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THE NEW ENTREPRENEURIAL OPPORTUNITY RECOGNITION PROCESS

- Assessing the role of public intervention on the electricity market -

Doctoral Dissertation

Loredana Sasso

Supervisor: Prof. Gianmaria Martini, PhD

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INTRODUCTION

The background

"In this second decade of the 21st century, on the backdrop of a changing world order, Europe faces a series of crucial challenges: low growth, insufficient innovation, and a diverse set of environmental and social challenges. Europe 2020, the EU's comprehensive long-term strategy, recognizes these challenges and argues that Europe faces a moment of transformation.

The solutions to all of these problems are linked. It is precisely by addressing its environmental and social challenges that Europe will be able to boost productivity, generate long-term growth and secure its place in the new world order.

Science and innovation are key factors that will help Europe to move towards smart, sustainable, inclusive growth, and along the way to tackle its pressing societal challenges. But Europe suffers from a number of critical weaknesses in its science and innovation system which contribute to the above problem.

The key driver of the problems is Europe's structural innovation gap: compared to its competitors, Europe's patenting performance is weak and it lags behind in developing new products, new processes and new services. To boost productivity and growth, it is critically important to generate breakthrough technologies and translate them into new products, processes and services."(European Commission, 30/11/2011, SEC(2011) 1428)

Therefore, increasing the entrepreneurial level is crucial. Europe has taken an early technological lead in many key technology areas, but in the face of growing competition its advantage is tenuous, and has not translated into an innovative and competitive lead. A timely and targeted European policy is needed if Europe wants to remain competitive. There is a clear case for public intervention to tackle the problems above. Markets alone will not deliver European leadership. However, Member States acting alone will not be able to make the required public intervention. Their investment in research and innovation is comparatively low, is fragmented and suffers from inefficiencies - a

crucial obstacle when it comes to technological paradigm shifts. It is difficult for Member States on their own to accelerate technology development over a sufficiently broad portfolio of technologies, or to tackle the lack of transnational coordination.

As highlighted in the proposal for the next Multi-annual Financial Framework, the EU is well positioned to provide added value, through measures of regulation which can enhance competitiveness and innovation investing on some critical areas such as entrepreneurship, clean energy and information and communication technologies.

At the moment when the present work started to be thought, Europe 2020 was just an idea, the antecedent of this programme, from where the idea of this research took origin, was the CIP, Competitiveness and Innovation Programme, which was mainly focused on providing better access to finance and delivering business support services in the regions taking small and medium-sized enterprises (SMEs) as its main target. It encouraged a better take-up and use of information and communication technologies (ICT) and helped to develop the information society. It also was intended to promote the increased use of renewable energies and energy efficiency. The CIP runs from 2007 to 2013 with an overall budget of € 3.621 million. It was divided into three operational programmes. Each programme has its specific objectives, aimed at contributing to the competitiveness of enterprises and their innovative capacity in their own areas, such as ICT or sustainable energy:

- The Entrepreneurship and Innovation Programme (EIP)
- The Information Communication Technologies Policy Support Programme (ICT-PSP)
- The Intelligent Energy Europe Programme (IEE)

Clearly now, the Europe 2020 programme should build on the experience from past Framework Programmes for Research and Technological Demonstration (FP7), the Competitiveness and Innovation Programme (CIP), and the European Institute of Technology and Innovation (EIT). In fact, important lessons can be learnt from the past, including academic insights and stakeholder feedback. Research, innovation and education should be addressed in a more coordinated manner and research results better disseminated and valorized into new products, processes and services. The intervention logic should be more focused, concrete, detailed and transparent. Programme access

should be improved and participation increased from start-ups, SMEs, industry, less performing Member States and extra-EU countries.

In this scenario, FP7, the innovation-related part of the CIP (Competitiveness Innovation Programme), and the EIT are fully integrated into a single unitary framework: Horizon 2020, The Framework Programme for Research and Innovation. Horizon 2020 will focus resources on three distinct, yet mutually reinforcing, priorities, where there is clear Union added value.

These priorities correspond to those of Europe 2020 and the Innovation Union:

(1) **Excellent Science**. It will support the best ideas, develop talent within Europe, provide researchers with access to priority research infrastructure, and make Europe an attractive location for the world's best researchers.

(2) **Industrial Leadership**. This will aim at making Europe a more attractive location to invest in research and innovation (including eco-innovation), by promoting activities where businesses set the agenda with dedicated support for ICT.

(3) **Societal Challenges**. This reflects the policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere. It will include establishing links with the activities of the European Innovation Partnerships.

Sustainable development will be an overarching objective of Horizon 2020. The dedicated funding for climate action and resource efficiency will be complemented through the other specific objectives of Horizon 2020 with the result that at least 60 % of the total Horizon 2020 budget will be related to sustainable development, the vast majority of this expenditure contributing to mutually reinforcing climate and environmental objectives. It is expected that around 35% of the Horizon 2020 budget will be climate related expenditure.

This flagship initiative includes a commitment to ensure strong participation by SMEs in Horizon 2020. SMEs have significant innovation potential and they have the agility to bring revolutionary technological breakthroughs and service innovation to the market. Strengthening the approach to SMEs, including enhancing the participation of micro-enterprises, is vital if Horizon 2020 is to help the fast-growing companies of today to become the multinationals of tomorrow.

The aim of international cooperation in Horizon 2020 will be to strengthen the Union's excellence and attractiveness in research, to tackle global challenges jointly and to support the Union's external policies. The focus of international cooperation in Horizon 2020 will be on cooperation with three major country groupings:
(1) industrialised and emerging economies;
(2) enlargement and neighbourhood countries;
(3) developing countries.

Where appropriate, Horizon 2020 will promote cooperation at regional or multilateral level.
International cooperation in research and innovation is a key aspect of the Union's global commitments and has an important role to play in the Union's partnership with developing countries, which are often disproportionately affected by global challenges.
"The enhanced scientific, technological and innovation impacts produced by Horizon 2020 should translate into larger downstream economic and competitiveness impacts. It is estimated that by 2030 it could generate the following impacts over and above the BAU option:

- ✓ *Horizon 2020 will stimulate Europe's economic growth, generating 0.53 percent of extra GDP.*
- ✓ *It will also enhance Europe's competitiveness, increasing its exports by 0.79 percent, and reducing its imports by 0.1 percent.*
- ✓ *It will create jobs for Europe's citizens, increasing employment by 0.21 percent."*

(European Commission, 30/11/2011, SEC(2011) 1428)

Consequently the Horizon 2020 programme and, more in general, the European Union recognizes the centrality of an entrepreneurial culture to allow the economic growth of EU Member States, to increase clean energy investment and sustainable development and, considering these two connected target together, cooperation (with the above cited typologies of countries) is the desirable enabling component for the success of the two previous objectives.

We have considered the unique nature of Italy: a EU Member State situated in the center of the Mediterranean sea and a country distinguished by its particular entrepreneurial system, historically characterized by SMEs and industrial specialized districts that are full of strong relations inside. Therefore we have decided to focus the analysis on two of the previous objectives that are strictly linked and the two that are able to take into account the specificities of Italy as described above. We have tried to deepen the analysis, not that much known and spread in the Italian academic context, related to the opportunity recognition process and its centrality in the creation of new business opportunities and consequently new ventures in the form of SMEs. We have understood the importance of public incentives in improving the entrepreneurial investments and we have seen how these incentives, inserted in a specific regulatory framework, can be crucial in enhancing entrepreneurship in those activities linked to clean energy production and transmission.

Consequently we have investigated this aspect trying to identify suitable regulatory frameworks for incentivizing transmission investment to enable international exchange and local use of renewable energy in EU-MENA region. This topic is particularly relevant for us considering that Italy can be viewed as the hub of the relations among the south (Africa), the east (Middle East), the North and the West (rest of Europe), and this aspect is relevant in terms of potential interconnections with countries that are rich in natural resources useful especially for clean energy (that is one of the main goal targeted from the EU).

The aim of the study

Many contributions on entrepreneurship concentrate on the process after an opportunity has been discovered and analyze the different steps of a new venture creation, instead our interest is towards the process of opportunity recognition (OR) in the attempt to investigate those factors influencing the entrepreneur in identifying and exploiting such opportunities, showing that concentrating only on the individual traits or on the new firm fails to fully understand this complex phenomenon. This process appears to be a more fruitful area of research because it acknowledges that opportunity recognition is a

multifaceted phenomenon influenced by numerous factors that may be critical to its outcome.

Therefore, in the debate, the suggestion that individuals interpret reality and create an opportunity reconciling their ideas with what emerges from the environment makes sense. Then, exploiting opportunities changes the reality and gives the possibility to other opportunities to be discovered and created by the individuals, again modifying the structure and so on.

Following this advice we decided to go directly to the roots of the phenomenon and, listening to the personal experience of the entrepreneurs, we attempt to relate the individual, with his personal traits, to the formation/recognition process of a profitable entrepreneurial opportunity. This matching attempt considers, on one side, the different sources for innovative opportunity, as pointed out by Drucker (1985) and, on the other, several traits of human personality which seems to be connected with a greater chance to start a new venture.

The approach to the opportunity recognition process is made through a qualitative analysis. Our sample of entrepreneurs will allow us to achieve a more comprehensive description of the process through a combined analysis of the diverse factors involved that have been mainly studied separately. The interviews gave us an enormous set of information and, subsequently, using the tools suggested by the literature, we have classified all these information and had the opportunity to reach a better comprehension of this complex but intriguing phenomenon.

The sample is made up by 52 entrepreneurs and the information used in the thesis have been collected through personal interviews performed in the last years. To identify the entrepreneurs we used different sources: some venture capitalists, a community of first generation entrepreneurs and the Confederation of firms in Lombardy. The research has mainly taken place in Lombardy, a rich and industrialized region in the north of Italy, especially along the area of Milan and neighborhoods. In the sample of technology based firms there are both recently born firms and some less recent, we also have few serial entrepreneurs entering in the sample with only one venture.

Using the sample we want to investigate both the profile of the entrepreneurs outlining their main features and, if possible, to point out some regularities concerning the opportunity recognition process. Our concern has been to highlight the elements that

can help institutions, public and private, to develop and refine policies and support regulatory frameworks for entrepreneurship.

The respondents were asked to tell their story, initially the narration was totally free but, step by step, the individuals were plied by some specific questions guided by a scheme expressly created in the attempt to highlight the key steps on the way through the discovery and the exploitation of the entrepreneurial opportunity.

The pattern of the interviews followed the advices emerged from the main literature available at the state of the art. In detail, as to the description of the distinctive personal traits influencing the opportunity recognition process, we referred to the classification suggested by Mueller and Thomas (2001). They selected four basic areas connected with the recognition of an opportunity: (1) the mental processes, (2) the knowledge, (3) the experience and (4) the environment surrounding the entrepreneur.

The mental processes pertains to all the aspects linked to the individual personality, his creativity, need for achievement and locus of control, his tolerance and ability to take advantage from ambiguous and complex situations and, finally, a risk perception below average. In particular, we have investigated the role played by the networks and eventually by teams in supporting the entrepreneurs in the new venture. Referring to networks, Granovetter (1973, 1995) points out that the ability to create new ideas comes, in general, from being a member of a network, especially if people are connected by weak ties. Teams play a different role and their relative importance shows a more or less need for support by the respondents. This allows us to classify our entries as “solo entrepreneurs” or “network entrepreneurs”. We also investigate the motivation to the entrepreneurial career: if the search was internally or externally stimulated and if the process of discovery was guided by alertness or awareness.

According to concern (2) and (3), we explore the sources of information and prior knowledge mastered by our entrepreneurs, in particular previous working experiences can represent a corridor principle for the discovery of the opportunity or, at least, can create a set of competencies useful to identify some interesting opportunities invisible to others.

Knowledge and experience play a pivotal role in the OR process in high-tech industries. The ability to develop, utilize and adapt knowledge, in particular technical knowledge, is critical for a firm operating in such high-tech environment (Oakey 2003; Park 2005).

