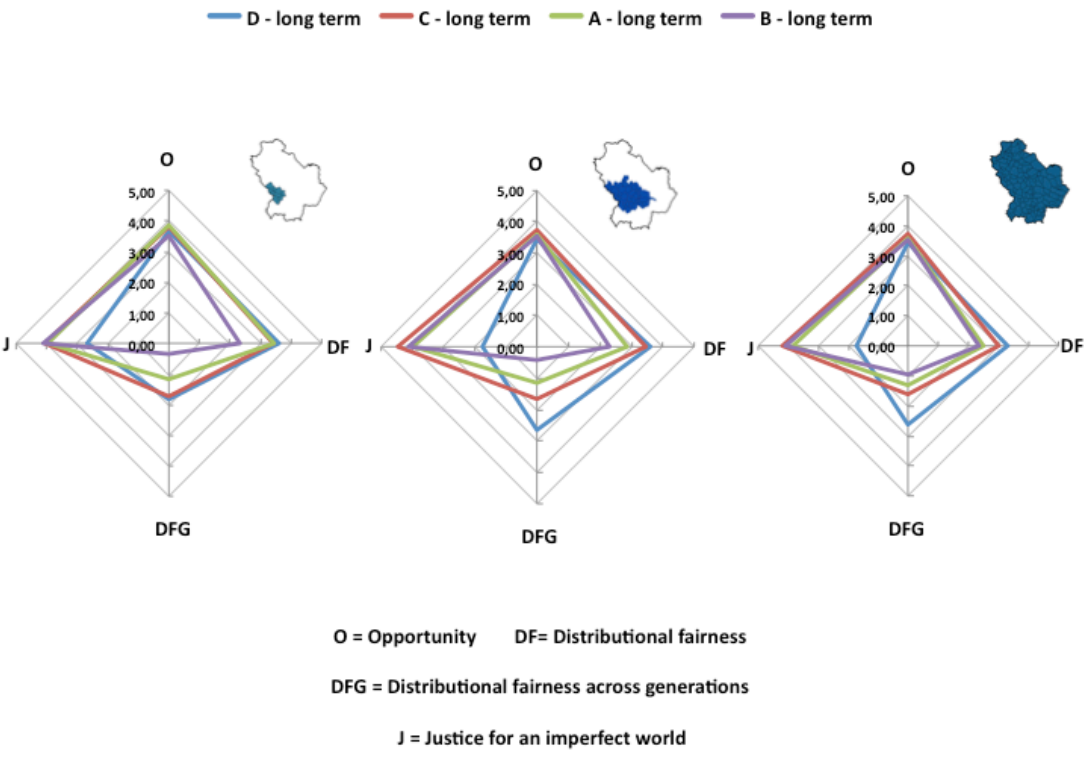

Fig. 7.8 – Equity perspectives comparison at medium-long term scenarios.

Opportunity

In term of *Opportunity* it is possible to notice similar performances across scenarios for short-term as well as for medium-long term. In general there is a slight decrease in total scores moving from short to medium-long term.

Distributional fairness

More evident changes in equity score are registered moving from short to medium-long-term under the *distributional fairness* perspective. In general scenarios C, D provide increase in scores in the long-run at each geographical scale, while scenario B produces decrease.

Distributional fairness across generation

In the long-term Scenario D offers more positive lasting effects in term of *Distributional fairness across generation*, especially at District and Region level. At site scale, the *Distributional fairness across generation* total score is lower than at the other two levels, and scenarios C and D performed similarly under this perspective. Both district and site levels present very low scores in the case of Scenario B.

Justice for an imperfect world

Scenarios A, B and C in the short as well as in medium-long run perform quite similarly under the *Justice for an imperfect world* perspective. In fact it is apparent that there is also a contextual quite increase in equity scores for the tree scenarios. On the contrary, Scenario D performs quite worse on the others over space and time.

7.5 Discussion and conclusion

None of the scenarios provides “the best solution” in term of aggregated equity scores or perfect win-win solutions for each equity perspective. But it is interesting to note that this approach helps to make more explicit different trade-offs between equity objectives. For instance, considering the aggregated equity with respect to time dimension, in general the hypothesized developmental decisions would favour an increase in equity in the short future. But having a more long-lasting perspective, scenarios show more clearly differences.

Scenario B displays an increasingly burden of negative impacts not adequately compensated by benefits from strong Oil & Gas development, which is more intense at site level. Thus, Scenario B is the worst in the long-term. Moreover, Scenario A helps to capture a trade-off between geographical scales. Scenario A shows an inverted trend for site level in comparison to district and regional level. In fact, positive increases of aggregated equity scores are ensured at site level only.

A possible explanation of this is the fact that at site level Scenario A combines a more direct control from local authorities of Oil & Gas economic benefits and compensation measurements with a limited increase in exploitations compared to the current situation. Whereas at district and regional level the accumulated amount of environmental burdens in the long run overcomes the potential social and economic benefits.

In addition, with respect to this point, it is essential to explore how Scenario A performs in relation to the single four equity perspectives. Thus, it is possible notice that what makes the difference between site and district and regional levels is the distributional fairness perspective rather than the others. In particular, Scenario A at site level provides a higher equity score in term of direct and tangible benefits on local population.

These results helped to identify opportunity and risk of different scenarios at strategic level. A first point of attention regards the comparative analysis of Scenario B in the long-term at the different space scales. Despite that it runs strong Oil & Gas development, none of the levels seems to acquire significant increase in equity benefits, not even one at expenses of each other. According to the assumptions shaped, this might suggest that incremental benefits are concentrated outside the three level considered.

A second observation concerns the equity trade-offs between Scenario B and D. While it is quite obvious to explain the trade-offs between *distributional fairness across generations* and *justice for an imperfect world* thinking that scenario D is more conservative and precautionary performing better in regard to access to natural resource for future generations, whereas Scenario B makes a greater reliance on compensatory tools, more insights are provided by comparing *distributional fairness* scores between the two scenarios.

It emerges that Scenario D always offers appreciably higher scores more comparable with the scores of scenarios A and C.

The comparative analysis reveals that Scenario D offers little contribution in term of pace and scale of development compared to Scenario B, but gives more equity contributions to distributional fairness between and across generations. Thus, it could be an important warning for decision makers. It confutes the quite dismissive assertion that strong Oil & Gas development would favour present generation and ensure at least weak sustainability counterweighed with compensation measurements and substitution of natural capital in the long term.

On the contrary, it is a matter of political decisions to adopt a stronger environmental agenda, which will favour distributional fairness between and across generation without relying on a relevant support of *justice for an imperfect world* criteria, that potentially will affect absolute results. Third; the analysis indicates that Scenario C seems to rebalance better equity concerns at the different geographical scales. This analysis supports the idea that assuming decisions involved institutions at different levels and approaching to decision with more attention to a sustainable management of the environment might help in achieving more wide-spread and long-term positive results. It also seems to confirm the role that shared and reflective environmental governance should play in integrating the overall political economy of natural resource with the socio-economic and environmental values in which local people recognize themselves.

However, other points of reflections need to be stressed with regard to case study methodological aspects. It is important to note that proposed scenarios presented possible significant trends in equity criteria, which were affected by restraints in data collected and indicators adopted, as well as, simplifications in analysis. Thus, it is therefore significant to highlight that several elaborations, such as estimations of emissions, water consumptions etc., were made purely proportionally to oil equivalent barrels extracted (e.g. without considering changing of hydrocarbons characteristics along time and between the two fields; differences or changing in technologies).

Moreover, available data, which were reported to the Val d'Agri Oil field, were purely used as a base for Tempa Rossa estimations as well. However, information gathered about potential development of the two fields helped to orient hypotheses, and imagine increase in and location of new wells. With respect to economic data, elaborations gave rough esteems of

potential improvements in income and variations in expenses (e.g. without accounting for revaluations, inflations and other macroeconomic aspects).

It is important to underline that in this exercise it was assumed that all equity criteria within each temporal dimension receive equal weights and that all three geographical levels were equally weighted too. In this regard, further specific reflexions and considerations are required for determining the relative weights of criteria using, for example, the method of pairwise comparisons. This mathematical approach allows determining relative weights of criteria by dividing the multi-criteria assessment into a set of one-on-one judgements concerning the significance of each criterion relative to the others.

In depth criteria analysis will be fundamental for understanding a preference order on the criteria and to determine the redundant and less important criteria in terms of discriminating power on the alternatives (Ozelkan and Duckstein, 1996).

Moreover, it should be therefore essential to combine relative sensitive analysis for assessing of the uncertainties in the analysis process. By acknowledging subjective nature related, for example, to the selection of indicators, or if any weights attached to the indicators, sensitivity analysis can determine whether the main results of a ranking system change substantially when those assumptions are varied over a reasonable range of possibilities (e.g. Munda and Saisana, 2011; Geneletti, 2007). The validity of the equity approach developed in this case study should be assessed by starting to study its sensitivity to the main source of uncertainty related to the number of indicators in the data set.

Chapter 8

Conclusions

This study was driven by three main objectives:

- to verify the degree of considerations of sustainability issues in current practice, focusing on SEA experiences of spatial planning and Oil & Gas development;
- to identify criteria and indicators to measure intra- and inter-generational equity, against which present state and future trends could be assessed;
- to test the applicability of the proposed methods to a case study, dealing with complex decisions at strategic level. The selected case study deals with Oil & Gas development in ecologically sensitive and biodiversity rich areas.

In this chapter, I will recapitulated the main findings of the research, grouped by the three specific objectives, and discussed strengths and weaknesses regarding the theoretical equity framework and the case-study application proposing some recommendations for future research.

8.1 Summary of main findings

Sustainability issues in current practice

In Chapter 2, a framework structured in 71 sustainability questions was developed, and applied to review the Environmental Report of the urban plans of 15 major Italian cities. The review showed that most of the attention was given to mitigation and compensation measures, rather than to actual attempts to propose more sustainable planning decisions in the first place. Moreover, the examination of the proposed framework put in evidence the need of flashing out equity concerns, as well as, of identifying suitable indicators for operationalizing the concepts of intra- and inter-generational equity in decision-making.

In Chapter 4, it was developed a framework for reviewing SEA practice structured into nine assessment parameters (object of assessment, entry point, interactivity, scope of assessment, strategic reference framework, process, participation, findings/outcomes, proposal for follow-up), and corresponding key questions. This framework was used to review 11 case studies related to both off-shore and on-shore Oil & Gas developments existing worldwide. This review provided evidences that crucial aspects are: stakeholders involvement from early stage of the procedures; identification of key environmental, social and economic factors; analysis of cumulative and synergistic effects in the long-run; fact-based provisions and recommendations for more integrated mitigation and monitoring management strategies for follow up. However, more efforts need to be made for enhancing and increasing the adoption of these best practices in current SEA processes.

In Chapter 5, it was examined to what extent these 11 case studies address sustainability concerns by referring to a holistic sustainability-oriented SEA approach based on the identification of "*critical decision factors*", which aim to ensure a strong focus on success aspects and dynamics of a strategic decision, rather than a vague notion on effects over a large sustainability broadband. Four key CDFs were proposed for the Oil & Gas sector, namely *Heritage Values, Community Benefits, Timescale*, and Governance. The review confirmed that aspects related to the selected four CDFs represent common requisites for SEA practice in the Oil & Gas sector, even where SEA cases may reveal different degrees of integration. Suitable recommendations in view of enhancing potential strategic contributions of SEA towards more sustainable outcomes were drawn up, in terms of protection of natural, social and cultural values, contribution to local development, management of uncertainty and improved decision-making processes.

It is interesting to notice that even if the practice, which was reviewed in urban planning and Oil & Gas sector, concerned different levels of strategic actions and a composite variety of contexts, they showed similar gaps in terms of intra- and inter-generational equity. Critical aspects mostly disregarded were distributional analysis of implications of decisions for different groups and communities, taking into consideration competing values and interests, as well as, assessment of alternatives that might enhance mutual benefits in the long run rather than mitigate negative impacts. However, it clearly emerged that sustainability issues are widespread recognized and several significant actions are already included in SEA

procedures towards sustainability. But, the key concern remains that these good actions should be reconsidered and interrelated each other more effectively according to a more organic and comprehensive scheme. Thus, the CDF approach apparently seemed as an effective step for answering this question.