Therefore, during the interviews we investigate the importance of technology in exploiting an opportunity; as a matter of fact many contributions focus on the knowledge of the market, leaving mostly unexplored the specific role of technical knowledge. Furthermore, concerning the nature of the opportunity, we also attempt to evaluate the degree of connection between the new opportunity recognized and the previous ones exploited by the entrepreneur (Holcombe, 2003).

The last area explored concerns the impact of the environment on the OR process, precisely we look at the particular familiar background of the entrepreneur and focus on the specific moment in his/her life when a strategic window has opened the horizons on new possibilities.

Finally, sharing the position of researchers about the limits of an investigation based mainly on entrepreneurial traits and, therefore, agreed upon the idea that identifying opportunities is a several steps process over time, we asked the entrepreneurs to distinguish the elements of the creative process they went through and, if possible, to identify the stages during the process of opportunity recognition. More precisely we propose the five different elements pointed out by Hills, Shrader and Lumpkin (1999), and previously by Wallas (1926) while identifying a creative process, as preparation, incubation, insight, evaluation and elaboration.

After listening to the entrepreneurs' experiences and reconciling them with the theoretical background suggested by the literature, we have reached some evidences about the following main areas of interest:

I. the typology of opportunity, how it appears in the market and how someone can discover it;
II. the personal characteristics of the entrepreneur;
III. the way the individual relates to the opportunity in the specific process that highlights clearly the indissoluble individual-opportunity nexus.

The second part of the study, the one dedicated to interconnections for energy transmission among EU and MENA countries aims to identify suitable regulatory frameworks and business models for transmission investment to enable new entrepreneurship involving international exchange and local use of renewable energy across the EU and MENA regions.

The analysis explores how policy frameworks can support the entrepreneurial investment in the realization of individual transmission lines and their use to support renewable project investment and energy transport in the short-term, e.g. next ten years. The current ten year network development plan of ENTSO-e envisages such lines between Italy and Tunisia and between Italy and Algeria with a total capacity of 1.5 GW. An interconnection of similar scale already exists between Spain and Morocco. Grid and renewable projects could facilitate closer cooperation between the EU and MENA regions to support their economic development, job prospects and reducing reliance on domestic subsidized gas purchases.

For the longer-term, large scale transmission between EU and MENA can lead to large cost savings, as it can enable an arbitrage in the daily and seasonal profiles of wind and solar plants and demand in the EU and MENA countries, and can allow to access some of the better resource potentials (DII, 2012). Such large scale energy cooperation requires early projects to develop trust, experience on institutional and technology sides and continuous dialog among all stakeholders involved. Therefore policy frameworks to support individual entrepreneurial investment projects also need to be assessed with regard to their ability to contribute towards such a longer-term perspective.

We first assessed issues associated with transmission investment in general and related to transmission in the context of desert power projects. The analysis was based on a review of existing literature and conducted interviews with 36 experts and different categories of stakeholders from Spain, Italy, UK, Netherlands, Scotland, Morocco, Algeria and Tunisia. They were selected based on their experience with different business models for interconnection projects. These include regulated transmission investment with an example of Morocco-Spain interconnector, merchant investment with an example of BritNed, and concession based transmission investment with an example of the UK offshore grid investments. Based on the stakeholders' experience with the current situation in Morocco, Algeria, Italy and Spain they provided us with insights relating to the EU-MENA cooperation linked to desert power.

Table 1. Summary of most frequent concerns in interviewees and in literature

Frequency of concerns mentioned and connected level of risk	Regulated investment	Concession-based invest.	Merchant investment
Desert power related concerns			
Lack of national interest	High		
Building trust between countries	High		
Interconnection specific concerns			
Selected stakeholders oppose	High (MENA) / Medium (EU)		
Co-ordination	Medium		
Permitting	Medium (MENA) / High (EU)		
Business model related concerns			
TO not motivated	High	-	-
Access to capital	Medium	-	-
Cost allocation between countries	High	High	-
Define quality for T line	-	Medium	-
Operation and expansion flexibility	-	Medium	Medium
Under-sizing	-	-	High
High cost of capital	-	-	High

As we can see from Table 1, merchant based transmission investments are often presented as a way to bypass blockages from transmission owners or regulators in neighboring countries. However, Table 1 illustrates that for the success of merchant based investments, the generic desert power and interconnection specific concerns, together with the strong connected risks of failure perceived by the potential entrepreneurs investing in these kinds of interconnection projects, need to be addressed. Indeed, transmission lines cannot be delivered without support of regulator and transmission owners who need to integrate the line into the existing network. This might explain why merchant based transmission investments, while very prominently represented in the literature and studies, in practice remain very rare (e.g. one line in Europe between UK and Netherlands, one line in Australia, several in the USA).

Concession based approaches for transmission investment offer an opportunity to engage resources of multiple competing project developers while creating contractual arrangements that can make the long-term value of transmission infrastructure accessible for financial investors and thus can allow for access of low-cost finance.

While so far rarely applied, this approach should be considered more actively as an alternative to a regulated transmission investment, as the analysis points out at its value.
Irrespective of the business model, the successful implementation of an interconnection project requires a comprehensive set of actions by governments, regulators and project developers to address difficulties. In the detailed discussion of the last chapter we describe various options for how these issues can in principle be successfully addressed. Their implementation will however require sufficient political support to ensure that public authorities (government, regulator etc) pursue them in a timely manner.

Methodology

The methodology implemented is mainly based on qualitative analysis realized through open interviews following the advices coming from Grounded Theory.
The grounded theory (GT) is a qualitative research methodology belonging mainly to sociology research, and recalling the so called “Interpretative Paradigm”. The main aim of GT is to allow the researcher to interpret the processes underneath a certain phenomenon.
The term grounded theory is typically used to label a specific mode of qualitative inquiry and the resultant products of that inquiry.
The grounded theory was first introduced by Barney and Glaser in 1967, with the intention to overcome the deep crisis incoming in qualitative research during the ‘60s, in a period where the quantitative research seemed to be the unique tool to make good research. For any in depth view of this theory the reader can refer to "The discovery of Grounded Theory" (Glaser and Strauss, 1967).
For the purpose of our work, it is possible to sum up the main advantages of this methodological tool saying that it involves the discovery of theory from data (Glaser & Strauss, 1967) and it allows to develop a well integrated set of concepts that provide a thorough theoretical explanation of social phenomenon under study.

In GT studies, the discovery of theory from data is accomplished by systematically discovering, developing, and provisionally verifying theory throughout the iterative

process of data collection and analysis (Strauss & Corbin, 1990). A grounded theory should explain as well as describe.

Thus, grounded theory seeks not only to uncover relevant conditions, but also to determine how the actors respond to changing conditions and to the consequences of their actions. These are the main reasons why we are choosing this tool instead of others.

In more detail, the logical path of a grounded theory research can be described with the following steps (Auerbach and Silverstein, 2003):

- ✓ Identification of issues: we have managed to do that reading through the literature and starting questioning and hypothesizing about the evidence emerging from this first phase (anyway concepts were left open and questions left unanswered);
- ✓ Identify research concerns and what type of people may be able to address them: after having identified the focal points that need to be investigated we have created a broad list with different categories of relevant stakeholders to look at the reality from various points of view;
- ✓ Create a narrative interview suggesting important topics on which the conversation should focus, which may reveal important information. We have tried to do that being extremely open minded, not to force the respondents into the picture that we can have created in our reasoning on the topic;
- ✓ Select a sample and collect data. Generalizability comes by sampling until responses converge on a single set of issues. After having identified a sample of stakeholders that can guarantee a certain level of sample size and sample diversity, we have collected all the information and data coming from the interviews and generalized the evidences using the feedbacks that obtained a big consensus among the respondents;
- ✓ Building theoretical constructs that are the underpinnings of the eventual research findings: it means that the themes emerging by the literature and tested through the interviews are organized into more abstract ideas;
- ✓ Arriving to theoretical narrative just combining the theoretical constructs into a coherent narrative: this is just to allow us to summarize the findings. This last

step provides the connection between the original research concerns and the participants experience.

The generalizability of a grounded theory is partly achieved through a process of abstraction that takes place over the entire course of the research. The more abstract the concepts, especially the core category, the wider the theory's applicability. At the same time, a grounded theory specifies the conditions under which a phenomenon has been discovered in this particular dataset.

The most common critique to the GT method is that it is used mainly as "à la carte" approach, and this generally causes four common pitfalls: (a) getting trapped by the concentration site; (b) failing to follow the story in the data; (c) coding for content, not theory; and (d) using GT where it is not well suited (O'Reilly, Paper and Marx, 2012).

We can reformulate this pitfalls saying that the major risks in which we could incur seem to correspond with the possibility of not selecting the sample that can be representative of all the categories of stakeholders involved in a transmission electricity line project or in a traditional opportunity recognition process, or to listen to some stories that are influenced by wrong statements elaborated by the personal impressions of the respondents or to mis-interpret the story telling. We can also risk to influence the answers of the audience. That is why we tried to be the least suggestive possible, to record the interviews just to reduce the possibilities of mis-interpretation, to send back to our respondents the feedbacks that we have caught and re-elaborated after the interviews to remark if we got to the right points or not and we have always compared the objective information coming from the personal opinions of the respondents with observable and public data.

Therefore, trying to avoid these hauntings, grounded theory seems to perfectly fit the needs of our research.

We decided to choose a qualitative analysis based on a relative small numbers of entrepreneurs in the first part and of other selected stakeholders for the second part to allow an in depth comprehension of the entrepreneurial phenomenon, also considering that the crucial elements involved in this intriguing process are not only linked to the law of big numbers but also connected to social, psychological and cultural aspects that need to be particularly addressed talking directly with people. Viceversa the big sample

collected using short and closed phone interviews or similar tools fails to highlight the most interesting aspects of these phenomena, the opportunity recognition process and the business venturing in focal industries such as the technological and environmental ones.

According to the policy and regulatory approach that we decided to embrace, we thought that the unique way to understand which are the elements that really impact on entrepreneurial culture and the subsequent level of entrepreneurship for our country and the entrepreneurial investment in clean energy production projects (that are the focus of every European programme to enhance competitiveness, sustainability and innovation and allow the overcoming of this devastating crisis) was to go directly to the people involved in them. This is the reason why we preferred a qualitative more than a quantitative approach, even if a quantitative analysis attempt has been made concerning the opportunity recognition process using a factor analysis to highlight the existence of some latent factors underneath the choice of some specific people to become entrepreneurs. Some concluding remarks and policy suggestions, both in the case of opportunity recognition process and in the study about entrepreneurial investment for electricity interconnection projects, have been drawn.

CHAPTER 1

The heart of entrepreneurship: opportunity recognition

Introduction

The phenomenon of entrepreneurship has long been the subject of continuous research and debate among economists, and together with psychologists, sociologists, and scholars from the majority of the social sciences, they have spent time investigating both entrepreneurial traits and the entrepreneurial process. However, this area of study is still more of a container for numerous contributions, some closely linked and others less so, than a precise conceptual framework. This interest in entrepreneurship derives from the fact that new business ventures seem to play a relevant role in the development of the economic and social system and therefore it is viewed as an essential component of any policy aimed at fostering competitiveness and growth.

For many decades the neoclassical approach relegated the entrepreneur and his role to a less significant position within the economic system; in particular according to the mechanistic view culminating in the static notion of competitive equilibrium, the entrepreneur is a mere organizer who brings together the production factors. According to this view an entrepreneur cannot make mistakes and does not have to seize new opportunities or identify new needs to satisfy; thus he is seen as a mere tool, helping the economic system move towards an equilibrium.

Since the contributions of famous economists such as Schumpeter, Kirzner, Von Mises and Baumol, the entrepreneur has begun to assume a more central role within economic debate, along with another important concept neglected by neoclassical scholars: innovation. Schumpeter brought the entrepreneur back to the economic scene and Kirzner defined him as the discoverer *par excellence*, the one who seizes opportunities that others have overlooked.

More recently, studies on entrepreneurship have extended both the range of essential qualities this complex individual has (sociological and psychological theories), and the

contextual variables. Bringing together the different research contributions, Shane and Venkataraman (2000) make an attempt to provide a consensus definition for the domain of entrepreneurship research, defining it as 'the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated and exploited. Consequently, the field involves the study of sources of opportunities and the process of discovery, evaluation and exploitation of opportunities. It also includes the set of individuals who discover, evaluate and exploit them' (Shane and Venkataraman 2000, p. 218). This contribution focuses on the process of opportunity recognition (OR) in an attempt to investigate those factors influencing the individual as he identifies and exploits such opportunities, showing that concentrating only on entrepreneurial traits or on new firms fails to provide a full understanding of this complex phenomenon. The OR process appears to be a more fruitful area of research because it acknowledges that opportunity recognition is a multifaceted phenomenon influenced by numerous factors that may be critical to its outcome.

The work by Ucbasaran, Westhead and Wright (2001) can be considered as a good starting point for the present analysis. Opportunity recognition is a specific aspect of the entrepreneurial process; without the opportunities providing the input which stimulates the individual to realize his business ideas in economic activity, entrepreneurship itself would have no reason to exist. The relationship between individuals and opportunity has fascinated and still fascinates scholars who have ventured into the analysis of the entrepreneurial phenomenon, although it is still a research area surrounded by an aura of mystery.

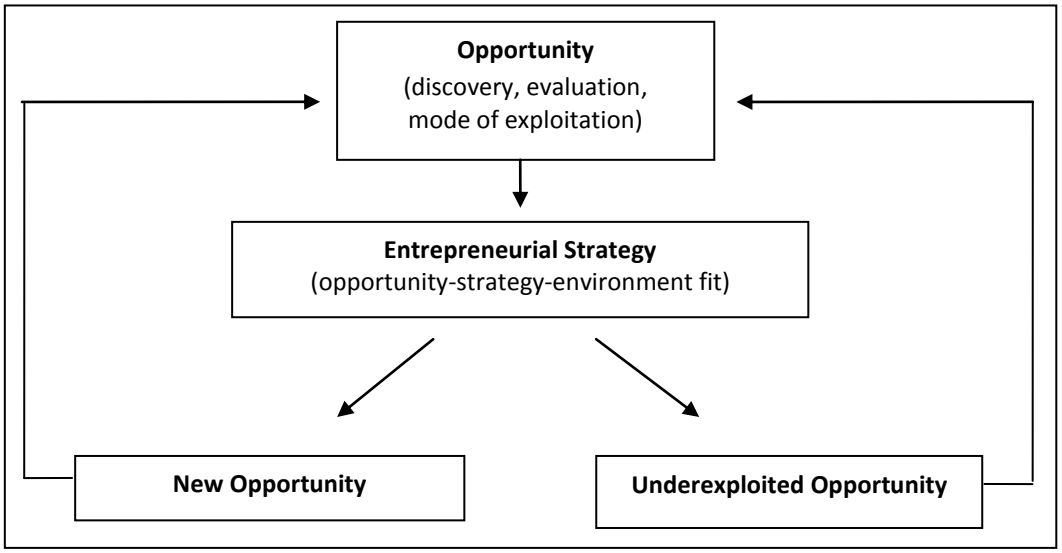
Holcombe (2003) describes the stages of the entrepreneurial process and emphasizes that it originates from the existence of opportunities. According to this author the entrepreneurial process takes shape through several phases:

1. *opportunity*: this phase includes three significant steps which lead the way to the entrepreneurial process: *discovery, evaluation* and *mode of exploitation*;

2. *entrepreneurial strategy*: refers to the moment in which the entrepreneur identifies an optimal strategy for reconciling aspects relating to the identified opportunity with the context of the entrepreneur's activity[1];

3. the two previous steps generate the inputs necessary to reactivate the virtuous circle of opportunity discovery and its exploitation: entrepreneurs supported by more knowledge and awareness may realize they underexploited opportunity, or may perceive new opportunities that previously they were unable to perceive.

Fig. 1.1 – The entrepreneurial process



Source: our elaboration from Holcombe (2003).

In the following section, we attempt to discover why, when and how the opportunity to create new goods and services are present in the economy. We then investigate why, when and how only some people are able to identify these opportunities, while others

[1] The strategic paradigms on which decision-making and organization are based are different, as each type of approach corresponds to a different way of judging opportunities. According to the *Structure-Conduct-Performance* (SCP) approach, opportunities arise from observing the industry and the needs which are still unmet. In the *Resource Based View* (RBV), they are instead found within the enterprise through the creation of resources that open the way to a greater or different use of those very resources, while in the theory of transaction costs (TCE-*Transaction Cost Economics*), opportunities arise from the possibility of reducing these costs through new organizational schemes. In the *Evolutionary Theory* they are generated by continuous deliberate search for them; finally, according to *Real Options Reasoning*, firms equip themselves to take advantage of any opportunities that may arise in the future by monitoring technological variables.

are not. The analysis focuses on the consequences of the exploitation of business opportunities, not only for those who discovered them, but for the community as a whole, and the chapter concludes with a description of some empirical works.

1.1 Entrepreneurial Opportunity: the debate

At the heart of much of today's reflection on entrepreneurship lie entrepreneurial opportunities, their discovery and their exploitation: 'entrepreneurship is primarily driven by perceptions of opportunity' (Stevenson, Roberts and Grousbeck, 1985, p. 312). In this perspective, entrepreneurship originates from the existence of opportunities that derive mainly from the disturbing factors which are present in markets; these trigger changes in consumers' needs, to which the system responds with the commercial production of new goods and services, the identification of new markets and the introduction of new production or organizational methods. These opportunities are the result of the dynamic environment, which continually opens and closes areas for business activity. 'Why, when and how do some people and not others discover and exploit opportunities?' (Shane and Venkataraman 2000, p. 218) is one of the major questions entrepreneurship research needs to address, and is the focus of the present contribution.

The works of Kirzner provide the starting point for the theoretical and empirical investigation of opportunity recognition. Kirzner's entrepreneur operates in an imperfect market defined by imbalances that stimulate entrepreneurial discovery, thus reducing the unconscious ignorance of market agents. This dynamic process depends primarily on alertness, 'the ability to notice, without search, opportunities that have hitherto been overlooked' (Kirzner 1973, p. 10). In Schumpeter, the entrepreneur is someone who systematically breaks the existing equilibrium to introduce change and innovation and create progress. He shifts the frontier of technological progress through a creative response which occurs whenever the economy or an industry or some firms in an industry do something else, something that is outside of the range of existing practices (Schumpeter, 1942).

Starting from the different views of Schumpeter and Kirzner, the debate has evolved, involving not only economics, but the broader context of the philosophy of science, giving birth to a contrast between constructivist and positivist views of the phenomenon. This contrast has been discussed in depth in studies of economics and organization, in the debate over the distinction between opportunity *discovery*, i.e. the existence of the opportunity regardless of individual perceptions, and *creation*, i.e. the possibility that opportunities are the result of social interaction and, therefore, do not exist separately from individuals. To this day both paradigms are found in research on entrepreneurship, but the positivist view, predominant in North American literature and identified as the *individual/ opportunity nexus approach*, has received more attention and has been the subject of systematic in-depth study. The constructivist (interpretative or social) position prevails in the European academic tradition; it suggests that opportunities emerge from an individual's perception and interpretation when he grasps the dynamics and the interplay of environmental forces.

The research carried out along both lines has produced an extensive body of work that focuses on the nexus between the individual and opportunity; however this remains an unclear, almost indecipherable phenomenon. On the one hand, it is difficult to explain what differentiates individuals who apparently have the same skills for recognizing opportunities, and on the other the theoretical foundations concerning the origin of opportunities are still limited, this being a difficult aspect to consider if separated from the subsequent exploitation of opportunities.

Two approaches to the process of entrepreneurial opportunity recognition derive from these positions on the nature of the opportunity: the so-called Discovery Approach (Gaglio and Taub 1992; Long and McMullan 1984; Shane 2000, 2003; Ardichvili, Cardozo and Ray 2003), and the Enactment Approach (Hills, Lumpkin and Singh, 1997, Lumpkin, Hills and Shrader, 1999; Gartner, Carter and Hills 2003; Baker and Nelson 2005). The former asserts that opportunities exist in reality regardless of individuals' self-perception, and so discovery is the only way to recognize them, while the latter believes that opportunities are subjectively created by the individual able in this way to imagine and design the future, starting from the environment and the resources available. Thus, while followers of the Discovery Approach believe that the discovery of opportunities is linked to economic factors that are independent of the entrepreneur's

action, such as information asymmetries, social, political and market changes, or technological innovations, those who adopt the Enactment Approach do not identify opportunity recognition exclusively with its discovery, but rather see it as a multi-stage process, which also includes the step of gathering the necessary information together with entrepreneurial discovery evaluation. If alertness were the only significant factor, anyone who is alert could become an entrepreneur, but the real world shows that this is not the case; hence many scholars have chosen to investigate other aspects contributing to the birth of the so-called 'entrepreneurial spirit', i.e. context, networks, work experience and skills and competencies (Colombatto 2001).

If they adopt the idea that opportunities exist in the market and are objective phenomena, scholars are only interested in understanding the factors facilitating their discovery and exploitation, and they try to evaluate empirically and measure the presence of alertness. This can be described as an efficiency approach, having the aim of creating the skills and competencies to permit a careful observation of the context surrounding the individual. For instance, Ardichvili, Cardozo and Ray (2003) find that networks and prior knowledge represent the antecedents to alertness and consequently facilitate opportunity recognition; Busenitz and Barney (1997) recognize several differences among the personal traits of a manager and an entrepreneur, identifying overconfidence and representativeness as key factors for the latter's success.

On the other hand, 'the gist of an enactment perspective is not to deny that certain concrete characteristics of an individual's circumstances exist and have an impact […] rather, the opportunity enactment perspective offers sensitivity towards viewing an environment as having features that are determined by the scope of an individual's actions' (Gartner, Carter and Hills, 2003, p. 117). Accepting this definition allows us to consider opportunity recognition as a creative process, where opportunities are not simply discovered but rather created by individuals, and so vary among entrepreneurs according to their different interpretations of knowledge and information, which are obviously mediated by the significance given to them by the unique individual interacting with his specific context in a dynamic process. In other words, the entrepreneur is able to exploit the present situation, his special perception enabling him to transform present circumstances for the better. According to this perspective, opportunity is in the mind and depends on the viewpoint of the individual.

In our view, the Enactment Approach can be considered to some extent as an evolution of the Discovery Approach, in that it contains and expands the latter. In particular, according to some scholars an individual's ability to recognize an opportunity depends on a bundle of uncontrollable factors (such as political, social and economic aspects or innate personality features) and on factors that can be controlled (such as the decision to look for a specific work opportunity or the decision to embark on risky projects). Recently, many authors have attempted to reconcile the diverse approaches to opportunity recognition (Azevedo 2002, Chiasson and Saunders 2005, Alvarez and Barney 2007, Vaghely and Julien 2010, Mole and Mole 2010) in order to avoid fragmented knowledge that often prevents fruitful synthesis. 'Numerous dichotomies in entrepreneurial research point to irreconcilable differences in the nature of entrepreneurship: independence vs. dependence, process vs. personal attributes, revolution vs. evolution, vision vs. action, and social vs. business orientations […]. The challenge of theoretical and methodological diversity is not unique to entrepreneurship. Management topics and social science disciplines deal with similar concerns' (Chiasson and Saunders 2005, p. 749)[2] .

In particular, Chiasson and Saunders (2005) argue that the *Structuration Theory* can be seen, if not as unifying the different approaches that have investigated entrepreneurial opportunities, at least as a link between the most interesting insights and considerations that the various approaches provide. The *Structuration Theory*, as it has been proposed by the sociologist Anthony Giddens (Giddens 1984, 1991) does not deal specifically with economic issues, but is rather an explanation of society in general terms. The author proposes an alternative to theories that consider social phenomena as being originated either by an agent, seen as a synonym of individual action, or by social structure, which instead represents the community. His intention is to overcome the shortcomings characterizing the two approaches that dominated social thinking during the late 80s and early 90s, represented by the 'positivist' and the 'interpretative' disciplines. As regards the former, he objected to the fact that too much importance is

[2] In particular Chiasson and Saunders (2005) consider six different approaches to the study of opportunity, three of them deterministic (*Neoclassical Equilibrium Theory*, NCET; *Coevolutionary lock-in*, CEL; *Trigger for Structural Change*, TSC), the other three more proactive (*Effectuation, Embeddedness and Relationality*, EER; *Path Creation*, PC, and *Prior Knowledge and Feedback Learning*, PKF) and show how, according to them, the Structuration Theory is able to overcome the dichotomies present in these different visions and enhance the contributions of each them in the study of entrepreneurial opportunities.

given to structure, regardless of the agent's intellectual and intervention abilities; as regards the second view, which sees the agent as highly resourceful, especially in the field of entrepreneurship, he criticizes the fact that it does not adequately take into account the great power and influence that the setting has on the individual.