Equity criteria construction

In Chapter 3, a conceptual framework for identifying the different implications related to the use of different values and perceptions on equity was framed. This framework identified the most accepted points of view on equity classifying them in the light of predominant sustainability conceptualizations. This framework helped in shedding light on the strongly nexus between equity and sustainability. In fact it was possible to derive a range of compatible equity perspectives along which to develop a set of equity criteria and general principles for strategic decisions.

Four equity perspectives were derived, namely, *opportunity, distributional fairness, distributional fairness across generations and justice for an imperfect world*. These four perspectives were recommended as compatible and intertwined angles for exploring the role played by the consideration of equity in distribution of the expected effects of decisions on present and future generations.

In addition, a set of general equity criteria was stemmed from these selected perspectives and suggested as metrics for measuring intra- and inter- generational equity in decision-making. The review of equity perspectives, as well as, of intra- and inter-generational equity conceptualizations allowed identifying a consistent range of general equity criteria that might be useful in centring assessment around crucial and integrative sustainability issues.

Case study application

In Chapters 6 and 7, the equity framework proposed in Chapter 3 was tested against the “Val d’Agri Oil fields” case study. The case study concerned the most promising Western-Europe on-shore oil fields located in Southern Italy, namely the “Val d’Agri Oil fields”. With the help of a scenario matrix, four plausible scenarios were constructed and corresponding storylines, related to key aspects drawn up from a theoretical and empirical analysis, were developed.

A range of 19 equity criteria and corresponding 23 indicators, adapted to data disposability, were designed for the case study. Indicators were therefore valued according to a quali-quantitative analysis that assisted in examining and comparing trade-off between human and environmental systems under the different scenarios. Comparisons were undertaken varying geographical scopes, ranging from the regional scale to two different local areas, surrounding the Oil & Gas activities (*Site and District*), and taking into consideration short and medium-long term scales. In spite of orthodox multi-criteria analysis procedures, it was assumed that all equity criteria within each temporal dimension received equal weights and that all three geographical levels were equally weighted too. According to the scope of testing the feasibility of the equity approach proposed, values hypothesized for all indicators provided broadly estimations of equity criteria, which helped to understanding general trends and to recognize opportunity and risk of different scenarios at strategic level.

The results showed that none of the scenarios provides "*the best solution*" in term of aggregated equity scores or perfect win-win solutions for each equity perspective. However, the analysis indicated that one scenario (C) seems to rebalance better equity concerns at the different geographical and temporal scales. This result supports the idea that assuming decisions involved institutions at different levels and approaching to decision with more attention to a sustainable management of the environment might help in achieving more wide-spread and long-term positive results. The results, broken down into the four perspectives, appeared to confuse that strong Oil & Gas development would favour present generation and ensure at least weak sustainability counterweighed with compensation measurements and substitution of natural capital in the long term.

8.2 Strengths and weaknesses of the theoretical framework

The proposed theoretical framework seeks to capture four central metrics of equity providing a means to make equity concerns more explicit in assessment. It represents a promising tool for improving equity consideration in decision-making. In fact, it provides a means of framing intra- and inter-generational equity in terms of equity implications potentially affecting generations at different temporal and territorial scale.

A key advantage of using this approach is that it makes possible to undertake assessment by taking into considerations conditions of inter- and intra-generational equity concurrently. This point is central in view of conceptualizing sustainability in term of equity. Another related positive implication is the possibility of incorporating sustainability concerns over time and space more effectively. In fact, the differentiation between the four equity perspectives offers a diverse key for reading how decisions might alternatively affect crucial and multiscaled components of sustainability. Moreover, it is possible to underline other two significant procedural and substantive aspects. Firstly, the equity framework implies a change of focus on sustainability concerns that overcomes the traditional subdivisions in economic, environmental and social spheres. Secondly, evaluating trade-offs among hypothetical scenarios using this approach promptly assists in flashing out which uses of the natural environment might generate more wide-spread and long-term benefits.

However, there are at least two closely critical aspects that need to be acknowledged. Firstly, although the equity perspectives considered in the approach are the most common and compatible each other, different points of view evidently exist. It is a matter of personal perceptions. With regard to impact assessment, equity concerns might be stated as how individuals and groups perceive the proportional availability of good and services or the relative deprivation compared with others (Halpern et al., 2013). It is clear that univocal and absolute answer is not possible. Nevertheless, having discussed and reached an agreement on perspectives to be adopted in assessment, the proposed equity framework might be useful for formalizing shared equity perspectives in decision-making by incorporating quantifiable and feasible related criteria.

A second interrelated aspect refers to the selection of equity criteria that might help in identifying indicators for making equity operable on the ground. Being aware of the vast interdisciplinary area that links concepts of sustainability and intra- and inter-generational equity, I made no claims to being comprehensive in translating the chosen equity perspectives into criteria. It is important to point out that this study lays some methodological foundations on how to address equity in strategic assessment, but they might be refined and enriched by other substantive insights. For instance, the most important area of further investigation is over how to establish suitable criteria for better covering social distributional implications across generations.

8.3 Strengths and weaknesses of the case study application

Combining sustainable criteria indicators, tailor-made for intra- and inter-generational equity issues, with scenario analysis, this study sought to develop and testing a methodology for comparing potential implications of different policy options over space and time. The application of the equity approach to the case study showed that dealing with equity in the context of sustainability is doable, even if shaping sustainability through the lens of equity presents several critical aspects.

The four equity perspectives and related criteria helped to identify and focus on opportunity and risk of different scenario options at strategic level. The approach to understanding benefits and trade-offs provided a simple yet flexible framework for quali-quantitatively assessing the implications of different potential futures. Firstly, the empirical analysis made possible to easily describe and visualize a picture of overall consequences of scenario options in term of aggregated equity score at the different geographical and temporal scales. Secondly, it enabled to compare trade-offs across the four equity perspectives appraised separately (e.g. Figure 7.7). Thirdly, it also helped to identify scenarios that favour more equitable solutions both in space and time over others. Moreover, although the constructed scenarios focused on assessing benefits and trade-offs at regional and local levels, this method may be applied to different spatial scales, if appropriate knowledge about key aspects (actors, factors and sectors), which may affect strategic actions, exists and is opportunely stated.

Nevertheless, it is not pointless to stress that the two main critical aspects about the theoretical framework underlined in Section 8.3, coexistence of different points of view on equity and possible need of considering other equity criteria, evidently constraint the results and the interpretation of implications potentially affecting generations at different temporal and territorial scale (local and regional). However, regarding the selection of equity criteria for translating the four equity perspectives into operational criteria and indicators for the case-study, I made efforts to anchor these perspectives to a restricted number of potential criteria of particular concern for the case study. Moreover, another limitation concerns the fact that, even if the case study focused on three geographical scales, it did not make distinction in distribution of equity within each level of analysis. Thus, this research was a first step in exploring distributive concerns resulting from developmental decisions by assessing consequences not simply in aggregate but trying to distinguish at least by macro-areas.

Clearly, there is room for improvement in a number of aspects that need to be added to those highlighted in Chapter 7. It is therefore important to critically evaluate the methodological approach employed for operationalized equity in relation to the use of indicators. There are important insights that deserve critical attention. Firstly, often indicators are not so neutral as they seem (Potschin, 2009). The answers that they offer in assisting decision-making might be influenced by considerations, priorities and expectations of those carrying out the analysis (Paracchini et al., 2011). Equally, such subjective limitations are recognised in making assessment by using scenarios (Helming and Pérez-soba, 2011). Thirdly, the assessment methodology can substantially benefit from the identifications of target and thresholds for the indicators.

Beyond providing a tool that aid in identifying equity trade-offs between scenarios, it is fundamental understanding the degree to which scenario outcomes should be considered acceptable. A consolidated way to tackle these issues could be to underpin the suggested approach by introducing extensive participatory processes between decision-makers, technicians and public. Thus, open deliberative comparisons could have the effects of underpinning reliability as well as effectiveness of the proposed method in supporting decision-making. However, an important aspect to be highlighted is that the review of equity perspectives allowed identifying suitable proxy indicators. Thus, although it is not argued completeness of the general statements about equity issues gathered from literature, they offered a room for manoeuvre in shaping indicators according to contexts as well as restraints in analysis. They helped in making more explicit the case specific equity issues and translating them into a feasible set of indicators.

8.4 Recommendations for future research

Although explained as having being carried out in well-defined consecutive stages, my research approach has rather been of an explorative nature, as learning from each stage partially changed my insights of what I had learnt and concluded in previous ones. As a consequence, my understanding of the topic of my research has progressively maturated, resulting in my views having partially expanded over time. I have deepened that models centred on equity could aid in evaluating the sustainability implications of decision-making

answering to the need to be integrative. According to my attempt, optimizing approaches for incorporate equity considerations in assessment should be highly beneficial for sustainability.

However, I am perfectly aware that my research is just a first effort in addressing the topic identified and offers several insights (reflections) for future research. The approach proposed need to be improved and refined in order to strengthen its robustness in addressing intra- and inter-generational equity issues in sustainability assessment. To do this, it would be important to formulate different scenarios that simulate more alternative and contrasting future storylines. It might help in revealing inconsistencies and conflicts in the adopted equity criteria, especially with regard to the comparison of trade-offs across the four equity perspectives. This should be of significance for verifying whether the method supports the identification of future options that seek to optimize benefits among multiscaled and potential more conflicting objectives. Thus, undertaking sustainability assessment through the lens of equity will be of proved assistance in "*maximizing multiple, mutually reinforcing, fairly distributed, adaptable and lasting contributions to sustainability while avoiding significant adverse effects"*.

Similarly, it would be worthwhile to compare results by zooming on other geographical scales around the study area. For example, investigating neighbouring areas outside the Region, which would potentially amplify questions related to possible unfair distributions of gains and loses, since these areas are excluded by direct economic benefits, but could be equally affected by negative consequences, such as environmental detriments and damages.

Another area for improvement refers to the inclusion of participatory processes into the model. Over the past decade, it has been strongly recognised that combining quantitative modelling with qualitative participatory tools could remarkably increase the validity of sustainability assessment tools. Specifically, It might be of crucial importance for bridging two substantial gaps emerged from this study: fine-tuning equity criteria and identifying target values for corresponding indicators. Firstly, participatory processes and stakeholder engagements can help in refining equity criteria, in particular fleshing out concerns related to social group equity (e.g. gender), which were excluded by this research for difficulties in addressing them by using desk research.

Secondly, it can be fundamental for identifying target values for indicators. Definitions of limits/thresholds, and their implications for strategic decisions have recently emerged as an important focus of debate in the sustainability issues. Sustainability limits are defined as the unacceptable damage of a pressure on a social, economic or environmental system based on current knowledge (Pérez-Soba et al., 2008). In order to value sustainability of strategic decisions according to the equity perspectives chosen, thresholds would provide a helpful way to associate a minimum level for the equity criteria under which solutions should be necessarily excluded by analysis.

Moreover, it is important to notice that using participatory approaches should be possible to consolidate the equity approach, since values and perceptions, along which base the definition of the set of equity criteria, would be legitimated by open comparison and assessment. For instance, by involving stakeholders and experts, it might be undertaken pairwise comparisons for determining the relative weights of each criterion, in order to take advantages from full potentiality of multi-criteria analysis. In fact, it should be essential to establish a preference order on the criteria and to determine the redundant and less important criteria in terms of discriminating power on the alternatives.

In this sense, the equity framework proposed might be a suitable tool for supporting and guiding this deliberative process. Similarly, suitable help could be expected from the simple spatial-temporal matrix framed through the lens of equity for analysing and discussing concurrently temporal and spatial implications of plausible future scenarios.

References

Agyeman J, Bullard R, Evans B. Exploring the Nexus: bringing together sustainability, environmental justice and equity. Space Policy 2002;6(1):77–90.

Agyeman J, Evans T. Toward just sustainability in urban communities: building equity rights with sustainable solutions. Ann Am Acad Pol Soc Sci 2003;590(1):35–53.

Albrechts L. Strategic (spatial) planning reexamined. Environ. Plan. 2004;31:743–58.

Alcamo J, Henrichs T. Towards guidelines for environmental scenario analysis. In Alcamo J, editor. Environmental Futures: The practice of environmental scenario analysis. Elsevier; 2008. Ch. 2, p. 13–35.

Alcamo J, Kok K, Busch G. Searching for the future of land: Scenarios from the local to global scale. Environmental Futures: The practice of environmental scenario analysis. Elsevier; 2008. Ch. 4, p. 67–103.