Other scholars, while not rejecting the constructivist perspective of knowledge and at the same time considering that reality, while independent of the individual, puts constraints on his actions, propose a vision they identify as the *Evolutionary Realistic Approach*. This assumes that reality is as the individual perceives it, but that this perception is validated by action and that by means of market selection of successes and errors, an increase in knowledge and the evolution of the social and economic system are achieved (Campbell 1974, McKelvey 1999; Azevedo 1997, 2002).

Bhave's considerations (1994) are also of great importance; this author identified two possible routes leading to the creation of an enterprise, subject of course to the recognition of opportunity: the first is the result of internal stimulation, *internally stimulated OR*, which leads to a *discovery*; the second, originating from an external stimulus, is *externally stimulated OR*, which guides a *systematic search*. Although radically different, both routes culminate in the identification of a business idea, and the achievement of this goal involves passing through several stages. For the purpose of our work it is interesting to observe the positioning of *opportunity recognition* depending on whether it is stimulated from outside or from within.

1. *Systematic search (or externally stimulated OR):*

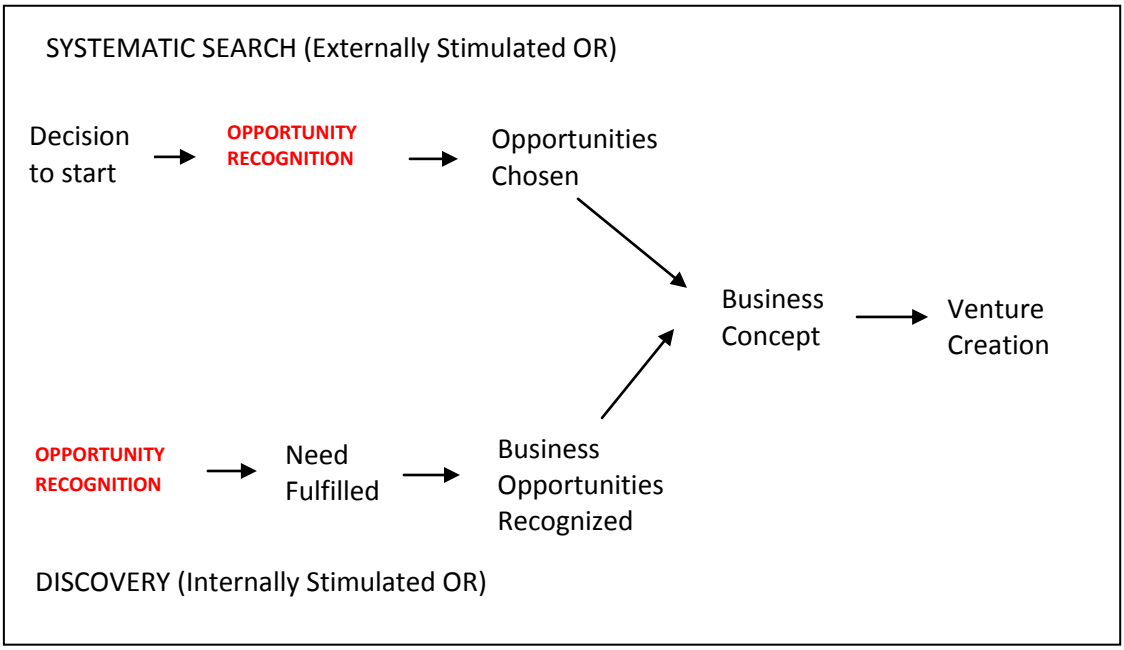
This first direction highlights the will of the individual to become an entrepreneur, regardless of the identification of a particular opportunity he can exploit. In some people the desire to become entrepreneurs may be present *a priori* without being stimulated by external events, while in others it may mature at a particular point in their life, perhaps due to the need to counter a difficult work situation. However, in all of these situations the decision is taken before any recognition of an opportunity. In these cases, we can therefore say that the process of opportunity recognition is stimulated by a systematic search by the individual, who, driven by the desire or the need to become an entrepreneur, is

constantly searching for opportunities to be seized, thus discovering many possibilities and therefore having as his greatest difficulty the selection and evaluation of the most appropriate of them.

2. *Discovery (or internally stimulated OR)*

In this case the first phase in the process of creating a new business involves the discovery of an entrepreneurial opportunity arising from the existence of needs unmet by the market. The entrepreneur, with *alertness*, *prior knowledge* and *prior experience*, identifies opportunities for profit and decides to seize them and turn them into a business idea. Once the mode of satisfaction of that particular need has been determined, the opportunities become not only evident to the potential entrepreneur, but also attractive in terms of profit, the latter being an aspect which brings the decision to start a business to fruition. The process described by Bhave (1994) can be summarized in the following figure.

Fig. 1.2 - Opportunity Recognition in the venture creation process



Source: our elaboration from Bhave (1994).

Briefly put, externally stimulated OR is understood as a systematic search for opportunity, driven by the individual's desire to become an entrepreneur, while internally stimulated OR can be defined as opportunity discovery which is not

deliberate, but rather almost random, though favoured by some traits typical of a person with an aptitude for entrepreneurship.

From the debate concerning the nature of the opportunities referred to so far it is clear that these opportunities have become the focus of research on entrepreneurship, but before going on to describe in detail the stages of the process of opportunity recognition and exploitation, it seems appropriate to provide a more in-depth consideration of the sources of entrepreneurial opportunities and the personal characteristics of a potential entrepreneur.

1.2 The Sources of Opportunity and the Entrepreneur's Personal Traits

All the approaches agree on the centrality of the entrepreneur, who has the important role of discovering or creating something previously undetected, and they direct their analyses towards exploration of the link between enterprising individuals and valuable opportunities. In particular, Shane and Venkataraman (2000) try to create a single conceptual framework capable of unifying two phenomena: the existence of profitable opportunities and the individuals ready to seize them. This matching attempt considers on the one hand the different sources of innovative opportunity as pointed out by Drucker (1985) and, on the other, several traits of human personality which seem to be connected with a greater chance of starting a new venture.

With reference to the different sources of opportunity, scholars have been able to identify a much higher number for Schumpeterian opportunity than for Kirznerian opportunity. The reason for this lies mainly in the fact that according to Kirzner's definition, opportunities originate from the errors and omissions committed by different economic agents, and the idiosyncratic nature of these errors makes them difficult to identify. In contrast, many more explanations, supported by empirical evidence, are available for Schumpeterian opportunities. In particular, for the latter the main sources identified are: technological change, change in the political and regulatory context, and social and demographic change, all of which introduce changes in the value of resources and their equilibrium prices, creating potential profit for the entrepreneur.

The identification of sources of opportunity is a complex exercise, which is why many scholars have created different classifications with the aim of understanding their nature and fundamental elements. A study in this direction is provided by Drucker (1985), according to whom the sources can clearly be classified and differentiated between on the one hand sources within the firm or sector, such as unexpected events, inconsistencies, needs arising from the production process and changes in the industry and in the market, and on the other outside sources which include demographic change, changes in perceptions and the generation of new knowledge.

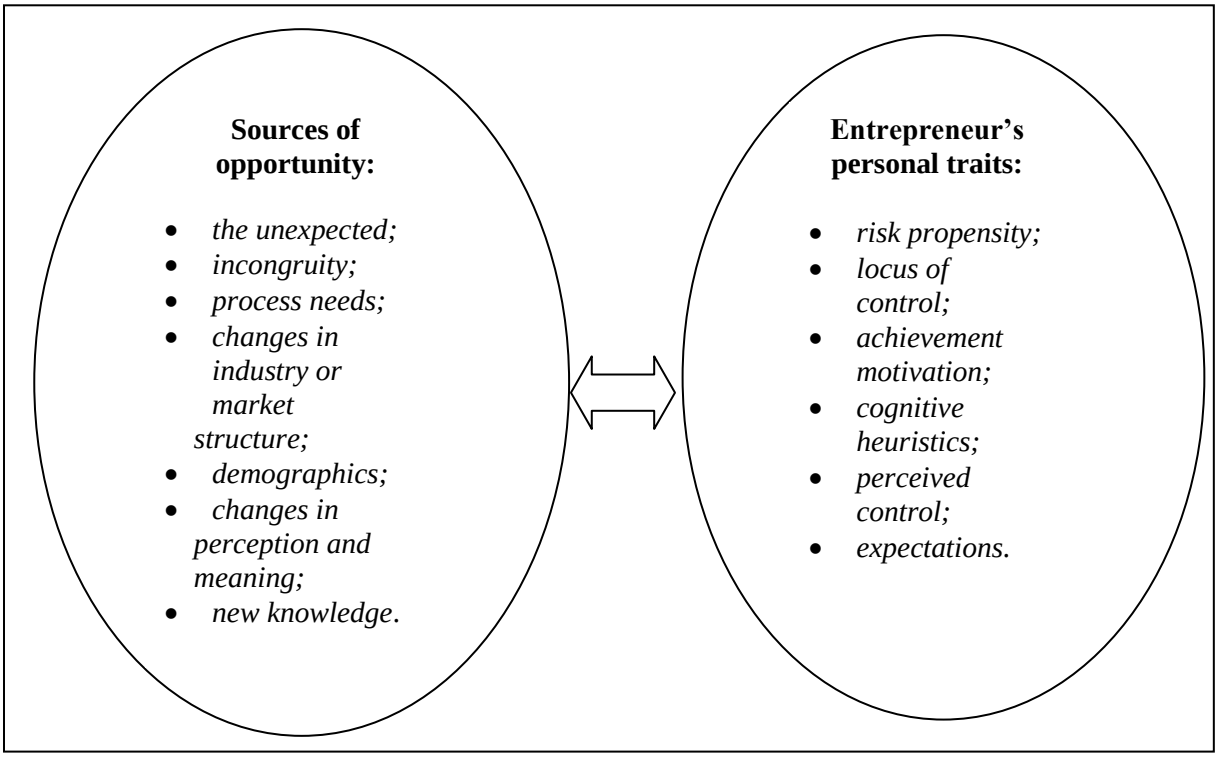
According to Shane and Venkataraman's conception of entrepreneurship (2000), opportunity recognition occurs as the result of the deliberate wish of some individuals, each with their cognitive abilities and intrinsic motivations, who are continually looking for opportunities to exploit, opportunities that may arise from events relating to the enterprise, business, institutions, the market, or that may fall outside these traditional contexts. Therefore, it is the combination of some personal factors related to the potential entrepreneur (*risk propensity*, *locus of control*, *achievement motivation*, *cognitive heuristics*, *perceived control* and *expectations*), together with the different sources of opportunity, which lead the process of *opportunity recognition*.

Many contributions have enriched the literature on opportunity recognition[3], trying to define in more detail the distinctive features that make it possible of both the individuals involved in opportunity recognition, and the environment. In this context the contribution by Mueller and Thomas (2001) proposes an interesting and exhaustive summary of the factors involved in the process of Opportunity Recognition, and integrates the already convincing analysis by Shane and Venkataraman (2000). According to Mueller and Thomas (2001), the factors involved in the process of OR can be grouped into four main broad classes (Fig. 4) and can act both positively and negatively, leaving the final result, which is the decision to engage in entrepreneurial activity, unchanged. Some of them are referred to as *push factors*, with a negative sign, for which the decision to become an entrepreneur stems from a deep dissatisfaction, for example with regard to professional employment; others are instead defined as *pull factors*, with a positive sign, according to which an entrepreneurial career is the natural

[3] See for example Sexton and Smilor (1997), Shane (2000), Ardichvili, Cardozo and Ray (2003), Busenitz and Barney (1997), Casson (2010) and many others.