Anand S, Sen A. Human development and economic sustainability. World Development 2000;28(12):2029–2050.

Annoni P, Dijkstra L. EU Regional Competitiveness Index RCI 2013. Unit of Econometrics and Applied Statistics, DG JRC, Ispra; 2013. Available at: http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/6th_report/rci_2013_report_final.pdf

Annoni P, Kozovska K. EU Regional Competitiveness Index RCI 2010. European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen. Luxembourg: Publications Office of the European Union; 2010.

Arrow K, Daily G, Dasgupta P, Goulder L, Gretchen D, Ehrlich P, Heal G, et al. Are We Consuming Too Much? The Journal of Economic Perspectives 2004;18(3):147–172.

Bach H, Bakker M, Farrington J et al. Indicators – methodology and descriptions. In: Helming K, Wiggering H, editors, SENSOR Report Series 2008/7, Müncheberg (Germany): ZALF; 2009. Available at: http://www.sensor-ip.eu.

Bachtler J, Yuill, D. Policies and Strategies for Regional Development: A Shift in Paradigm? European Policies Research Centre University of Strathclyde Glasgow Regional and Industrial Policy Research Paper 46; 2001; p. 1–41. Available at: http://www.eprc.strath.ac.uk/eprc/Documents/PDF_files/R46PoliciesandStrategiesforRegionalDevelopment.pdf

Bäcklund AK. Impact assessment in the European Commission – a system with multiple objectives. Environ. Sci. Policy 2009;12(8):1077–87.

Banca d'Italia. Le Economie Regionali. L'economia della Basilicata. Numero n° 18. Banca d'Italia; 2013. Available at: http://www.bancaditalia.it.

Basiago A. Economic, social, and environmental sustainability in development theory and urban planning practice. The Environmentalist 1999;19:145–161.

Basso B, De Simone L, Ferrara A, Cammarano D, Cafiero G, Yeh M, et al. Analysis of Contributing Factors to Desertification and Mitigation Measures in Basilicata Region. Ital. J. Agron. / Riv. Agron 2010; 3 Suppl.:33–44.

Baycan-Levent T, Bruinsma F, Nijkamp P. Urban spiders: A comparative framework for evaluation and scenario analysis. In Curwell SR, Deakin M, Symes M, editors, Sustainable Urban Development: The environmental assessment methods, New York: Routledge; 2007.

Beanlands GE, Duinker PN. An ecological framework for environmental impact assessment in Canada. Institute for Resource and Environmental Studies, Dalhousie University, Halifax and Federal Environmental Assessment Review Office, Hull, Quebec, Canada; 1983.

Beder S. Costing the Earth: Equity, Sustainable Development and Environmental Economics. New Zealand Journal of Environmental Law 2000;4:227–243.

Berkes F. Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. Natural Hazards 2007;41(2):283–295.

Bina O, Wallington T, Thissen W. SEA theory and research: an analysis of the early discourse. In: Sadler B, Aschemann R, Dusik J, Fischer TB, Partidário MR, Verheem R, editors. Handbook of strategic environmental assessment. London: Earthscan; 2011. p. 445–71.

Blamey RS, Commin MS. Valuation and ethics inenvironmental economics. In Bergh JCJM van den, editor. Handbook of Environmental and Resource Economics; 1999. Ch. 56.

Bond A, Morrison-Saunders A, Pope J. Sustainability assessment: the state of the art. Impact Assessment and Project Appraisal 2012;30(1):53–62.

Bond A, Morrison-Saunders A. Re-evaluating sustainability assessment: aligning the vision and the practice. Environ Impact Assess Rev 2011;31(1):1–7.

Boone CG. Environmental justice, sustainability and vulnerability. International Journal of Urban Sustainable Development 2010;2(1-2):135–140.

Börjeson L, Höjer M, Dreborg KH, Ekvall T, Finnveden G. Scenario types and techniques: Towards a user's guide. Futures 2006;38:723–739.

Boschma R, Crescenzi R, Esteves AM, Huber W, Percoco M, de Propris L, Thiene, M. Towards an Operational Regional Development Program Basilicata Region 2014-2020. Capacity Lab Pilot Project, Final report january 2013. Available at: http://www.pofesr.basilicata.it/11287.

Bragagnolo C, Geneletti D, Fischer TB. Cumulative effects in SEA of spatial plans—evidence from Italy and England. Impact Assess Proj Apprais 2012;30(2):100–10.

Bramley G, Dempsey N, Power S, Brown C. What is 'Social Sustainability' and How do our Existing Urban Forms Perform in Nurturing it? Paper presented at the 'Sustainable Communities and Green Futures' Conference, Bartlett School of Planning, University College London, London; 2006.

Brandon P, Lombardi P. Evaluating Sustainable Development in the Built Environment. John Wiley and Sons; 2010.

Brigthon & Hove City Council. Sustainability Appraisal of the Core Strategy. Brigthon & Hove City Council's Local Development Framework. Brigthon & Hove City Council; 2010.

Canada-Newfoundland Offshore Petroleum Board (prepared for). Strategic Environmental Assessment Laurentian Subbasin. Prepared by Jacques Whitford Environment Limited; 2003.

CCME (Canadian Council of Ministers of the Environment). Regional Strategic Environmental Assessment in Canada: Principles and Guidance. Winnipeg, MB: Canadian Council of Ministers of the Environment; 2009.

CEC (Commission of the European Communities). The EU Compendium of Spatial Planning Systems and Policies Commission of the European Communities, Luxembourg: Office for the Official Publications of the European Communities; 1997.

Chapin FS, Carpenter SR, Kofinas GP, Folke C, Abel N, Clark WC, et al. Ecosystem stewardship: sustainability strategies for a rapidly changing planet. Trends Ecol. Evol. 2010;25(4):241–9. Available at: http://www.ncbi.nlm.nih.gov/pubmed/19923035.

Chichilnisky G. What is sustainable development. Land Economics 1997;73(4):467–491.

Christen M, Schmidt S. A Formal Framework for Conceptions of Sustainability – a Theoretical Contribution to the Discourse in Sustainable Development. Sustainable Development 2011;19:n/a.

Clark WC (adapted by). Sustainable Development and Sustainability Science. In Clark WC and Levin SA. Toward a Science of Sustainability. Report from Toward a Science of Sustainability Conference Airlie Center. Warrenton, Virginia November 29, 2009 – December 2, 2009; 2010: p.80-100. Available at http://www.nsf.gov/mps/dms/documents/SustainabilityWorkshopReport.pdf.

Clarke AH. Understanding sustainable development in the context of other emergent environmental perspectives. Policy Sci 2002;35(1):69–90.

Colantonio A, Lane G. Measuring Social Sustainability: Best Practice from Urban Renewal in the EU 2007. EIBURS Working Paper Series. Renewal 2009;1–37.

Connelly S, Richardson T. Value-driven SEA: time for an environmental justice perspective? Environ Impact Assess Rev 2005;25(4):391–409.

Corte Costituzionale. Sentence n° 117 of June 3, 2013. Unconstitutionality of the Basilicata Regional Law n° 16 of August 8, 2012. Article 37.

Costanza R, Daly HE. Natural capital and sustainable development. Conserv. Biol. 1992;6:37–46.

Costanza R, Fisher B, Ali S, Beer B et al. Quality of life: an approach integrating opportunities, human needs, and subjective well-being. Ecological Economics 2007;61(2–3):267–276.

Costanza R. The Value of Natural and Social Capital in Our Current Full World and in a Sustainable and Desirable Future. In Weinstein MP and Turner RE, editors. Sustainability Science: The Emerging Paradigm and the Urban Environment. New York: Springer Science+Business Media, LLC; 2012; p. 99-110.

Cutter S. Race, class and environmetal justice. Progress in Human Geography 1995;19(1):111–122.

Dalal-Clayton B, Sadler B. Strategic environmental assessment: a sourcebook and reference guide to international experience. Trowbridge, UK, London: Earthscan; 2005.

Daly H. Commentary: toward some operational principles of sustainable development. Ecol Econ 1990;2:1–6.

Daly HE. Steady-State Economics, 2nd edn. Washington, DC: Island Press; 1991.

Dasgupta P. La vera ricchezza delle nazioni: per un pianeta sostenibile, una società giusta e un'economia in crescita. Lectio Magistralis. 14.02.2013. Trento: Euricse.

Dasgupta P. The Ethics of Intergenerational Distribution: Reply and Response to John E. Roemer. Environ Resource Econ 2011;50:475–493.

Dasgupta, P. The Place of Nature in Economic Development. In Rodrik D, and Mark Rosenzweig M, editors, Handbook of Development Economics. North-Holland: 2009. Vol. 5.

de Vries BJM. Sustainability Science. Outlook on Futures. Cambridge University Press; 2013. Ch. 15, p. 516–536.

DECC (Department of Energy and climate Change). Strategic Environmental Assessment for a 14th – and subsequent –onshore oil and gas licensing round. Department of Energy and climate

Change; 2010. Available at: http://og.decc.gov.uk/en/olgs/cms/tech_papers/conf_papers/conf_papers.aspx.

DECC (Department of Energy and Climate Change). UK Offshore Energy Strategic Environmental Assessment Future Leasing for Offshore Wind Farms and Licensing for Offshore Oil & Gas and Gas Storage - Environmental Report. Department of Energy and Climate Change; 2009.

Decree of the president of the Italian Republic 8 December 2007. Institution of the Val d'Agri – Lagonegrese (D.P.R. 8 Dicembre 2007. Istituzione del Parco della Val d'Agri Lagonegrese).

Department of State Development Government of Western Australia Strategic assessment of the Browse Basin liquefied natural gas precinct. Department of State Development Government of Western Australia; 2010. Available at: http://www.dsd.wa.gov.au/7909.aspx.

Diamantini C, Geneletti D. Reviewing the application of SEA to sectoral plans in Italy: the case of the mobility plan of an alpine region. Eur Environ 2004;14:123–33.

Directive 2001/42/EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment. Available at: http://eur-lex.europa.eu.

Duinker PN, Greig LA. Scenario analysis in environmental impact assessment: Improving explorations of the future. Environmental Impact Assessment Review 2007;27:206–219.

E&P Forum/UNEP. Environmental Management in oil and gas exploration and production. An overview of issues and management approaches. Joint E&P Forum/UNEP Technical Publication; 1997.

Eales RP, Sheate WR. Effectiveness of policy level environmental and sustainability assessment: challenges and lessons from recent practice. J Environ Assess Policy Manage 2011;13(1):39–65.

Ecologic Institute. Establishing environmental sustainability thresholds and indicators. Final report to the European Commission's DG Environment; 2010. European Commission. Impact Assessment Guidelines. Available at: http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf 2009.

Eickhout, B., Meijl, H. Van, Tabeau, A., & Rheenen, T. Van. (2007). Economic and ecological consequences of four European land use scenarios. Land Use Policy 2007;24:562–575.

Ekins P, Vanner R. Sectoral Sustainability and Sustainability Assessment Methodologies: A Review of Methodology in light of collaboration with the UK Oil and Gas Sector. J Environ Plan Manage 2007; 50(1): 87–111.

Elvin, S. S., Fraser, G. S., 2012. Advancing a National Strategic Environmental Assessment for the Canadian Offshore Oil and Gas Industry With Special Emphasis on Cumulative Effects. Journal of Environmental Assessment Policy and Management 14(3):1–37.

ENI. Eni in Basilicata: Local Report – Synthesis 2013. Ente Nazionale Idrocarburi; 2013. Available at: https://www.eni.com.

Eni. Eni in Basilicata: Local Report 2012. Ente Nazionale Idrocarburi; 2012. Available at: http://www.eni.com/it_IT/attachments/sostenibilita/impegno-sostenibilita/eni-in-basilicata.pdf.

EPA Ghana. Guidelines for Environmental Assessment and Management in the Offshore Oil and Gas Development. An overview of Ghanaian Environmental Assessment procedure, oil and gas development issues and management approaches. Available from: http://www.www.epa.gov.gh.

European Commission, DG ENV. Study concerning the report on the application and effectiveness of the SEA Directive (2001/42/EC). Final report April 2009. Available at: http://ec.europa.eu/environment/eia/pdf/study0309.pdf 2009.

European Commission. GDP and beyond: measuring progress in a changing world. COM(2009) 433 final. Brussels: European Commission; 2009b.

European Commission. GDP and beyond: measuring progress in a changing world. COM(2009) 433 final. Brussels: European Commission; 2009b.