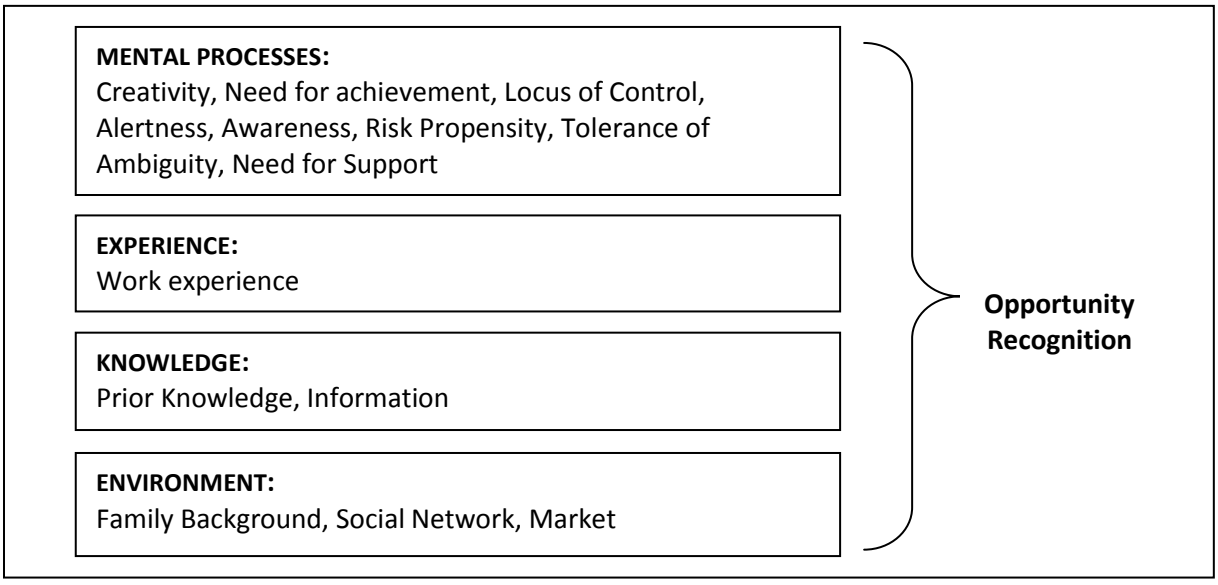
and spontaneous evolution of a series of traits (desire for challenge or independence) that differentiate the potential entrepreneur from other individuals.

Fig. 1.3 - The sources of opportunity and the entrepreneur's personal traits



Source: our elaboration

Fig. 1.4 - Factors influencing the recognition of entrepreneurial opportunities



Source: our elaboration from Mueller and Thomas (2001).

1.2.1 Mental processes

This category refers to the cognitive mechanisms typical of an entrepreneur or would-be entrepreneur (Baron, 2006); these are purely psychological factors related to the individual sphere that specifically concern:

Creativity

Schumpeter was the first to argue that the crucial factor leading an individual to recognize opportunity is creativity. Ardichvili, Cardozo and Ray (2003) define creativity in the field of opportunity recognition as the ability to connect what is apparently unrelated. Of fundamental importance is the entrepreneur's special talent in providing answers which are not obvious, different from those that other people would provide. In addition to this aspect, and in relation to the particular reasoning skills of the entrepreneur, it is important to mention a strong propensity for innovation and change. The *innovating entrepreneur* is necessarily a creative individual, but a *firm organizing entrepreneur* is too: in the latter case, creativity is recognizable in the organization, in the strategic management and in the future growth of the company. Creativity is relevant both in the case where the desire to become an entrepreneur precedes recognition and, therefore, will guide the search, and also in the opposite case, as it represents the main cause of the discovery.

Need for Achievement

Mueller and Thomas (2001), like Shane and Venkataraman (2000), consider the individual's need for self-realization as essential. This characteristic, which is expressed in the continual attempt to go beyond one's own standards of excellence in order to achieve better and better results, is able to motivate aspiring entrepreneurs in the same sense as that suggested several decades ago by McClelland (1961). Sometimes this definition could take on a negative meaning, only capturing the strong desire of individuals to feel superior to others, but in fact the description of *achievement need* argues that some individuals are particularly motivated by difficult situations, by goals which cannot be reached by everyone, and are stimulated by fair and constructive comparison with their peers.

Internal locus of control

In psychology, the *locus of control* is defined as the individual's propensity to distinguish events under his or her direct control, because they can be influenced

through his or her actions (*internal locus of control*), from those wholly independent of his or her actions (*external locus of control*). An *internal locus of control* leads the individual to consider personal effort, commitment and skills as being factors that shape circumstances in order to bring to fruition a predetermined project. In contrast, those with an *external locus of control* tend to consider a given situation as the result of forces that operate outside human control. In this context, potential entrepreneurs must surely believe themselves able to influence events, or, in other words, must be aware of their skills and potential and regard these as significant in the achievement of the result. Shapero (1982) and Krueger (1993) argue that this ability is a direct consequence of a high *need for achievement* and look to it as the driving force of entrepreneurial action.

Alertness

According to Kirzner, the entrepreneur finds opportunity in the process of price adjustment and takes advantage of the information disparities existing on the market that allow entrepreneurial alertness to flourish. Opportunity is therefore objectively present in the market and the role of the entrepreneur is simply to know how to find it. Alertness is an idiosyncratic resource, something much deeper than a mere superior knowledge of the market; it is tacit and specifically attributable to the individual subject and is free of cost, since it is a resource that is learnt or acquired spontaneously.

The entrepreneur cannot recognize the opportunities arising from asymmetric information only through his or her alertness and without having daily knowledge of the market; therefore, alertness and knowledge are both equally important factors. In addition, the process of opportunity recognition is much more complex than a simple identification of knowledge gaps in a particular market: it may take the form of an intricate network of information that simultaneously affects both markets and technologies. Entrepreneurial activity is achieved when the individual takes advantage of his/her knowledge (which is refined day by day), allowing him or her to seize unique market opportunities.

Awareness

This is the tendency of the potential entrepreneur to be particularly sensitive to information relating to the object of interest, the reference context, unmet needs, in short, to all possible sources of opportunity. It is a characteristic closely linked to alertness, but differs from it in not being an innate gift but the result of a specific desire

that leads to the continuous search for information. Awareness goes together with information, so the more the individual is informed, the more his/her awareness increases and, with it, the likelihood of recognition of entrepreneurial opportunity.

Risk propensity

Many economists and psychologists have devoted themselves to the study of this factor, which plays an important role in the field of entrepreneurship: the entrepreneur operates in uncertainty, which derives from risk (Knight 1921). However, it is incorrect and simplistic to characterize the entrepreneur in terms of his high tolerance of risk, because the latter tendency does not necessarily distinguish entrepreneurs from non-entrepreneurs. What really distinguishes entrepreneurs from the rest of the population is their subjective perception of risk, which is lower than that of most people, being supported by a greater ability to collect and handle a large amount of information, enabling them to better face the situations of uncertain outcome in which an entrepreneur is typically involved. All things being equal, entrepreneurs tend to assess a situation as being less risky than others would, due to the series of psychological traits that scholars have defined as *overconfidence*, *illusion of control* and *belief in the law of small numbers* (Simon, Houghton and Aquino, 2000; Busenitz and Barney, 1997). Such traits should promote recognition, but not be so excessive as to obscure a clear-headed assessment of the opportunity identified. Risk is not an objective but a subjective element, and as such can seriously influence the evaluation process, both in a positive sense (i.e. lead to a too generous judgment of the business idea) and negative sense (i.e. block the process or postpone it).

Tolerance of ambiguity

Ambiguity leads to uncertainty, complexity and incomprehension, and being able to move in complex situations, such as those governed by ambiguity, it is not an ability everyone has. Non-entrepreneurs, unable to control such situations, would be assailed by anxiety, stress and worry, while entrepreneurs are able to govern this condition and, indeed, regard it as a sort of challenge to which they seek the most appropriate answer, not feeling the need to minimize exposure to an ambiguous situation. ‘Under conditions of uncertainty, the decision maker who finds ambiguity undesirable, approaches problem-solving with less than adequate environmental information’ (Sexton and Bowman 1985 p.131).

Need for support

The literature tends to characterize the entrepreneur as an individualist pursuing autonomy and independence who does not need any support, in other words as a person who prefers *leadership* to *membership*. Despite this, some contributions on entrepreneurial teams show that often entrepreneurial opportunity recognition is performed by more than one person and not a single aspiring entrepreneur. Membership is not only important from a psychological point of view, i.e. in terms of risk sharing, but also from the perspective of the knowledge and skills identified as being essential to the implementation of the opportunity.

1.2.2 Experience

Experience is a key factor in the process of OR, as it contributes to the maturation of specific know-how and entrance into a given field of activity where the business idea will be identified. Therefore it seems appropriate to dedicate consideration to this factor and treat it separately from the category of *prior knowledge*, which will be described later. Experience is fundamental for three specific reasons:

1. it provides the opportunity to accumulate knowledge, skills, tacit abilities which are difficult to obtain if not in the field (i.e. it contributes to the formation of prior knowledge);
2. it provides the opportunity to enter into a sector where new business opportunities could occur;
3. it provides the opportunity to form social networks, which are often important in the process of opportunity recognition.

Previous work experience types are endless but, for simplicity, and because it will be useful for analyzing the results of our empirical investigation, we divide them into three categories: *start-up experience*, *management experience* and *cross-functional experience.*

With regard to start-up experience, Ronstadt (1988) states that 'the mere act of starting a venture enables entrepreneurs to see other venture opportunities they could neither see nor take advantage of until they had started their initial venture' (Ronstadt 1988 p.34). On this point the author has developed the theory of the *corridor principle*, of great interest and worthy of further explanation. Entrepreneurial experience (*start-up*

experience) increases the ability to evaluate information and, in this regard, 'regular' entrepreneurs are better than non-entrepreneurs at recognizing and taking advantage of latent ideas, because experience strengthens their *sense-making* ability (McGrath, 1999). Turning to management experience, an existing business can also be the source of new ideas both *per se* (i.e. through accumulated experience) and due to the network of contacts in which the (future) entrepreneur is included in the management of the enterprise. Management experience allows potential entrepreneurs to 'practise' and to have adequate training in various activities within the organization, such as negotiation, planning, leadership, communication, decision-making and problem-solving. In addition, experience in corporate management provides aspiring entrepreneurs with knowledge of the market, how to serve it and the problems and needs of consumers.

Finally, the term *cross-functional experience* indicates professional experience in various functional areas within the company: research and development, production, marketing and communications, trade and sales, administration, finance and control. Shane (2003) argues that general business experience, functional experience in marketing, product development and management, and experience in earlier start ups provide information and skills for aspiring entrepreneurs that increase their likelihood of exploiting successful opportunities.

The Corridor Principle

This concept was introduced by Ronstadt (1984) to explain the phenomenon of the birth and regeneration of firms. He points out that the creation of a new business leads the entrepreneur to enter a *venture corridor*, a business corridor being followed by many others and which allows him to recognize opportunities that are not visible to those who are not involved in that particular business. The corridor is obviously a metaphor, used by the author to explain the fact that immersion in a specific market or in a certain industry facilitates the recognition of entrepreneurial opportunity: only by understanding and being involved in the internal dynamics of a sector can information be attained relating to supply, emerging markets and outlets and potential competitors, which could promote the implementation of a business idea. The corridor principle gives due importance to the role played by experience in the process of opportunity recognition: working in a particular sector can, indeed, permit the development of

specific know-how in terms of skills and the gaining of a good understanding of the dynamics of that market.

This theory is proved by the existence of *spin-offs*, i.e. those new firms that are set up by people previously working for a firm, who at a certain point decided to use the knowledge acquired to leave the firm and start their own business.