European Commission. Impact Assessment Guidelines. 2009a. Available at: http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf.

Farley J. Ecosystem services: The economics debate. Ecosystem Services;2012;1:40–49.

Ferrara A, Bellotti A, Faretta S, Mancino G, Baffari P, D'Ottavio A, Trivigno V. Carta delle aree sensibili alla desertificazione della Regione Basilicata. Forest@ 2005;2(1):66-73. Available at: http://www.sisef.it.

Ferreira S, Akay A, Brereton F, Cuñado J, Martinsson P, Moro M, Ningal TF. Life satisfaction and air quality in Europe. Ecological Economics 2013;88:1-10.

Fidler C, Noble B. Advancing strategic environmental assessment in the offshore oil and gas sector: Lessons from Norway, Canada, and the United Kingdom. Environ Impact Assess Rev 2012;34:12–21.

Finnveden G, Nilsson M, Johansson J, Persson A, Moberg A, Carlsson T. Strategic environmental assessment methodologies: applications within the energy sector. Environ. Impact Assess. Rev. 2003;23:91–123.

Fisher TB. The Theory and Practice of Strategic Environmental Assessment. Towards a More Systematic Approach. London: Earthscan; 2007.

Foluke A. Strategic Environmental Assessment (Sea) for Oil and Gas Development Plans. Submitted to the Department of Environmental Science, Avans University of Applied Science, Breda, Netherlands; 2012. Available at: http://docs1.eia.nl/mer/diversen/foluke_finalassignment2.pdf.

Gandy OH. Wedging equity and environmental justice into the discourse on sustainability. For presentation to the Environment, Science and Risk Communication Working Group. IAMCR Istanbul, 2011.

Gardner JE. Decision making for sustainable development: Selected approaches to environmental assessment and management. Environ Impact Assess Rev 1989;9:337–366.

Gasparatos A, El-haram M, Horner M. A critical review of reductionist approaches for assessing the progress towards sustainability. Environmental Impact Assessment Review 2008;28:286 – 311.

Gaudreau K, Gibson RB. Illustrating integrated sustainability and resilience based assessments: a small-scale biodiesel project in Barbados. Impact Assess Proj Apprais 2010;28(3):233–43.

Geneletti D, Bagli S, Napolitano P, Pistocchi A. Spatial decision support for strategic environmental assessment of land use plans. A case study in southern Italy. Environ Impact Assess Rev 2007;27:408–23.

Geneletti D. An approach based on spatial multicriteria analysis to map the nature conservation value of agricultural land. J. Environ. Manage. 2007;83:228–35.

George C. Testing for sustainable development through environmetal assessment. Environmental Impact Assessment Review 1999;19:175–200.

Gibson R. Beyond the pillars: sustainability assessment as a framework for effective integration of social, economic and ecological considerations in significant decision-making. J Environ Assess Policy Manage 2006;8(3):259–80.

Gibson RB, Holtz H, Tansey J, Whitelaw G, Hassan S. Sustainability assessment: criteria and processes. London: Earthscan; 2005.

Gibson RB. Application of a contribution to sustainability test by the Joint Review Panel for the Canadian Mackenzie Gas Project, Impact Assessment and Project Appraisal 2011;29(3):231-244.

Glasser H. Ethical perspectives and environmental policy analysis. In: Bergh JCJM van den, editor. Handbook of Environmental and Resource Economics. Chehenham, UK, Northampton, MA, USA: Edward Elgar; 1999. p. 981–1000.

Goodland R. The biophysical basis of environmental sustainability. In: Bergh JCJM van den, editor. Handbook of Environmental and Resource Economics. Chehenham, UK, Northampton, MA, USA: Edward Elgar; 1999. Ch. 48, p. 709–721.

Government of Québec (prepared for). Strategic Environmental Assessment of Oil and Natural Gas Exploration and Development in the Anticosti, Madeleine and Baie des Chaleurs Basins (SEA2): Genivar (prepared by); 2011. Available at: http://www.ees.gouv.qc.ca/english/publications.asp.

Government of Saskatchewan. The Great Sand Hills Regional Environmental Study: Final Report, 2007-104: Government of Saskatchewan; 2007. Available at: http://www.environment.gov.sk.ca/Default.aspx?DN=bc247d49-29a2-4685-98bced6cc4a3c7e0.

Govierno de Chile Guía para la Evaluación de Impacto Ambiental. Servicio de Evaluación Ambiental; 2011.

Grace W. Healthy and resilient socio-ecological systems: towards a common approach to sustainability assessment and management [Internet]. Paper presented at the 2010 Sustainability Assessment Symposium. Fremantle, Western Australia; 2010. Available from: http:// integral-sustainability.net/sas-2010-programme-updates/pa pers/bill-grace.

Greeuw SCH, van Asselt MBA, Grosskurth J, Storms CAMH, Rijkens-Klomp N, Rothman DS. Cloudy crystal balls: an assessment of recent European and global scenario studies and models. Environmental Issue Report, vol. 17. Copenhagen, Denmark: European Environment Agency; 2000. Available at: http://reports.eea.europa.eu/Environmental_issues_series_17/en.

Gunn J, Noble BF. Conceptual and methodological challenges to integrating SEA and cumulative effects assessment. Environ Impact Assess Rev 2011;31:154–160.

Halpern BS, Klein CJ, Brown CJ, Beger M, Grantham HS, Mangubhai S, et al. Achieving the triple bottom line in the face of inherent trade-offs among social equity, economic return, and conservation. Proc. Natl. Acad. Sci. 2013;110(15):6229–34.

Hargrove, EC. Foundations of Environmental Ethics. EnglewoodCliffs, N.J.: Prentice-Hall; 1989.

Harriman JAE, Noble BF. Characterizing project and strategic approaches to regional cumulative effects assessment in Canada. J Environ Assess Policy Manage 2008;10:25–50.

Harsanyi JC. Rule utilitarianism, equality, and justice. In: Paul EF, Miller FD, Paul J, editors. Ethics and Economics. Oxford: Basil Btackwell; 1985. p.115–127.

Haughton G. Environmental justice and the sustainable city. Journal of Planning Education and Research 1999;18(3):233–243.

Haughton G. Geographical equity and regional resource management: water management in southern California. Environment and Planning B. Planning and design 1998;25:279–298.

Helming K, Pérez-soba M. Landscape Scenarios and Multifunctionality: Making Land Use Impact. Ecology and Society 2011;16(1): 50.

Hermans F, Knippenberg L. A Principle-Based Approach for the Evaluation of Sustainable Development. Journal of Environmental Assessment Policy and Management 2006;8(3):299–319.

Horvath CL, Barnes JL. Applying a regional strategic environmental assessment approach to the management of offshore oil and gas development. Jacques Whitford Environment Ltd; 2004. Available at: http://siteresources.worldbank.org/INTRANETENVIRONMENT/1705736-1127758054592/20686579/UK_Oil_and_Gas_SEA.pdf.

Howarth RB. Sustainability under Uncertainty: A Deontological Approach. Land Economics 1995;71(4):417– 427.

IFC. Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development. World Bank Group; 2007.

ISTAT and CNEL. Bes| 2013. Il benessere equo e sostenibile in Italia. Istituto nazionale di statistica e Consiglio Nazionale dell'Economia e del Lavoro; 2013.

ISTAT. Anni 1995-2011. Il reddito disponibile delle famiglie nelle regioni italiane. Istituto Nazionale di Statistica; 2013a. Available at: http://www.istat.it/it/files/2013/02/Report_RedditoDisponibile_Regionale.pdf?title=Reddito+disponibile+delle+famiglie+-+06%2Ffeb%2F2013+-+Testo+integrale.pdf.

ISTAT. L'Italia del censimento struttura demografica e processo di rilevazione Basilicata. Istituto Nazionale di Statistica; 2013b. Available at: http://www.istat.it/it/files/2013/01/Basilicata_Volume.pdf.

ISTAT. L'Italia del censimento. Struttura demografica e processo di rilevazione: Basilicata. 15° Censimento Generale delle popolazioni e delle abitazioni 2011. Istituto Nazionale di Statistica; 2013. Available at: http://www.istat.it.

Johnson BL. Introduction to the special feature: adaptive management — scientifically sound, socially challenged? Conserv Ecol 1999;3(1):10. Available at: www.consecol.org/vol3/iss1/art10/.

Johnson D, Lalonde K, McEachern M, Kenney J, Mendoza G, Buffin A, Rich K. Improving cumulative effects assessment in Alberta: Regional strategic assessment. Environ Impact Assess Rev 2011;31:481–483.

Joint Review Panel for the Mackenzie Gas Project. Foundation for a Sustainable Northern Future, December 2009. Available at http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=155701CE-1.

Jones C, Baker M, Carter J, Jay S, Short M, Wood C. Strategic environmental assessment and land use planning: an international evaluation. London: Earthscan; 2005.

Kajikawa Y. Research core and framework of sustainability science. Sustainability Science 2008;3(2):215-239.

Kates RW, Clark WC, Corell R, Hall JM et al. Sustainability science. Science 2001;292:641-642.

Kauffman J. Advancing sustainability science : report on the International Conference on Sustainability Science (ICSS) 2009; Sustain Sci 2009;4:233–42.

Kidd S, Fischer TB. Towards sustainability: is integrated appraisal a step in the right direction? Environ Plan C Gov Policy 2007;25(2):233–49.

Kosow H, Gaßner R. Methods of future and scenario analysis. Overview, assessment, and selection criteria. German Development Institute (DIE) Research Project "Development Policy: Questions for the Future". German Development Institute; 2008.

Kuik OJ, Gilbert AJ. Indicators of sustainable development. In: Bergh JCJM van den, editor. Handbook of Environmental and Resource Economics. Chehenham, UK, Northampton, MA, USA: Edward Elgar; 1999. Ch. 49.

Leopold A. A Sand County Almanac and Sketches Here and There. New York: Oxford University Press; 1949.

Leopold A. The Land Ethic. In: Keller DR, editor. Environmental Ethics: The Big Questions., Chichester,UK: John Wiley & Sons; 2010. Ch.23, p.194.

Levin SA. Epilogue: The challenge of sustainability: Lessons from an evolutionary perspective. In Weinstein M, Taylor RE, editors. Sustainability Science: The Emerging Paradigm and the Urban Environment. New York: Springer; 2012. p. 168–174.

MAP. Scenario tendenziale dei consumi e del fabbisogno al 2020. Ministero Attività Produttive, Direzione Generale Energia e Risorse Minerarie; 2005. Available at: http://dgerm.sviluppoeconomico.gov.it/dgerm/scenarioenergetico/scenario_energetico_tendenziale_al_2020_vers05_05.pdf.

Marshall JD, Toffel MW. Framing the elusive concept of sustainability: a sustainability hierarchy. Environ Sci Technol 2005;39(3):673–82.

Martens P. Sustainability: science or fiction? Sustain. 2006;2(1):36–41.

Maschewsky W. Environmental justice in Scotland: just words? A view from outside. Edinburgh: Friends of the Earth Scotland; 2005. Available at: www.foe-scotland.org.uk/Aviewfromoutside.

McKenzie S. Social Sustainability: towards some definitions. Hawke Research Institute Working Paper Series No 27. Magill, South Australia: Hawke Research Institute University of South Australia; 2004.

Millennium Ecosystem Assessment (MA), Ecosystems and HumanWell-being: A Framework for Assessment. Washington, DC: Island Press; 2003.

Ministerio de Hidrocarburos y Energia de Bolivia. Propuesta de Guia de Evaluacion Ambiental Estrategica del Sector Hidrocarburos. La Paz: Ministerio de Hidrocarburos y Energia de Bolivia; 2011.

Ministry of Commerce, Industry and Tourism of the Republic of Cyprus (prepared for). Strategic Environmental Assessment concerning Hydrocarbon Activities within the Exclusive Economic Zone of the Republic of Cyprus. Marine Communication Services, Inc. (MCI), Aeoliki Ltd., and CSA International, Inc. (CSA) in cooperation with the University of Cyprus Oceanographic Centre (prepared by); 2008.

Ministry of Industry of Iceland. Oil exploration in the Dreki area on the Jan Mayen Ridge. Proposal for a plan to offer exclusive exploration and production licences for oil and gas in the Dreki area (Dragon area) on the Jan Mayen Ridge, northeast of Iceland and a Strategic Environmental Assessment (SEA) of the proposed plan; 2007. Available at: http://eng.idnadarraduneyti.is/media/Rafraen_afgreidsla/Report_on_oil_exploration-KK.PDF.