1.2.3 Knowledge

Knowledge is understood here in two senses, the first as *prior knowledge* derived from training and experience accumulated by individuals, the second as asymmetric information existing on the market that leads entrepreneurs to a different interpretation of its inputs and, therefore, to a different ability in recognizing business opportunities. In the case where the desire to become an entrepreneur pre-exists the identification of the opportunity, knowledge is crucial for the implementation of the business (Kaish and Gilad 1991); when OR is the result of a chance discovery, and therefore *alertness*, leading to awareness of the business idea, it causes the discoverer to take on the role of entrepreneur.

Prior Knowledge

'People recognize those opportunities related to information that they already possess' (Venkataraman, 1997 p.121). Therefore, according to the author it is necessary to possess knowledge useful for the recognition of existing opportunities, and indeed it renders individuals better able to understand, interpret and extrapolate the signals which for those without any training would be indecipherable. *Prior knowledge*, which can result from education or from work experience, can be configured as tacit or explicit. While the latter category includes all knowledge available to anyone and tending to be formalized at the institutional level, tacit knowledge refers to the concept commonly known as *know-how*, i.e. the set of non-codified procedures related to a certain activity. A successful entrepreneur has both, even though it is know-how that can make the difference between entrepreneurs and non-entrepreneurs. This body of knowledge, accumulated over the course of a person's life, can make that person *alert to opportunities*, in the case of internally stimulated recognition, or *aware* of the business potential in the event of *externally stimulated OR*. Furthermore, the information is often

distributed through a stochastic process and, therefore, some people have information unavailable to others due to simple *blind luck* (Nelson and Winter, 1982)[4].

According to Shane (2000), prior knowledge comprises three aspects of equal importance for the process of opportunity recognition:

• *prior knowledge* of the market, which influences the choice of which market to enter;

• *prior knowledge* of ways of serving the market;

• *prior knowledge* of consumer needs and *customer satisfaction*.

It is however simplistic to speak of *prior knowledge* only in terms of market dynamics, and it is Shane himself who in this connection emphasizes the importance of another kind of knowledge: technological. Expert technological training can stimulate a person to develop innovation, thus helping to extend the technological frontier.

An individual's accumulation of tacit and explicit knowledge in a given market domain is well captured by the concept of human capital, which represents the knowledge and skills that each of us matures as a result of education and practical experience. Human capital theory distinguishes *general human capital* from *specific human capital*: the former consists of any individual's general education and experience, whatever his field of specialization, while specific human capital refers to education and experience in a particular domain and is more limited because it cannot easily be transferred to other domains of knowledge. Specific human capital is not a necessary and sufficient condition for the pursuit of opportunity, since it may represent an obstacle to the ability of thinking '*outside the box*' and finding different ways to solve problems (Dimov, 2003).

Information

The existence of information asymmetry means people have different information concerning the operation of the market. It is seen as an element of great inefficiency, which does not operate in perfectly competitive markets. The Austrian school re-evaluates this feature of real markets, assigning it the role of rendering business opportunities visible thanks to different people's discrepancies in their perceptions concerning the market. When the aspiring entrepreneur achieves access to a specific

[4] Personal *prior knowledge* creates a *knowledge corridor* enabling its possessor to recognize only some opportunities and not others. This fact recalls the concepts of technological regimes and sectoral systems of innovation, basic to evolution theory, which refer to the knowledge and learning context typical of a certain technology or industry which have the aim of reducing innovation-related risk.

market channel, he obtains the possibility of securing a continuous flow of information that has the function of pointing out new business opportunities. Information is thus an important factor from the point of view of the recognition of entrepreneurial opportunities. On it depends the success of the process and the subsequent *venture creation*; in addition, information may contribute to the development of skills such as *alertness*, *awareness* and *risk propensity*.

1.2.4 Environment

Our analysis now focuses on those factors we could define as exogenous, in that they derive from the external environment and, as such, are to some extent beyond the control of the potential entrepreneur. Opportunity recognition is not exclusively subjective: the identification of the *business idea* is a phenomenon resulting from certain conditions that relate to the individual, but its implementation in the form of an enterprise necessarily involves favourable environmental factors such as, firstly, the market.

The environment is identified in the joint action of several factors, including family *background*, *social networks* and the market. The family background is a context that can have a strong impact on the entrepreneurial career of a potential entrepreneur, but he or she has no power over it. *Social networks* also form part of the person's background, but the entrepreneur may intervene personally by activating certain contacts that might be more or less advantageous, changing the status quo to meet his needs. The market is an exogenous factor in all respects, to which the individual can only adapt, unless he or she introduces a radical technological innovation.

Family background

Belonging to a family that has an entrepreneurial tradition is a factor that can influence the process of *opportunity recognition*, especially in the case of a *systematic search*. The economic literature tends to give little relevance and limited attention to the family background in which an individual is born and from which he absorbs certain cultural, social and professional inputs. Marshall (1932) was one of the few economists to be interested in family background and to have studied how the family tradition in business may affect the decision to start a new business. Referring to industrial districts, Marshall believed that an individual whose parents or relatives run their own business grows up

breathing the *industrial atmosphere* which in most cases leads to the introjection of the advantages and disadvantages associated with entrepreneurship. Care should be taken not to reduce the influence of this factor to the desire to continue the management of the family business and succeed to relatives at the top of the company. In this case, we should not speak of *opportunity recognition*.

Growing up in close contact with entrepreneurs necessarily leads an individual to 'breathe' the air of freedom, autonomy and independence and to absorb attitudes and skills that render the possibility of conducting one's own business desirable. The prospective entrepreneur is immersed naturally in the *industrial atmosphere* and unconsciously and indirectly this may affect future career choices.

Social Network

This term is commonly used to refer to the network of relationships that an individual builds throughout his or her life, against his or her surrounding background. Many economists consider the *social network* as the element that can have the greatest influence on the process of opportunity recognition. The reason is simple: entrepreneurship is an economic, but also a social phenomenon (Granovetter, 1973) and an entrepreneur's being rooted in the social fabric of which he or she is part (*embeddedness*) provides clear advantages in identifying opportunities.

The academic literature on networks argues that individuals gain access to information through interaction with other people, who in turn are connected to other people again, and that the characteristics of this network of relationships affect the availability, timing and the quality of access to information. The literature on the embeddedness of individuals in their network of personal contacts focuses on the level of cohesion of the network and, on the one hand, analyzes the types of links within the network and, on the other, focuses on the quality of the information.

Ozgen and Baron (2007) dwell on the social sources of information, i.e. mentors, industrial networks and participation in professional forums (conventions, conferences, seminars and workshops), which might encourage opportunity recognition. Singh (2000) explores the extent of social networks and concludes that the larger a person's network, the more opportunities he recognizes. Entrepreneurs can also benefit from the information provided by another social source, the informal networks that exist within the sector in which they operate. Family and friends have neither industry-specific

knowledge nor experience, so they seem less useful than contacts made at the workplace in providing the aspiring entrepreneur with relevant information during the opportunity identification phase.

Market

The market is a key factor for the entrepreneur, because it is where opportunities arise; their exploitation and their translation into the form of an enterprise depend on the receptivity of customers and consumers. The market is a reality that the potential entrepreneur must necessarily consider as given, and which he has to deal with constantly: from the market itself derive the opportunity openings the entrepreneur can enter, and it also gives the final judgment on the feasibility or otherwise of the business concept.

Government policies (industrial, fiscal, monetary, regulatory and anti-trust), culture and the media follow market trends and have the power to encourage or discourage entrepreneurial activity, because they raise or lower the barriers to the process of opportunity recognition. In this regard, according to Aldrich (1990), environmental conditions generate significant variations in the number of start-ups over time. An example is the case of 'strategic windows': it may happen that due to the introduction of a new technology (incremental or radical), the opportunity frontier is pushed forward, creating new needs, new niches or even emerging sectors, i.e. a series of stimuli external to opportunity recognition that serve to stimulate entrepreneurship. In this respect, the market is considered as a push factor to entrepreneurship.

1.3 The entrepreneurial process

Some elements have already been introduced above that may characterize the process of opportunity recognition. In the following section, this process will be described in detail in order to lay the foundations for the empirical survey which is discussed later. For this reason we focus on the contribution by Hills, Lumpkin and Shrader - HLS (1999), who when their work was published were teachers of entrepreneurship at the University of Illinois at Chicago, and on the subsequent developments or empirical tests of their work by the authors themselves or some of their collaborators. With great simplicity and

clarity, they developed an extremely effective model of opportunity recognition. It serves as a sort of guideline by which the presentation of empirical cases has become coherent and comparable, in the sense that it has made it possible to identify some patterns and recurring behaviour which have allowed us to draw interesting conclusions on the subject.

Furthermore, an advantage of this model is that it has also permitted the achievement of a compromise between the different views of OR mentioned above, as on the one hand it describes opportunity recognition as a process that takes shape over different stages, and on the other does not conceive these phases as closely bound in a chronological sequence, but provides for jumping from one phase to another in no particular order or going back, in order to constantly improve the outline of the business idea.

This model considers the process of OR as a particular example of the creative process and therefore finds its origin in psychological and creativity literature, consistent with the numerous studies on entrepreneurship which have emphasized the essential role of creativity in this context. The elements of the creative process have been identified in a number of academic studies, the most relevant of which is that by Csikszentmihalyi (1996), who identified the five elements - preparation, incubation, insight, evaluation and elaboration - that have emerged from years of research on creativity. Hills, Lumpkin and Shrader (1999) developed a creative model of opportunity recognition and tested it by analyzing the behaviour of 165 entrepreneurs. In a subsequent contribution, Hills, Lumpkin and Shrader (2004) presented the same model alongside further empirical validation referring to 218 entrepreneurs who were asked to indicate the nature and importance of the mechanism of entrepreneurial opportunity recognition, with the additional aim of identifying the best way to communicate these issues to students of entrepreneurship.

Despite being a key element of the model proposed by the three researchers, the necessary presence of creativity in the process of opportunity recognition is however likely to limit significantly the number of entrepreneurs interviewed (Whiting, 1988), i.e. to exclude those persons who, although they have created nothing new, have started profitable businesses from ideas generated due to factors such as knowledge of the market, the relationship network and passion for different activities. We believe that the creative element does not distinguish only the entrepreneur, triggering the process of

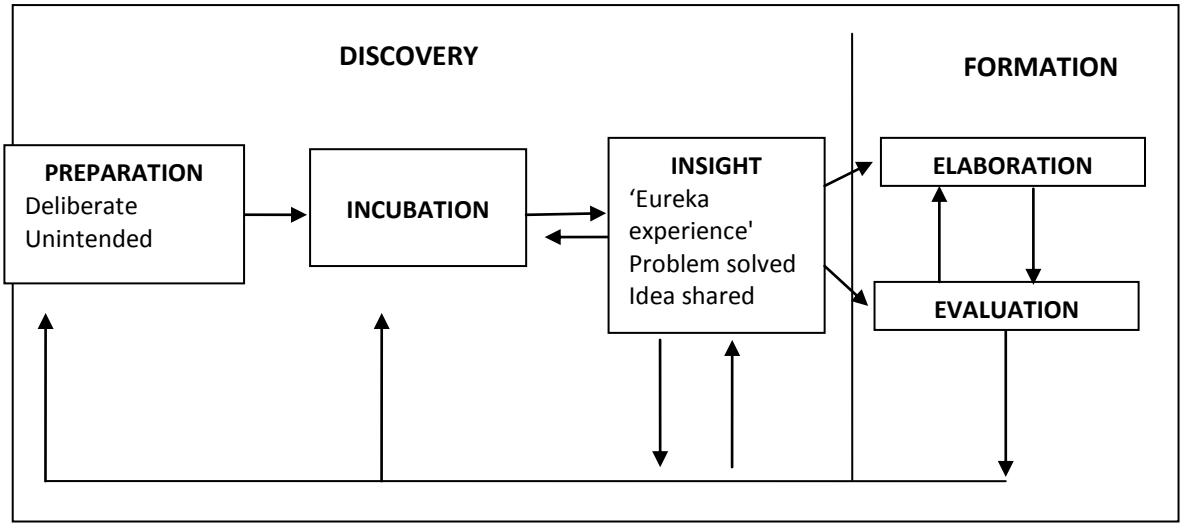
opportunity recognition, and we feel justified in expanding the meaning of creativity, giving it a double significance, both as cause of the process and also its effect, revealing itself in the different ways of implementing the process.