MISE. Annual report 2013. Ministero Sviluppo Economico; 2013. Available at: http://unmig.sviluppoeconomico.gov.it/unmig/stat/ra2013.pdf.

MISE. Strategia Energetica Nazionale: per un'energia più competitiva e sostenibile. 2012. Available at: http://www.sviluppoeconomico.gov.it.

Mitchell G, Dorling D. An environmental justice analysis of British air quality. Environment and Planning A 2003;35(5):909–29.

Morita T et al. Greenhouse Gas Emission Mitigation Scenarios and Implications. In: Metz B et al. editors, Climate Change 2001: Mitigation. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, U.K., and New York, N.Y.: Cambridge University Press; 2001. Available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm. Retrieved 2010-01-10.

Morris JB, Tassone V, de Groot R, Camilleri M, Moncada S. A Framework for Participatory Impact Assessment (FoPIA): involving stakeholders in European policy making, a case study of land use change in Malta. Ecology and Society 2011;16(1): 12.

Morrison-Saunders A, Arts J. Assessing Impact. Handbook of EIA and SEA Follow-up. London: Earthscan; 2004.

Morrison-Saunders A, Fisher TB. What is wrong with EIA and SEA anyway? A sceptic's perspective on sustainability assessment. J Environ Assess Policy Manage 2006;8(1):19–39.

Morrison-Saunders A, Hodgson N. Applying sustainability principles in practice: guidance for assessing individual proposals. Presented at: IAIA09 Impact Assessment and Human Well-Being, 29th Annual Conference of the International Association for Impact Assessment, 16–22 May 2009, Accra, Ghana; 2009. Available at: http://researchrepository.murdoch.edu.au/1707/1/Applying_Sustainability_Principles_2009.pdf.

Morrison-Saunders A, Pope J. Conceptualising and managing trade-offs in sustainability assessment. Environ. Impact Assess. Rev. 2013;38:54–63.

Morrison-Saunders A, Therivel R. Sustainability Integration and Assessment. Journal of Environmental Assessment Policy and Management 2006;8(03):281–298.

Mosbech A, Boertmann D, Jespersen M. Strategic Environmental Impact Assessment of hydrocarbon activities in the Disko West area. National Environmental Research Institute, NERI technical report no. 618, University of Aarhus; 2007.

Munda G., Saisana M. Methodological Considerations on Regional Sustainability Assessment Based on Multicriteria and Sensitivity Analysis. Reg. Stud. 2011;45(2):261–276.

Munier N. Introduction to Sustainability: Road to a Better Future. Dordrecht, The Netherlands: Springer; 2005. Ch.1.

NCEA (Netherland Commission for Environmental Assessment). Advice on Terms of Reference for SEA for Oil and Gas – Bolivia. Netherland Commission for Environmental Assessment; 2009. Available at: http:// www.eia.nl.

NCEA (Netherland Commission for Environmental Assessment). Review of SEA for Oil and Gas NCEA – Bolivia. Netherland Commission for Environmental Assessment; 2012. Available at: http://www.eia.nl.

Nelson P. SEA and Spatial Planning. In: Sadler B, Aschemann R, Dusik J, Fischer TB, Partidário MR, Verheem R, editors. Handbook of strategic environmental assessment. London: Earthscan; 2011. p. 310–334.

Neville Ash, Blanco H, Brown C, Garcia K, Henrichs T etal. Ecosystems and Human Well-Being. UNEP, editor. ISLAND Press; 2010.

Newman P. The environmental impact of cities. Environ Urban 2006;18:275–95.

Noble B. Strategic approaches to regional cumulative effects assessment: a case study of the Great Sand Hills, Canada. Impact Assess Proj Apprais 2008;26(2):78–90.

NORAD (Norwegian Agency for Development Cooperation) and World Bank Group (prepared for). Environmental Governance in Petroleum Producing Countries - Findings from a comprehensive survey; September 2009. Available at: http://siteresources.worldbank.org/EXTOGMC/Resources/Environmental_Governance.

Norgaard RB. The case for methodological pluralism. Ecological Economics 1989;1:37–57.

Norgaard RB. Vision and Methods of Ecological Economics. In: Sahu NC and Choudhury AK, editors. Dimensions of Environmental and Ecological Economics. Hyderabad, India: Universities Press; 2005. p. 19-29.

Norwegian Ministry of Environment. Environmental Manual for petroleum activities. The Oil for Development Programme, Norad Petrad. DRAFT January 21, 2009.

ODPM. A practical guide to the strategic environmental assessment directive. Northern Ireland: Office of the Deputy Prime Minister, Scottish Executive, Welsh Assembly Government and Department of the Environment; 2005. Available at: http://www.communities.gov.uk/publications/planningandbuilding/practicalguidesea.

OECD. Conducting Sustainability Assessment. Organisation for Economic Co-operation and Development; 2008.

Ortolano. Environmental planning and decision making. New York: Wiley; 1984.

Osmani SR. Theory of Justice for an Imperfect World: Exploring Amartya Sen's Idea of Justice. J. Hum. Dev. Capab. 2010;11(4):599–607.

Ostrom E. A general framework for analysing sustainability of social–ecological systems. Science 2009;325:419–22.

Ozelkan EC, Duckstein L. Analysing water resources alternatives and handling criteria by multi criterion decision techniques. Journal of Environmental Management 1996;48:69-96.

Padilla E. Intergenerational equity and sustainability. Ecological Economics 2002;41:69–83.

Page T. On the Problem of Achieving Efficiency and Equity, Intergenerationally. Land Economics 1997;73(4):580–96.

Pahl-Wostl C. The implications of complexity for integrated resources management. Environ. Model. Softw. 2007;22(5):561–9.

Paracchini ML, Pacini, C, Jones, MLM, Pérez-Soba M. An aggregation framework to link indicators associated with multifunctional land use to the stakeholder evaluation of policy options, Ecological Indicators 2011;11(1):71-80.

Partidário MR, Augusto B, Vicente G., Lobos V. Learning the practice of strategic-based SEA. Presented at the 29th Annual Conference of the International Association for Impact Assessment IAIA09, Accra, 17-22 May, 2009. IAIA; 2009.

Partidário MR, Gomes RC. Ecosystem services inclusive strategic environmental assessment. Environmental Impact Assessment Review 2013;40:36–46.

Partidário MR, Vicente G, Belchior C. Can new perspective on sustainability drive lifestyles? Sustainability 2010;2:2849–72.

Partidário MR. Scales and associated data – what is enough for SEA needs? Environmental Impact Assessment Review 2007a;27:460–478.

Partidário MR. Strategic Environmental Assessment: Good Practices Guide, Methodological Guidance, Portuguese Environment Agency; 2007b.

Partidário MR. Strategic Environmental Assessment: Good Practices Guide, Methodological Guidance, Portuguese Environment Agency and Redes Energética Nacionais (REN), SA; 2012.

Partidário MR. Strategic Environmental Assessment: Key issues emerging from recent practice, Environmental Impact Assessment Review 1996;16:31–55.

Partidário MR. Strategic-based model for SEA based on Critical Factors for Decision Making (CFD). Proceedings of the 28th Annual IAIA Conference. Perth, Australia; 2008.

Pearce D, Hamilton G, Atkinson GD. Measuring sustainable development: progress on indicators. Environment and Development Economics 1996;1:85–101.

Pearce DW, Turner RK. Economics of Natural Resources and the Environment. Hertfordshire, England: Harvester Wheatsheaf; 1990.

Perman R. et al. Natural Resource and Environmental Economics. 2nd edition. Longman; 1999.

Pezzey JCV, Toman MA. Progress and Problems in the Economics of Sustainability. Forthcoming in Tom Tietenberg and Henk Folmer, editors. International Yearbook of Environmental and Resource Economics 2002/2003. Cheltenham, UK: Edward Elgar; 2002.

Pope J, Annandale D, Morrison-Saunders A. Conceptualising sustainability assessment. Environ Impact Assess Rev 2004;24:595–616.

Pope J, Dalal-Clayton B. From SEA to sustainability assessment? In: Sadler B, Aschemann R, Dusik J, Fischer TB, Partidário MR, Verheem R, editors. Handbook of strategic environmental assessment. London: Earthscan; 2011. p. 547–65.

Potschin M. Land use and the state of the natural environment. Land Use Policy 2009;26(1):S170-S177.

Proops JLR. Integration and communication between environmental economics and other disciplines In: Bergh JCJM van den, editor. Handbook of Environmental and Resource Economics. Chehenham, UK, Northampton, MA, USA: Edward Elgar; 1999. Ch. 79.

Prugh T, Costanza R, Daly HE. The Local Politics of Global Sustainability. Washington, DC; Island Press; 2000.

Qizilbash M. On Ethics and the Economics of Development. The Journal of Philosophical Economics 2007;I:1,54–73.

Ravetz J. Post-normal science and the complexity of transitions towards sustainability. Ecological Complexity 2006;3:275–284.

Rawls J. A Theory of Justice. Oxford: Oxford University Press; 1971.

Rees W. Ecological footprint and appropriated carrying capacity: what urban economics leaves out. Environ Urban 1992;4(2):121–30.

Regional Law n° 16 of August 8, 2012. Article 37. Urgent provisions for land management and land take reduction.

Regione Basilicata, UnionCamere Basilicata, ISTAT, SISTAN. Annuario Statistico Regionale 2011 – Basilicata; 2012. Avaliable at: http://rsdi.regione.basilicata.it.

Regione Basilicata. Carta delle aree sensibili alla desertificazione in Basilicata; 2004. Available at: http://annuario.isprambiente.it/data/T15/2201/Ver_9/carta_basilicata.jpg.

Regione Basilicata. Programma Operativo 2007-2013. Fondo Europeo di Sviluppo Regionale. III[a] versione; 2007. Available at: http://www.regione.basilicata.it/sportelloeuropa/default.cfm?fuseaction=linkdoc&doc=6270&link=6421.

Regione Basilicata. Report di sintesi sullo stato di attuazione del programma operativo Val d'Agri - Melandro - Sauro – Camastra aggiornato al 31 dicembre 2011. Regione Basilicata, Struttura di Progetto " Val d'Agri"; 2013. Available at: www. povaldagri.basilicata.it.

Regione Basilicata. Rete Natura 2000. Available at: http://natura2000basilicata.it/la-rete-in-basilicata.

Reidsma P, König H, Feng S, Bezlepkina I, Nesheim I, Bonin M, et al. Methods and tools for integrated assessment of land use policies on sustainable development in developing countries. L. Use Policy 2011;28(3):604–17.

Rein M, Schön D. Reframing Policy Discourse. In: Fischer F, Forester J, editors. The Argumentative Turn in Policy Analysis and Planning. Durham: Duke University Press; 1993. p. 145–66.

RIM (Islamic Republic of Mauritania) and World Bank (prepared for). Strategic Environmental and Social Assessment of Oil and Gas Development in Mauritania. Integrated Environments Ltd and D'Appolonia S.p.A (prepared by); 2011.

Roemer J, Suzumura K, editors. Intergenerational Equity and Sustainability. Pag. xvi. Palgrave Publishers Ltd; 2007.

Rose A, Kvernd S. Equity in environmental policy with an application to global warming In Bergh JCJM van den, editor. Handbook of Environmental and Resource Economics; 1999: Ch. 24.

Rothman DS. 2008. A survey of Environmental Scenarios. In Alcamo J, editor. Environmental Futures: The practice of environmental scenario analysis. Elsevier; 2008. Ch. 3, p. 37–65.

Rotmans J, van Asselt M, Anastasi C, Greeuw S, Mellors J, Peters S, et al. Visions for a sustainable Europe. Futures. 2000;32(9-10):809–31.

Scanlon T. What We Owe to Each Other, Cambridge, MA: Harvard University Press; 1998.

Schwartz P. The Art of the Long View: Planning for the Future in an Uncertain World. New York: Doubleday; 1996.

Sen A. Choice, Welfare and Measurement. Oxford: Basil Blackwell; 1982.

Sen A. On Ethics and Economics, Oxford: Blackwell; 1987.

Sen A. The Idea of Justice. Cambridge, MA: The Belknap Press of Harvard University Press; 2009.

Seto KC, Reenberg A, Boone CG, Fragkias M, Haase D, Langanke T, Marcotullio P, Munroe DK, Olah B, Simon D. Urban land teleconnections and sustainability. PNAS 2012;109(20):7687–7692.

Shearer AW, Mouat DA, Bassett SD, Binford MW, Johnson CW, Saarinen JA. Examining development-related uncertainties for environmental management: Strategic planning scenarios in Southern California. Landsc. Urban Plan. 2006;77:359–81.

Sheate WR, Dagg S, Richardson J, Aschemann R, Palerm J, Steen U. Integrating the environment into strategic decision-making: conceptualizing policy SEA. European Environment 2003;13:1–18.

Sheate WR, Partidário MR, Byron H, Bina O, Dagg S. Sustainability assessment of future scenarios: methodology and application to mountain areas of Europe. Environ Manage 2008;41:282–99.

Singh RK, Murty HT, Gupta SK, Dikshit AK. An overview of sustainability assessment methodologies. Ecological Indicators 2009;9:189–212.

Slootweg R, Jones M. Resilience thinking improves SEA: a discussion paper. Impact Assessment and Project Appraisal 2011;29(4):263-276.

Stato Italiano and Regione Basilicata. Memorandum di intesa Stato - Regione Basilicata per la accelerazione dello sviluppo regionale attraverso politiche aggiuntive di sviluppo industriale, generatore di occupazione, di incremento della dotazione infrastrutturale, di investimenti in ricerca e innovazione, connesse alla ricerca e coltivazione delle fonti fossili in Basilicata. 2011. Available at: http://unmig.sviluppoeconomico.gov.it/unmig/norme/pdf/memorandum_intesa_basilicata_290411.pdf.

Steinberger JK, Krausmann, F. Material and Energy Productivity. Environmental Science & Technology 2010;45:1169-1176.

SVIMEZ. Rapporto Svimez 2012 sull'Economia del Mezzogiorno. Associazione per lo Sviluppo dell'Industria nel Mezzogiorno. Edizioni il Mulino; 2012.

Swart RJ, Raskin P, Robinson J. The problem of the future: sustainability science and scenario analysis. Sustainable Development 2004;14:137–46.

Tacconi L, Bennett J. Economic implications of intergenerational equity for biodiversity conservation Ecological Economics 1995;12:209-223.

Taylor RW. Urbanization, Local Government, and Planning for Sustainability. In Weinstein M, Taylor RE, editors. Sustainability Science: The Emerging Paradigm and the Urban Environment. New York: Springer; 2012. p. 293-313.

Teixeira IMV. O uso da Avaliação Ambiental Estratégica no planejamento da oferta de blocos de E&P de petróleo e gás natural: uma proposta. Doctoral Thesis Universidade Federal do Rio de Janeiro, COPPE; 2008.

The Bureau of Minerals and Petroleum of Greenland (prepared for). Eastern Baffin Bay - A strategic environmental impact assessment of hydrocarbon activities. The Danish Centre for Environment and Energy and the Greenland Institute of Natural Resources (prepared by); 2011. Available at: http://www.dmu.au.dk.

The World Bank, 2010. Environmental Governance in Oil-Producing Developing Countries: Findings from a Survey of 32 Countries. Extractive Industries for Development Series #17. Available at: http://siteresources.worldbank.org/EXTOGMC/Resources/336929-1266963339030/eifd17_environmental_governance.pdf

Therivel R, Christian G, Craig C, Grinham R, Mackins D, Smith J, et al. Sustainability focused impact assessment: English experiences. Impact Assess Proj Apprais 2009;27(2):155–68.

Therivel R. Strategic Environmental Assessment in Action. Second Edition London: Earthscan; 2010.

TNEM (Tanzania National Environmental Management Council). Terms of reference (ToR) for Strategic Environmental & Social Impact Assessment (SESIA) for the oil & natural gas sub – sector. Through the Tanzania Energy Sector Capacity Assistance Project. (ESCAP). Funded by World Bank; 2012.

Turner RK. Environmnetal and ecological economics. In Bergh, J.CJ.M. van den, editor. Handbook of Environmental and Resource Economics. Edwars Elgar; 1999. p.1001–1033.

United Nations. Report of the United Nations Conference on Environment and Development. UNCED Report A/CONF.151/5/Rev.1 13; 1992.

van der Heijden K. Scenarios: The Art of Strategic Conversation. New York: John Wiley and Sons; 1996.

van Notten PW, Rotmans J, van Asselt MB, Rothman DS. An updated scenario typology. Futures 2003;35(5):423–43.

Van't Klooster SA, van Asselt MBA. Practicing the Scenario-Axes Technique. Futures 2006;38(1):15-30.

Vercelli A, Borghesi B. La sostenibilità dello sviluppo globale. Carocci editore; 2005.

Walker B, Holling CS, Carpenter SR, Kinzig A. Resilience, Adaptability and Transformability in Social – ecological Systems. Ecol. Soc. 2004;9(2): 5.

Walker B, Salt D. Resilience Thinking: Sustaining Ecosystems and People in a Changing World, London: Island Press; 2006.

Walker G. Environmental justice, impact assessment and the politics of knowledge: the implications of assessing the social distribution of environmental outcomes. Environ Impact Assess Rev 2010;30(5):312–8.

Walker GP. Environmental justice and the distributional deficit in policy appraisal in the UK. Environ Res Lett 2007;2:1–7.

WCED (World Commission on Environment and Development Our Common Future). Our common future. Oxford: Oxford University Press; 1987.

Wilkinson R. Societal Equality and Global Sustainability. International conference Planet under pressure, 26-29 March London. Available at: http://www.planetunderpressure2012.net.

Wood C, Djeddour M. Strategic Environmental Assessment: EA of policies, plans and programmes. Impact Assessment Bulletin 1992;10(1):3–22.

World Bank. World Development Report 2006. Equity and development. New york, USA: Oxford University Press; 2006. Available at: http://web.worldbank.org/.

York R, Rosa EA, Dietz T. Footprints on the Earth: the environmental consequences of modernity. Am Sociol Rev 2003;68(2):279–300.

Zhu Z, Bai H, Xu H, Zhu T. An inquiry into the potential of scenario analysis for dealing with uncertainty in strategic environmental assessment in China. Environ. Impact Assess. Rev. 2011;31(6):538–48.

Appendix

This appendix reports the methods, which were adopted in Chapter 7, to assess the indicator values in the different scenarios described in Chapter 6.

Methods to assess the indicator values in the different scenarios.

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
1	Number of local workers occupied in the Oil & Gas sector (directly and indirectly)	D	Number of local workers occupied in the Oil & Gas attributed on the base of population in the territory (demographic data, 2011)	as D (Site, ST) (no increase of production)	Number of local workers occupied in the Oil & Gas attributed on the base of population in the territory (demographic data, 2011)	as D (District, ST) (no increase of production)	Number of local workers occupied in the Oil & Gas attributed on the base of population in the territory (demographic data, 2011)	as D (Region, ST) (no increase of production)
		C	Increase in employment at Region (ST) distributed on the base of % of population in Site	Increase in employment at Region (MLT) distributed on the base of % of population in District	Increase in employment at Region (ST) distributed on the base of % of population in District	Increase in employment at Region (ST) distributed on the base of % of population in District	Hypothesis of Increase in employment in proportion to increase for the realization of Tempa Rossa field	Hypothesis of Increase in employment in proportion to increase of barrels produced
		A	Increase in employment at Region (ST) distributed on the base of % of population at Site	Increase in employment at Region (MLT) distributed on the base of % of population at Site	Increase in employment at Region (ST) distributed on the base of % of population at District	Increase in employment at Region (ST) distributed on the base of % of population at District	Hypothesis of Increase in employment in proportion to increase of barrels produced	Hypothesis of Increase in employment in proportion to increase of barrels produced
		B	As A (Site, ST)	Increase in employment at Region (MLT) distributed on the base of % of population at Site	As A (Site, ST)	Increase in employment at Region (ST) distributed on the base of % of population at District	Hypothesis of Increase in employment in proportion to increase of barrels produced	Hypothesis of Increase in employment in proportion to increase of barrels produced
2	Emissions of SO_2	D	Emissions data (same values for district and region)	Total amount after 16 years (hypothesis constant yearly emissions)	Emissions data (same values for Site and Region)	Total amount after 16 years (hypothesis constant yearly emissions)	Emissions data (same values for Site and District)	Total amount after 16 years (hypothesis constant yearly emissions)

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
		C	As D (ST)	As D (MTL)	Added increase in emissions due to Tempa rossa field calculated on the base of barrels produced	Added total amount of emissions after 11 years for Tempa Rossa (hypothesis constant yearly emissions)	As C (District, ST)	As C (District, MTL)
		A	Added increase in emissions due to VAD field calculated on the base of barrels produced	Added total amount of emissions for after 16 years for VAD field (hypothesis constant yearly emissions)	Added increase in emissions due to Tempa Rossa field calculated on the base of barrels produced	Added total amount of emissions after 11 years for Tempa Rossa (hypothesis constant yearly emissions)	As A (District, ST)	As A (District, MLT)
		B	As A (Site, ST)	As A (Site, MLT) plus total amount of emissions for 10 years due to further increase in production for VAD field (hypothesis constant yearly emissions)	As A (District, ST)	As A (District, MLT) plus total amount of emissions for due to further increase in production for 10 years (VAD field) and 5 years (Tempa Rossa field) (hypothesis of constant yearly emissions)	As B (District, ST)	As B (District, MLT)
3	Proportion of population aged 0 – 14	D	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset)	High scenario projections (ISTAT dataset)
		C	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset) (regional data disaggregated on the base of related projections of population in the territory)	High scenario projections (ISTAT dataset)	High scenario projections (ISTAT dataset)
		A	Main scenario projections (ISTAT dataset) (regional data disaggregated	Main scenario projections (ISTAT dataset) (regional data disaggregated	Main scenario projections (ISTAT dataset) (regional data disaggregated	Main scenario projections (ISTAT dataset) (regional data disaggregated	Main scenario projections (ISTAT dataset)	Main scenario projections (ISTAT dataset)

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
			on the base of related projections of population in the territory)	on the base of related projections of population in the territory)	on the base of related projections of population in the territory)	on the base of related projections of population in the territory)		
		B	Low scenario projections (ISTAT, 2013) (regional data disaggregated on the base of related projections of population in the territory)	Low scenario projections (ISTAT, 2013 dataset) (regional data disaggregated on the base of related projections of population in the territory)	Low scenario projections (ISTAT, 2013) (regional data disaggregated on the base of related projections of population in the territory)	Low scenario projections (ISTAT, 2013) (regional data disaggregated on the base of related projections of population in the territory)	Low scenario projections (ISTAT, 2013)	Low scenario projections (ISTAT, 2013)
4	Consumption of water	**D**	Consumption data (same values for district and region)	Total amount after 16 years (hypothesis constant yearly consumption)	Consumption data (same values for Site and Region)	Total amount after 16 years (hypothesis constant yearly consumption)	Consumption data (same values for Site and District)	Total amount after 16 years (hypothesis constant yearly consumption)
		C	As D (Site, ST)	As D (Site, MTL)	Added increase in consumption due to Tempa Rossa field calculated on the base of barrels produced	Added total amount of consumption after 11 years for Tempa Rossa (hypothesis constant yearly consumption)	As C (District, ST)	As C (District, MTL)
		A	As D (Site, ST) + increase in consumption due to VAD field calculated on the base of barrels produced	As D (Site, MTL) +total amount of consumption for after 16 years for VAD field (hypothesis constant yearly consumption)	As D (District, ST) + increase in consumption due to Tempa Rossa field calculated on the base of barrels produced	As D (District, MTL) + total amount of consumption for 11 years for Tempa Rossa (hypothesis constant yearly consumption)	As A (District, ST)	As A (District, MLT)
		B	As A (Site, ST)	As A (Site, MLT) + total amount of emissions for 10 years due to further increase in production for VAD field (hypothesis constant yearly consumption)	As A (District, ST)	As A (District, MLT) + total amount of emissions due to further increase in production for 10 years (VAD field) and 5 years (Tempa Rossa field) (hypothesis of constant yearly consumption)	As B (District, ST)	As B (District, MLT)
5	Mtep provided/ Mtep Oil & Gas Italian needs	**D**	Oil energy contribution data in Mtep (source: Mise, 2013)	Calculated on the base of barrels produced and projections of	Oil energy contribution data in Mtep (source: Mise, 2013)	Calculated on the base of barrels produced and projections of	Oil energy contribution data in Mtep (source Mise: 2013)	Calculated on the base of barrels produced and projections of