1.3.1 The phases of the HLS model

To provide a clear idea of the model, Figure 5 shows an exemplification of its different phases with the potential relationships that characterize them. First, the macro-phases Discovery and Formation, introduced by Hills, Lumpkin and Shrader (2004), correspond more or less to those aspects of opportunity recognition found in the definition of entrepreneurship coined by Shane and Venkataraman (2000).

Opportunity recognition is a recursive process: although the components of the model are separate stages, it is important to stress that the relationship between them is not simply linear and one-directional; indeed, it is not necessarily true that in the recognition of opportunities all entrepreneurs follow the predetermined sequence shown in the figure. The five stages, Preparation, Incubation, Insight, Evaluation and Elaboration, represent a sort of matrix, elaborated for theoretical purposes only and able to highlight all the possible paths that lead to the identification of the business idea, without going so far as defining a unique and specific path, which would limit the inherently creative nature of the entrepreneurial process.

Fig. 1.5 - A model of opportunity recognition



Source: Hills, Lumpkin and Shrader (2004), p. 75

Phase 1: Preparation

"Preparation refers to the base of experience and knowledge that begins the OR process." (Hills, Lumpkin and Shrader, 2004, p.75)

This phase refers to all the knowledge, life experience, family, study and previous work that, although not directly intended to result in the launch of an entrepreneurial process, provide the foundation necessary for setting out on the journey of opportunity recognition. Aspects related to the stage of Preparation concern the situations able to create that mentality and background favourable for initiating the process. This phase is critical for potential entrepreneurs, enabling them to discover their own vocation, to accumulate know-how, to build a network of stimulating relationships, and is capable of opening up new ways forward. Typically, this phase takes place in a totally unconscious manner: it is not a deliberately-chosen, thought-out and systematic path, but rather a part of the life of each individual. The conditioning factors included in the stage of Preparation are certainly subjective, but despite this the authors of the model, backed up by the theoretical contributions of many other researchers, consider family background, schooling, work experience and networks of relationships as being crucial for this stage.

Phase 2: Incubation

"Incubation is the part of the process that occurs when a person is thinking about a problem or considering an idea." (Hills, Lumpkin and Shrader, 2004, p.79)

During this stage the individual is engaged in reflection on a given problem, or starts to consider a particular idea. Again this often takes place unconsciously, while he or she continues with normal activities. In other words, the space is created for the emergence of the so-called new combinations mentioned by Schumpeter (1942), i.e. those new ways of combining existing resources in such a way as to result in innovation, the creator of 'creative disruption'. The extreme subjectivity of this phase of the process is clear, being different from person to person, but it is however more natural in those subjects supported by a significant phase of Preparation. We can exclude the idea that incubation can be guided by a systematic search and aimed at a specific purpose.

Phase 3: Insight

"Insight refers to the point at which an entrepreneur consciously realizes that an idea may indeed represent an entrepreneurial opportunity." (Hills, Lumpkin and Shrader, 2004, p.79)

This stage represents the real 'illumination', the moment at which all the confused ideas in a state of incubation take a precise shape and the individual reaches a state of increased awareness and certainty. This moment during the process of opportunity recognition corresponds to the so-called 'Eureka! experience' defined by Gaglio and Taub (1992) and the 'Aha! experience' identified by Long and McMullan (1984). The Insight phase is absolutely crucial for the potential entrepreneur, because it is when he realizes that all his dreams could come true, that he may have a project with which he can become an entrepreneur.

This is the point in the journey where either the momentum necessary for seizing the opportunity and becoming an entrepreneur is found, or the prospective entrepreneur goes back to previous steps to spend more time on Preparation or Incubation and refining the idea further. At this point social networks are crucial, since the potential entrepreneur can obtain feedback, an opinion or support from other competent persons and can also obtain backup in terms of financial resources from people close to him. It has been shown that entrepreneurs with a dense network of formal and informal social relations are also facilitated in the identification of a successful business idea (Singh, 2000).

Phase 4: Evaluation

"Evaluation is the phase in the process when insights are formed into viable business." (Hills, Lumpkin and Shrader, 2004, p.79)

Once the outline of the business idea has been defined, an assessment is carried out which may be more or less formal and can take place in different ways, including external consultancy, preparation of a business plan and market analysis highlighting the ability of the market itself to respond to the new opportunity. Honesty with respect to the potential of the identified idea and objectivity in this context are absolutely essential for being ready to deal with the last stage, realization, without running into failure due to overlooking some detail. Studies show a generalized excessive optimism in assessments by potential entrepreneurs, who are often so determined and driven by the need to achieve that they are not able to observe reality impartially. All the creativity typical of earlier stages at this point must be mediated by rationality and here again opinions provided by social networks may be useful. Very often the result of this phase is a return to previous steps: the entrepreneur may realize he does not possess the

appropriate knowledge for the development of the business idea (Preparation), or may feel the need to investigate previously-overlooked aspects that can render the idea feasible (Incubation).

Phase 5: Elaboration

"*Elaboration is the stage in which the creative insight is actualized."* (Hills, Lumpkin and Shrader, 2004, p.80)

Some authors do not include this step in the process of opportunity recognition, preferring to frame it within a separate and later process, that of 'Opportunity Exploitation', the precise moment when the idea actually takes the form of a business enterprise. We consider it essential to confirm the thinking of the authors who prefer to include this step in the process, because only the actual realization of the business idea to create new profit falls within the definition of opportunity recognition; vice versa, an idea that is only theoretical cannot confirm the potential of the recognition process to succeed.

Csikszentmihalyi (1996) states that this step, not foreseen in the original model proposed by Wallas (1926), is the most difficult and, in general, is the one that requires more time than all the others. If, after being subjected to careful evaluation, the business idea continues to be perceived as feasible, during the phase of elaboration the potential entrepreneur defines the necessary details for proceeding to its implementation. The process described so far does not end with the Elaboration phase and the birth of a start-up, as ongoing review and continuous updating of the business idea are clearly required in order to continue successfully in the market. In addition, as repeatedly stressed by various authors, the recognition of a specific opportunity may open the way to the discovery of many other business ideas which until then could not be perceived (Shane, 2000).

1.3.2 The results of the HLS model

At this point we summarize some empirical work aimed at verifying the effectiveness of the model. First, the three authors of the two contributions already cited (Hills, Lumpkin and Shrader, 1999, and Hills, Lumpkin and Shrader, 2004) have carried out two empirical studies aimed at investigating the relationship between entrepreneurs and

opportunity discovery and highlighting successful behaviour patterns, to be presented later in their teaching. This has been possible through the observation of a sample, in the first work comprising 165 entrepreneurs operating in the Chicago area, to which were added in the second contribution 53 entrepreneurs who over a three-year period had qualified in selections for the 'Entrepreneurship Hall of Fame'[5] in the Chicago area.

In the 1999 work the entrepreneurs in the sample indicated their level of agreement or disagreement with 31 different statements about the process of opportunity recognition, and six factors emerged that highlight the multidimensional nature of the process under analysis: 'sensitivity to ideas, gut feeling, radical innovation, incremental innovation, prior experience and serendipity' (Hills, Lumpkin and Shrader, 1999, p. 6). Each of these factors corresponds to one of the phases of the creative process, except for the phase of Evaluation, for which no characterizing factors were identified, despite the fact that a majority of entrepreneurs deems it essential in the process that leads to determining if an idea or intuition may turn into a realizable opportunity.

In Hills, Lumpkin and Shrader (2004), the responses from a questionnaire given to the two groups of entrepreneurs selected (Hall of Fame Entrepreneurs – HFE, and Representative Entrepreneurs - RE) are compared. In general, the responses did not highlight substantial differences between the two components of the sample and revealed the following:

1. Opportunity recognition is a creative process. Creativity has proved to be an essential feature of entrepreneurial thinking, because not only is it generally accompanied by qualities such as spontaneity, imagination, curiosity, enthusiasm, ambition, etc., but especially because only through creativity are 'out of the box' thoughts, useful in finding innovative ways to solve problems, developed.
2. Opportunity recognition involves testing (experimentation). Vesper (1996) argues that the best way to test the feasibility of a business idea is trying it, and recommends this solution in environments with little initial cost and low risk. The authors' survey shows that many of the entrepreneurs experienced several failed attempts before finding a profitable opportunity, but these errors

[5] The *Entrepreneurship Hall of Fame* is a non-profit organization with the aim of recognizing and rewarding the world's best entrepreneurial efforts and promoting studies in this field. (http://www.theehalloffame.com)

provided invaluable experience, trial and error leading to success. More precisely, 80% of entrepreneurs in the sample had experienced one or more failures, but this did not generate fear of making mistakes; indeed, those very errors often opened the way to previously-hidden possibilities.

3. Opportunity recognition is related to knowledge. Basic knowledge and experience in a specific field represent a substantial advantage, increasing the chances of identifying an opportunity and leading the way to the discovery of valid ones.

4. The validity of a business idea must be assessed in terms of business opportunity. Not all the ideas are actually opportunities which can be exploited. Not only does the potential of the idea need to be evaluated; it has to be translated into practice in terms of resources required, the aspiring entrepreneur's ability to complete the project, the willingness of the market to welcome the innovation, etc..

Tab. 1.1 - Main behaviour in the recognition of entrepreneurial opportunities

Item	HFE (*Hall of Fame Entrepreneurs*)					
	(SA%)	*(PA%)*	*(N%)*	*(PD%)*	*(SD%)*	*Mean*
1. New business opportunities often arise in connection with a solution to a specific problem.	53	41	2	2	2	1.60
2. I listen extremely carefully to what customers say they want and don't want as a way of identifying opportunities.	61	23	10	6	0	1.61
3. Being creative is very important to identifying business opportunities.	50	40	8	2	0	1.63
4. I am not a creative person.	2	13	11	17	57	4.15
5. Identifying opportunities is really several learning steps over time, rather than a one-time occurrence.	44	42	10	0	4	1.78
6. Our company experiments with new venture ideas which result in both failures and successes.	40	42	8	4	6	1.92
7. Other people bring new venture business to me	25	35	23	13	4	2.35
Item	RE *(Representative Entrepreneurs)*					
	(SA%)	*(PA%)*	*(N%)*	*(PD%)*	*(SD%)*	*Mean*
1. New business opportunities often arise in connection with a solution to a specific problem	56	39	3	2	0	1.51
2. I listen extremely carefully to what customers say they want and don't want as a way of identifying opportunities.	67	24	6	3	0	1.44
3. Being creative is very important to identifying business opportunities.	58	30	6	4	1	1.60
4. I am not a creative person.	3	9	15	25	48	4.05
5. Identifying opportunities is really several learning steps over time, rather than a one-time occurrence.	61	31	5	2	1	1.50
6. Our company experiments with new venture ideas which result in both failures and successes.	35	42	13	9	1	1.99
7. Other people bring new venture business to me.	14	44	26	11	5	2.49

Key: SA=strongly agree=1; PA=partly agree=2; N=neutral=3; PD=partly disagree=4; SD=strongly disagree=5; n=53 HEFs, 165 REs

Source: Hills, Lumpkin and Shrader (2004), p. 83.

The contribution by Hills, Lumpkin and Shrader (2004) ends with some useful indications in terms of education for entrepreneurship. Firstly, from the two samples observed it emerges that entrepreneurial opportunity recognition is not modelled by specific sectoral characteristics, but rather happens regardless of the industry in which

subjects are routinely engaged. In other words, the factors that characterize the process of recognition can be taught/communicated without a close connection to a particular economic activity; the authors call these 'stand-alone OR skills'. Of these factors, creativity plays an important role and is associated with an attitude inclined to experimentation and learning. Finally, recognition of an opportunity is often driven by consumers' needs and benefits from the presence of a network to which the individual may refer.