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
			(same values for District and Region)	Italian needs at 2030 (source: Mise, 2013) (same values for District and Region)	(same values for Site and Region)	Italian needs at 2030 (source: Mise, 2013) (same values for Site and Region)	(same values for Site and District)	Italian needs at 2030 (source: Mise, 2013) (same values for Site and District)
		C	As D (ST)	As D (MTL)	Added increase due to Tempa Rossa field calculated on the base of barrels produced	Added total amount of consumption for 11 years for Tempa Rossa (hypothesis constant yearly consumption)	As C (District, ST)	As C (District, MTL)
		A	Added increase in contribution due to VAD field calculated on the base of barrels produced	Added total contribution for 16 years (VAD field) (hypothesis constant yearly consumption)	Added increase in contribution due to Tempa Rossa field calculated on the base of barrels produced	Added total amount of contribution for 11 years (Tempa Rossa field) (hypothesis constant yearly consumption)	As A (District, ST)	As A (District, MLT)
		B	As A (Site, ST)	As A (Site, MLT) plus total contribution for 10 years due to further increase in production for VAD field (hypothesis constant yearly consumption)	As A (District, ST)	As A (District, MLT) plus total contribution due to further increase in production for 10 years (VAD field) and 5 years (Tempa Rossa field) (hypothesis of constant yearly consumption)	As B (District, ST)	As B (District, MLT)
6	Mtep provided/ Mtep Oil & Gas Italian needs	**D**	Natural Gas energy contribution data in Mtep (source: Mise, 2013) (same values for district and region)	Calculated on the base of barrels produced and projections of Italian needs at 2030 (source:Mise, 2013) (same values for District and Region)	Natural Gas energy contribution data in Mtep (source Mise, 2013) (same values for site and region)	Calculated on the base of barrels produced and projections of Italian needs at 2030 (source: Mise, 2013) (same values for Site and Region)	Natural Gas energy contribution data in Mtep (source Mise: 2013) (same values for site and district)	Calculated on the base of barrels produced and projections of Italian needs at 2030 (source Mise: 2013) (same values for Site and District)
		C	As D (ST)	As D (MTL)	Added increase due to Tempa Rossa field calculated on the base of barrels produced	Added total amount of Mtep after 11 years for Tempa Rossa (hypothesis constant yearly	As C (District, ST)	As C (District, MTL)

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
						contribution)		
		A	Added increase in contribution due to VAD field calculated on the base of barrels produced	Added total contribution for 16 years (VAD field) (hypothesis constant yearly consumption)	Added increase in contribution due to Tempa Rossa field calculated on the base of barrels produced	Added total amount of contribution for 11 years (Tempa Rossa field) (hypothesis of constant yearly consumption)	As A (District, ST)	As A (District, MLT)
		B	As A (Site, ST)	As A (Site, MLT) plus total contribution for 10 years due to further increase in production for VAD field (hypothesis constant yearly consumption)	As A (District, ST)	As A (District, MLT) plus total contribution due to further increase in production for 10 years (VAD field) and 5 years (Tempa Rossa field) (hypothesis of constant yearly consumption)	As B (District, ST)	As B (District, MLT)
7	Migration rate	D	Regional data disaggregated on the base of population in the territory	Hypothesis 5% of population cancelled (due to change of place of residence) to total population cancelled	Regional data disaggregated on the base of population in the territory	Hypothesis 13% of population to cancelled (due to change of place of residence) to total population cancelled	Regional data	Existent Regional data projections at 2030 (as in high scenario projections, ISTAT, 2013)
		C	As D (Site, ST)	Hypothesis of reduction from 5% to 4% of population cancelled (due to change of place of residence) to total population cancelled	As D (District, ST)	Hypothesis of reduction from 13% to 10% of population cancelled (due to change of place of residence) to total population cancelled	As D (Region, ST)	As D (Region, MLT)
		A	As D (Site, ST)	Hypothesis of increase from 5% to 7% of population cancelled (due to change of place of residence) to total	As D (District, ST)	Hypothesis of increase from 13% to 15% of population cancelled (due to change of place of residence) to total	As D (Region, ST)	Existent Regional data projections at 2030 (as in main scenario projections, ISTAT, 2013)

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
				population cancelled		population cancelled		
		B	As D (Site, ST)	Hypothesis of increase from 5% to 10% of population cancelled (due to change of place of residence) to total population cancelled	As D (District, ST)	Hypothesis of increase from 13% to 20% of population cancelled (due to change of place of residence) to total population cancelled	As D (Region, ST)	Existent Regional data projections at 2030 (as in low scenario projections, ISTAT, 2013)
8	Revenue from Oil & Gas development	D	Existent data of Site revenues and % of Regional revenues on the base of population in the territory (source: Mise, 2013)	Total amount Site revenues % of Regional revenues for 16 years (hypothesis of constant value per year)	As D (Site, ST)	As D (Site, MLT)	Site and Regional revenues (source: Mise, 2013)	Total amount of Site and Regional revenues for 16 years (hypothesis of constant value per year)
		C	As D (Site, ST)	As D (Site, MLT)	As D (Site, ST) + increase according to barrel production for Tempa Rossa field + % of Regional revenues on the base of population in the territory	As D (Site, MLT) + increase according to barrel production for 11 years (Tempa Rossa field) + added % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	As D (Region, ST) + increase according to barrel production (VAD and Tempa Rossa fields) (hypothesis of constant value per year)	As D (Region, MLT) + increase of regional revenues according to barrel production (for 16 years VAD and 11 years Tempa Rossa fields) (hypothesis of constant value per year) added
		A	As D (Site, ST) + increase according to barrel production + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	As D (Site, MLT) + increase according to barrel production for 16 years + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year	As D (Site, ST) + increase according to barrel production (VAD and Tempa Rossa fields) + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	As D (Site, MLT) + increase according to barrel production (for 16 years VAD and 11 years Tempa Rossa fields) + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	As D (Region, ST) + increase according to barrel production (VAD and Tempa Rossa fields) (hypothesis of constant value per year)	As D (Region, MLT) + increase of regional revenues according to barrel production (for 16 years VAD and 11 years Tempa Rossa fields) (hypothesis of constant value per year) added
		B	As A (Site, ST) + increase	As A (Site, MLT) +	As A (Site, ST) + increase	As A (Site, MLT) +	As A (Region, ST) + increase	As A (Region, MLT) +

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
			according to barrel production + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	increase according to barrel production for 16 years + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	according to barrel production (VAD and Tempa Rossa fields) + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	increase according to barrel production (for 16 years VAD and 11 years Tempa Rossa fields) + % of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	according to barrel production (VAD and Tempa Rossa fields) (hypothesis of constant value per year)	increase of regional revenues according to barrel production (for 16 years VAD and 11 years Tempa Rossa fields) (hypothesis of constant value per year) added
9	Hydrocarbon bonus benefit	D	Existent data (source: Mise, 2013)	Total amount for 16 years (hypothesis of constant value per year)	Existent data (source: Mise, 2013)	Total amount for 16 years (hypothesis of constant value per year)	Existent data (source: Mise, 2013)	Total amount for 16 years (hypothesis of constant value per year)
		C	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	As D (Region, ST) + increase in regional revenues according to barrel production (VAD and Tempa Rossa fields) (hypothesis of constant value per year)	As D (Region, MLT) + in regional revenues according to barrel production (for 16 years VAD and 11 years Tempa Rossa fields) (hypothesis of constant value per year) added
		A	% of regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of regional revenues on the base of population in the territory (hypothesis of constant value per year)	As C (Region, ST) + increase in regional revenues according to barrel production (VAD and Tempa Rossa fields) (hypothesis of constant value per year)	As C (Region, MLT) + increase in regional revenues according to barrel production (for 16 years VAD and 11 years Tempa Rossa fields) (hypothesis of constant value per year) added
		B	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	% of Regional revenues on the base of population in the territory (hypothesis of constant value per year)	As A (Region, ST) + further increase in regional revenues according to barrel production (VAD and Tempa Rossa	As A (Region, MLT) + further increase in regional revenues according to barrel production (for 10 years

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
							fields) (hypothesis of constant value per year)	VAD and 5 years Tempa Rossa fields) (hypothesis of constant value per year) added
10	Number of schools within 5 km from areas interested by developmental activities/ total number within the territory	D	Buffer around VAD field; Existent data for schools	Buffer around VAD field; Number of schools as D (Site, ST)	Buffer around VAD field; Existent data for schools	Buffer around VAD field; Number of schools as D (District, ST)	Buffer around VAD field; Existent data for schools	Buffer around VAD field; Number of schools as D (Region, ST)
		C	As D (Site, ST)	As D (Site, MLT)	Buffer around VAD and Tempa Rossa fields (41+6)	Buffer around VAD and Tempa Rossa fields (41+6 wells)	Buffer around VAD and Tempa Rossa fields (41+ 6 wells)	Buffer around VAD and Tempa Rossa fields (41+6 wells)
		A	As D (Site, ST)	No new wells but more production	No new wells but more production	No new wells but more production	No new wells but more production	No new wells but more production
		B	Increase of buffer for presence new wells (hypothesis 9 VAD field)	Increase of buffer for presence new wells (hypothesis 9 VAD field)	Increase of buffer for presence new wells (hypothesis 9 VAD + 15 Tempa Rossa fields)	Increase of buffer for presence new wells (hypothesis 9 VAD + 15 Tempa Rossa fields)	Increase of buffer for presence new wells (hypothesis 9 VAD + 15 Tempa Rossa fields)	Increase of buffer for presence new wells (hypothesis 9 VAD + 15 Tempa Rossa fields)
11	Number municipalities protesting / total municipalities	D	Existent information Hypothesis 60% (6/10)	0 (due to the progressive dismission)	Existent information Hypothesis 57% (20/35)	0 (due to the progressive dismission)	Existent information Hypothesis 35% (46/131)	0 (due to the progressive dismission)
		C	As D (Site, short term)	As D (Site, short term)	Hypothesis 49% (17/35)	0 (due to the progressive dismission)	Hypothesis 33% (43/131)	0 (due to the progressive dismission)
		A	As D (Site, short term)	As D (Site, short term)	Hypothesis 49% (17/35)	Hypothesis 31% (11/35) (due to agreements with local population in Upper VAD)	As C (Region, ST)	27% (35/131) (due to agreements with local population in Upper VAD)
		B	Hypothesis 60% (6/10)	Hypothesis 60% (6/10)	Hypothesis 49% (17/35)	Hypothesis 49% (17/35)	Hypothesis 33% (43/131)	Hypothesis 33% (43/131)
12	Value Added (Meuro) / yearly total crude Oil & Gas production (kBoe)	D	Existent data for VA and productions (Oil & gas production same values for District and Region)	2% VA increase	Existent data for VA and productions (Oil & gas production same values for Site and Region)	2% VA increase	Existent data for VA and productions (Oil & gas production same values for Site and District)	2% VA increase
		C	Hypothesis increase in VA (%): agriculture 0,5; industry 0,5; constructions 1,0; services	Hypothesis increase in VA (%): agriculture 5; industry 8; constructions 10; services 4	Hypothesis increase in VA (%): agriculture 0,5; industry 0,5; constructions 1,0; services	Hypothesis increase in VA (%): agriculture 5; industry 8; constructions 10; services 4	Hypothesis increase in VA (%) as rest of Basilicata: agriculture 0,8; industry 0,5; constructions	Hypothesis increase in VA (%) as rest of Basilicata: agriculture 10; industry 5; constructions

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
			0,5		0,5		1,0; services 0,7	10; services 4
		A	Hypothesis increase in VA (%): agriculture 0,3; industry 0,3; constructions 1,0; services 0,3	Hypothesis increase in VA (%): agriculture 4; industry 15; constructions 8; services 4	Hypothesis increase in VA (%): agriculture 0,3; industry 0,3; constructions 1,0; services 0,3	Hypothesis increase in VA (%): agriculture 4; industry 15; constructions 8; services 4	Hypothesis increase in VA (%) as rest of Basilicata: agriculture 0,7; industry 0,5; constructions 1,0; services 0,3	Hypothesis increase in VA (%) as rest of Basilicata: agriculture 10; industry 10; constructions 8; services 4
		B	As A (Site, ST)	Hypothesis increase in VA (%): agriculture 2, industry 15, constructions 8, services 2	As A (District, ST)	Hypothesis increase in VA (%): agriculture 2, industry 15, constructions 8, services 2	As A (Region, ST)	Hypothesis increase in VA (%) as rest of Basilicata: agriculture 7, industry 12, constructions 8, services 4
13	km/km^2 of roads and trails	D	Sum of linear road and trails extension to a buffer of 3000 km (referred to the existent VAD field)	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	As D (District, ST)
		C	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	Sum of linear road and trails extension to a buffer of 3000 km (referred to VAD and Tempa Rossa fields)	As D (Site, ST)	As C (District, MLT)
		A	As C (Site, ST)	As C (Site, MLT)	As C (District, ST)	As C (District, MLT)	As C (District, ST)	As C (District, MLT)
		B	As A (Site, ST)	Sum of linear road and trails extension to a buffer of 3000 km (referred to increase due to new wells - VAD rossa field)	As A (District, ST)	Sum of linear road and trails extension to a buffer of 3000 km (referred to increase due to new wells - VAD and Tempa rossa fields)	As A (District, ST)	Sum of linear road and trails extension to a buffer of 3000 km (referred to increase due to new wells - VAD and Tempa rossa fields)
14	Amount of water re-injected after Oil & Gas upstream treatment	D	Existent data (source: ENI, 2012; 2013) (same values for District and Region)	Calculated on the base of barrels produced (same values for District and Region)	Existent data (source: ENI, 2012; 2013) (same values for District and Region)	Calculated on the base of barrels produced (same values for Site and Region)	Existent data (source: ENI, 2012; 2013) (same values for District and Region)	Calculated on the base of barrels produced (same values for Site and District)

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
		C	As D (ST)	As D (MTL)	Added increase due to Tempa Rossa field calculated on the base of barrels produced	Added total amount for 11 years for Tempa Rossa (hypothesis constant yearly re-injection)	As C (District, ST)	As C (District, MTL)
		A	Added increase in contribution due to VAD field calculated on the base of barrels produced	Added total contribution for 16 years (VAD field) (hypothesis constant yearly re-injection)	Added increase in contribution due to Tempa Rossa field calculated on the base of barrels produced	Added total amount of contribution for 11 years (Tempa Rossa field) (hypothesis of constant yearly re-injection)	As A (District, ST)	As A (District, MLT)
		B	As A (Site, ST)	As A (Site, MLT) + total contribution for 10 years due to further increase in production for VAD field (hypothesis constant yearly re-injection)	As A (District, ST)	As A (District, MLT) + total contribution due to further increase in production for 10 years (VAD field) and 5 years (Tempa Rossa field) (hypothesis of constant yearly re-injection)	As B (District, ST)	As B (District, MLT)
15	Protected area in a buffer of 3000 m from oil & gas field/ territory	D	Existent data	As D (Site, ST)	Existent data	As D (District, ST)	Existent data	As D (Region, ST)
		C	As D (Site, ST)	As D (Site, ST)	As D (District, ST)	Added Tempa Rossa field	As D (Region, ST)	Added Tempa Rossa field
		A	As C (Site, ST)	As C (Site, MLT)	According to buffer extension for increase in wells	According to buffer extension for increase in wells	According to buffer extension for increase in wells	According to buffer extension for increase in wells
		B	As C (Site, ST)	According to buffer extension for increase in wells	According to buffer extension for increase in wells	According to buffer extension for increase in wells	According to buffer extension for increase in wells	According to buffer extension for increase in wells
16	Protected area in a buffer of 3000m from oil & gas field / protected area in territory	D	Existent data	As D (Site, ST)	Existent data	As D (District, ST)	Existent data	As D (Region, ST)
		C	As D (Site, ST)	As D (Site, ST)	As D (District, ST)	Added Tempa Rossa field	As D (Region, ST)	Added Tempa Rossa field
		A	As C (Site, ST)	As C (Site, MLT)	According to buffer extension for increase in wells	According to buffer extension for increase in wells	According to buffer extension for increase in wells	According to buffer extension for increase in wells
		B	As C (Site, ST)	According to buffer extension for	According to buffer extension for	According to buffer extension for	According to buffer extension for	According to buffer extension for

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
				increase in wells	increase in wells	increase in wells	increase in wells	increase in wells
17	Land managed with organic method/territory	D	Existent data	Hypothesis of 20% increase	Existent data	Hypothesis of 20% increase	Existent data	Hypothesis of 20% increase
		C	Existent data	Hypothesis of 10% increase	Existent data	Hypothesis of 10% increase	Existent data	Hypothesis of 25% increase
		A	Existent data	Hypothesis of 30% increase	Existent data	Hypothesis of 30% increase	Existent data	Hypothesis of 15% increase
		B	Existent data	Hypothesis of 60% decrease	Existent data	Hypothesis of 60% decrease	Existent data	Hypothesis of 15% decrease
18	Land area affected by Oil & Gas activities/territory – percentage	D	Existent data	As D (Site, ST)	Existent data	As D (District, ST)	Existent data	As D (Region, ST)
		C	As D (Site, ST)	As D (Site, MLT)	According to new wells and more production	According to new wells and more production	According to new wells and more production	According to new wells and more production
		A	As C (Site, ST)	As C (Site, MLT) no new wells but more production	As C (District, ST)	As C (District, MLT) no new wells but more production	As C (Region, ST)	As C (Region, MLT)
		B	As A (Site, ST)	According to new wells and more production	As C (District, ST)	According to new wells and more production	As C (District, ST)	According to new wells and more production
19	Number of actions	D	Qualitative assessment (existent information about regional policies for enhancing agriculture and tourism - values as for District and Region)	As D (Site, ST)	Qualitative assessment (existent information about regional policies for enhancing agriculture and tourism - values as for Site and Region)	As D (District, ST)	Qualitative assessment (existent information about regional policies for enhancing agriculture and tourism - values as for Site and District)	As D (Region, ST)
		C	-	Subscription of agreement for promoting local occupation Strict consultation among decisional levels	-	Subscription of agreement for promoting local occupation Strict consultation among decisional levels	-	Subscription of agreement for promoting local occupation Strict consultation among decisional levels
		A	Subscription of a memorandum agreement " Local content" for promoting activities in the Oil & Gas sector chain ensuring local occupation	As A (Site, ST)	Subscription of a memorandum agreement " Local content" for promoting activities in the Oil & Gas sector chain ensuring local occupation	As A (District, ST)	Subscription of a memorandum agreement " Local content" for promoting activities in the Oil & Gas sector chain ensuring local occupation	As A (Region, ST)
		B	As A (Site, ST)	As A (Site, MLT)	As A (District, ST)	As A (District, MLT)	As A (Region, ST)	As A (Region, MLT)

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
20	Value Added / expenses in R&D (VA as in ID 12 for analogous scenarios)	D	Existent data (expenses in R&D derived by distribution of the regional expenses for inhabitants)	Hypothesis of 20% increase for expenses in R&D	Existent data (expenses in R&D derived by distribution of the regional expenses for inhabitants)	Hypothesis of 20% increase for expenses in R&D	Existent data (expenses in R&D derived by distribution of the regional expenses for inhabitants)	Hypothesis of 20% increase for expenses in R&D + 2% increase in VA
		C	Expenses in R&D derived by distribution of the regional expenses for inhabitants as C (Region, ST)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as C (Region, MLT)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as A (Region, ST)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as A (Region, MLT)	As D (Region, ST)	Hypothesis of 20% increase for expenses in R&D
		A	Expenses in R&D derived by distribution of the regional expenses for inhabitants as A (Region, ST)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as A (Region, MLT)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as A (Region, ST)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as A (Region, MLT)	As D (Region, ST)	Hypothesis of 5% increase for expenses in R&D
		B	Expenses in R&D derived by distribution of the regional expenses for inhabitants as B (Region, ST)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as B (Region, MLT)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as B (Region, ST)	Expenses in R&D derived by distribution of the regional expenses for inhabitants as B (Region, MLT)	As D (Region, ST)	Hypothesis of 10% increase for expenses in R&D
21	Financial contribution	D	Company contribution for local development (for activities, events, agreements, territory promotions) (Average on four year (2009-2012)	Total amount for 16 years	-	-	-	-
		C	Forfeit contribution (VAD field) Financial contribution to Region calculated on the base of population in the territory (Tempa Rossa field) (hypothesis	Total amount for 16 years (VAD field)	Financial contribution to Region calculated on the base of population in the territory (Tempa Rossa field) + Forfeit contribution (VAD field) (hypothesis of constant	Total amount for 16 years VAD and 11 Tempa Rossa fields	Company contribution according to production (50 cent/barrel)	Total amount Company contribution according to production (50 cent/barrel)

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
			of constant value per year)		value per year)			
		A	Forfeit contribution (VAD field) + Financial contribution to Region calculated on the base of population in the territory (Tempa Rossa field) (hypothesis of constant value per year)	Total amount for 16 years (VAD field) + Financial contribution to Region calculated on the base of population in the territory for 11 years (Tempa Rossa field) (hypothesis of constant value per year	Financial contribution to Region calculated on the base of population in the territory (Tempa Rossa field) + Forfeit contribution (VAD field) (hypothesis of constant value per year)	Financial contribution to Region calculated on the base of population in the territory for 11 years (Tempa Rossa field)+ Total amount forfeit contribution for 16 years (VAD field)	Company contribution according to production (50 cent/barrel)+ Forfeit contribution (VAD field)	Total amount Company contribution according to production (50 cent/barrel)+ Forfeit contribution for 16 years (VAD field)
		B	As A (Site, ST)+ Financial contribution to Region calculated on the base of population in the territory (Tempa Rossa field)	As A (Site, MLT) + further company contribution according to increased production for 5 years calculated on the base of population in the territory (hypothesis of constant value per year)	As A (District, ST) + further company contribution according to increased production calculated on the base of population in the territory (hypothesis of constant value per year)	As A (District, MLT) + further company contribution according to increased production for 5 years calculated on the base of population in the territory (hypothesis of constant value per year)	As A (Region, ST) + further company contribution according to increased production cent/barrel)	As A (Region, MLT) + further company contribution according to increased production for 5 years (50 cent/barrel)
22	Number of actions for compensation	D	-	-	-	-	-	-
		C	-	Indirect benefit for upper VAD population due to gas extracted in the district allocated to local population in the District	-	Gas extracted allocated to local population (5.633 kboe for 11 years)	-	Indirect benefit for total population due to gas extracted in the district allocated to local population in the District
		A	-	Gas extracted allocated to local population (4.392 kboe for 16 years) + Indirect benefit for the Upper VAD population due to gas extracted in the district	-	Gas extracted allocated to local population (5.633 kboe for 11 years) + Indirect benefit for the District population due to gas extracted in the district allocated to	-	Indirect benefit for total population due to gas extracted in the district allocated to local population in the Site and District

ID	Description	Scen.	Method for deriving values for the four scenarios					
			SITE		DISTRICT		REGION	
			Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)	Short term (ST)	Medium/ Long term (MLT)
				allocated to local population in the District		local population in the Upper VAD		
		B	-	Gas extracted allocated to local population (5.078 kboe for 16+10 years) + Indirect benefit for the Upper VAD population due to gas extracted in the district allocated to local population in the District	-	Gas extracted allocated to local population (8.194 kboe for 11+5 years) + Indirect benefit for the District population due to gas extracted in the district allocated to local population in the upper VAD	-	Indirect benefit for total population due to gas extracted in the district allocated to local population in the Site and District
23	Number of actions	D	Existence of regional observatory for monitoring and information management	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)
		C	As D (Site, ST) + Companies contribution to transparency (annual reports for local population)	As D (Site, ST) + Companies contribution to transparency (annual reports for local population)	As D (Site, ST) + Companies contribution to transparency (annual reports for local population)	As D (Site, ST) + Companies contribution to transparency (annual reports for local population)	As D (Site, ST) + Companies contribution to transparency (annual reports for local population)	As D (Site, ST) + Companies contribution to transparency (annual reports for local population)
		A	As D (Site, ST)	As D (Site, ST)	As D (Site, ST) + Participation of local workers to baseline monitoring (Tempa Rossa field)	As D (Site, ST)	As D (Site, ST) + Participation of local workers to baseline monitoring (Tempa Rossa field)	As D (Site, ST)
		B	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)	As D (Site, ST)

Key to abbreviations:

MLT = Medium/Long Term;
R&D = Research and Development;
Scen. = Scenario;
ST = Short Term;
VA = Value Added;
VAD = Val d'Agri.