Over the years there have been numerous contributions aimed at validating or otherwise the original model. Hansen, Hills and Hultman (2004) [6] focused on creating value deriving from the process of entrepreneurial opportunity recognition. This work confirms that opportunity recognition is an ongoing process that occurs repeatedly and is stimulated by each new discovery. Many entrepreneurs in the sample admitted to having used intuitive methods rather than formal procedures to assess market opportunities. Almost all the entrepreneurs had in-depth knowledge of the market they wanted to enter, and emphasize the importance of flexibility in order to adapt quickly to market changes and consumer preferences, to take advantage of these situations advantageously. For these entrepreneurs the Evaluation phase is often replaced by a 'do it now' approach. They set to work as soon as they have the idea, leaving the important phase of evaluation to informal, somewhat incomplete analysis.

Hills, Lumpkin and Singh (1997), using a sample of 171 U.S. companies, focused on some factors such as creativity and alertness and the impact on them of belonging to a network. The subjects that the authors identify as network entrepreneurs[7] identified a significantly greater number of opportunities than the rest of the sample. This work of 1997 clearly shows that for 91% of the entrepreneurs considered, OR is a process that develops in stages, although about one-third of the sample said that their business idea came unexpectedly. Finally, the entrepreneurs interviewed consider themselves entrepreneurially alert, and describe themselves as individuals who recognize opportunities instinctively. Creativity is a factor which is typical of the entrepreneurs in the sample, and those who are identified as 'solo entrepreneurs' give it greater

[6] The sample used in this paper consists of 59 small and medium-sized enterprises, 29 Swedish and 30 U.S. The analysis presented is qualitative and it identifies a number of factors which are of interest for the development of research in this field, although they cannot be generalized.

[7] The sample was divided into two groups, SEs (*solo entrepreneurs*) and NEs (*network entrepreneurs*).

significance, probably because they do not count on positive externalities generated from belonging to a network.

Instead, in Hills et al. (2004) [8], the focus is on the verification of the existence of the two types of OR mechanisms introduced by Bhave (1994), 'externally stimulated' and 'internally stimulated' opportunity recognition. 43.9% of respondents first decided to start a business and then recognized the opportunity to exploit, while 34.5% first took an opportunity, which later translated into an enterprise. For the remaining 21.6%, the opportunity and the decision to start the business were simultaneous. Entrepreneurs whose identification of opportunities is through a systematic search and not due to a moment of 'Eureka! experience' considered a number of ideas before choosing the one which then led to the start-up phase. Age and education are not significant factors in influencing the number of ideas considered. In addition, more than half of nascent entrepreneurs made changes, in some cases slight, in others substantial, to the initial business idea.

Previous experience in the industry or market in which it will operate is the main source of the birth of new companies, followed by social and professional networks (friends and family, consumers, suppliers and potential investors). A more thorough analysis of personal contacts reveals that 62% of entrepreneurs acquired the business idea through contacts with former colleagues, friends or relatives.

The majority of business owners agree that opportunity recognition is a process consisting of several intermediate stages. For 70% of respondents, 'identifying business opportunities has involved several learning steps over time, rather than a one-time thing' (Hills et al., 2004, p. 4). 31% said that the best opportunities presented themselves without any systematic search for them, while 36% said they had been involved at various levels in a deliberate search for opportunities. The two reasons why

[8] The authors use data from the Panel Study of Entrepreneurial Dynamics (PSED), a longitudinal study involving more than a hundred academic researchers interested in entrepreneurship, who are members of an organization called 'Entrepreneurial Research Consortium' (ERC). The PSED methodology consists of the collection of data from a representative sample of the U.S. population through telephone interviews followed by a questionnaire sent by e-mail. The sample consists of 31,261 individuals. This methodology enabled Hills et al. (2004) to identify in this sample 716 subjects who are involved in the start-up phase of a business, the so-called "Nascent Entrepreneurs" (NEs), and to ask them the main questions related to the process of recognizing opportunities: What comes first, the opportunity or the desire to become an entrepreneur? How many changes are made to the initial business idea? How many ideas are considered before choosing one to pursue and exploit? Where do the ideas originate? Is opportunity recognition a systematic process? For a discussion on the use of the PSED questionnaire in OR research see Hills and Singh (2004).

entrepreneurs decide to set up a business on their own are the desire to achieve a higher social position, and the desire to become wealthy. In particular, in this regard the age factor discriminates between the entrepreneurs interviewed: younger nascent entrepreneurs responded that what prompted them to start the company was the desire for social status, while older ones were induced by the prospect of significant gains.

More recently, Hansen and Lumpkin (2009) have used 4 groups of students from courses in mechanical engineering, industrial design and MBAs, and asked each group to work on a project to develop a market opportunity for the same customer. The paper describes in detail the unfolding of the OR process over several weeks and confirms the existence of the different phases, but highlights the fact that they are recurrent, i.e. as the authors say, they recur 'out of phase', and each of them can be regarded as a creative process in itself with its own result. In describing this structure, which is identified by the authors as 'models within the model', the authors point out that there are multiple levels, each characterized by an identifiable creative process, that each process has its own creative result (deliverable/creative product) and, finally, that the product of each phase enters a cycle and serves as input to one of the different levels of the same phase or to start the next phase. The authors find no support for the hypothesis that the process can be reduced to just two stages, as proposed by Hills, Lumpkin and Shrader (2004). Finally, detailed analysis of the behaviour of the different groups reveals that two different ways of proceeding emerge over time. The first involves the conceiving of an idea in the early stages of the process and its continual development in an attempt to render it able to withstand criticism and the emergence of new ideas, while the second involves a continuous process of comparison with other opportunities that emerge gradually during the different phases, the best of them coming to the forefront. These two different kinds of behaviour could be the subject of further investigation.

1.4 Empirical evidence and new research directions

For the empirical study of the issue of entrepreneurial opportunity recognition, two methods are generally proposed: on the one hand the collection of entrepreneurs' histories, and on the other the econometric analysis of large business databases. These are two contrasting empirical approaches: the first is more subjective, very close to real

life but difficult to abstract and generalize, the second much more rigorous, but far from any comprehension of the more personal aspects that emerge from knowledge of the entrepreneurs' past histories. This second mode of analysis, through mainly quantitative targeted studies using large samples, investigates a very large number of aspects potentially related to entrepreneurship, and then, based on the evidence, determines the contribution of each factor to the interpretation of the entrepreneurial phenomenon. All this is achieved through the use of variables, so-called 'proxies' that permit the identification of the measures able to standardize and describe the behaviour or the trend of the issues under investigation, through indices, numbers, percentages, etc.

The aspects most investigated by empirical work concern on the one hand the entrepreneur as an individual having specific characteristics and being part of a network of relationships affecting his view of reality, his behaviour and therefore his action, and on the other, the context in which he operates. This context establishes a two-way relationship with the individual, influencing his choices and itself being influenced by the entrepreneurial and business fabric that is generated.

The first group of empirical works considers the environment first of all, to gain understanding of how it influences both the discovery of entrepreneurial opportunity and the subsequent setting up of the company. The environment is in turn modified by entrepreneurial activity which in a virtuous circle influences the development and growth of the different countries. In this section, however, we will analyze some of the works most focused on the personal characteristics of the entrepreneur; in particular, we will consider those studies that seek to explore how an entrepreneurial character is formed and to gain a more specific understanding of the mental processes, training, experiences and prior knowledge possessed by the subjects, as well as the context in which this character has been able to develop and express itself, in terms of background, social networks and market. Some empirical studies that verify the existence and weight of the different phases of the process of entrepreneurial opportunity recognition have already been considered at the end of the paragraph on the model proposed by Hills, Lumpkin and Shrader (2004).

1.4.1 The context: entrepreneurs and their environment

Studies have generally considered the entrepreneur and how he or she is influenced by variables such as the existence of high concentrations of firms, the level of unemployment, private and public research, the role of institutions, the development of technology, innovation, the racial melting pot, taxation rates and much more. Some particularly innovative studies have tried to link all these aspects, noting the effect of the interactions between them.

The three levels at which the entrepreneurial phenomenon has been most studied (Caree and Thurik, 2010) are national, regional and sectoral. With regard to the first, most of the analyses seek to investigate the spread of entrepreneurship in different countries and measure the number of individuals engaged in self-employment, as this is considered a proxy for the desire to set up an enterprise. These studies focus in particular on the occupational choices of individuals and the size of the business. Studies concerning the regional level mainly focus on the impact of small businesses on the productive output of a region, comparing the level of entrepreneurial ferment in regions having many small and medium-sized enterprises with that of regions with a more concentrated industrial structure. To the sectoral level instead belong all those investigations aiming to capture the effect of a larger number of firms on the market and on the competitiveness of individual sectors and, therefore, on their vitality.

As for the relationship between self-employment[9] and the economic growth rate of the different countries, most of the works on the subject show that a greater presence of self-employment creates an increase in the growth rate of the countries, although this hypothesis is not always significantly confirmed (Blanchflower, 2000). For example, in an econometric analysis carried out on Swedish data covering the period between 1976 and 1995, Fölster (2000) found a significant relationship between increased self-employment and the increase in total employment, a proxy often used as an estimator of a country's growth. In this work, using the method of Instrumental Variables - 2LSL, the author tries to evaluate the effect of an increase in the support offered to new

[9] In this regard it should be noted that not all forms of self-employment take the form of entrepreneurship as it is considered in this volume, and so the results of these studies should be considered with caution to avoid jumping to conclusions on the entrepreneurial phenomenon and its impact on a nation's growth rate.

business ventures, represented by the increase in self-employment, on total employment. The estimate identified a long-term effect, which shows an increase in the impact of up to 1.3%, i.e. in the presence of an increase in self-employment by one unit, total employment increased 1.3 times. This opens up the debate on the need to address employment policies towards supporting entrepreneurship and all those conditions that are crucial to creating a favourable environment for business development.

These results had already been suggested by Davidsson et al (1994) and were then confirmed by numerous in-depth studies in the following years. Carree and Thurik (1998) analyze the effects of countries' industrial structures on their economic growth. Based on Eurostat data for the years between 1990 and 1994, 13 countries (Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom) and 14 industry sectors are considered. The authors' regression demonstrates that the increase in the number of small and medium-sized enterprises is directly and significantly related to the increase in sectoral productivity, and thus indirectly to the GDP of the country. In fact, in the period 1990-1993, in those areas where the presence of enterprises with a number of employees exceeding 500 was more significant, there was a 1% decrease in growth, while the decrease was of 2% in the 1990-1994 period. All this shows that not only sectors with a higher share of large enterprises have been most affected by the recession, but that this sectoral structure also makes recovery after the crisis more difficult and slower.

Taking this cue, Audretsch et al. (2001) arrive at the same conclusions. In their work they take as a reference sample 23 OECD countries, observing them over the period 1974-1998, and demonstrating the existence of a complex relationship between the two variables of unemployment and entrepreneurship. They identify the existence of two different effects caused by unemployment, on the one hand that identified as the shopkeeper effect, i.e. the starting up of any activity which permits avoidance of unemployment and, secondly, the Schumpeter effect, i.e. the launch of new business initiatives that can operate creative destruction as introduced by Schumpeter. Subsequently, Audretsch et al. (2002), using an econometric study of 18 European countries that have experienced a visible vertical disintegration of their industrial fabric through the dismantling of large firms, find that as a result of this change, these

countries have experienced substantial growth and that the creation of small and medium-size enterprises has contributed significantly to this process.

The GEM (Global Entrepreneurship Monitor), a non-profit organization founded in 1999 by the London Business School and Babson College in Boston (Massachusetts) to monitor the entrepreneurial phenomenon globally and its impact on the growth of different countries (59 are considered from all over the world), says with great conviction that there is a strong and significant relationship between the presence of start-up activities and economic growth, maintaining that entrepreneurship can be considered as the most important factor among the determinants of this growth.

Researchers in the field of urban economics have also taken part in the debate; see for example Vernon (1960) and Chinitz (1961) or Jacobs (1969) and more recently Saxenian (1994), who have written directly about entrepreneurship, or indirectly have developed some empirical approaches to investigate how the urban environment affects entrepreneurship. Specifically, these authors have tried to counter the widespread idea that identifies mere proximity to primary resources as a main cause of a greater flourishing of entrepreneurial opportunities. In fact, they believe that there are also other factors affecting new businesses and therefore formulate and test various hypotheses concerning mainly the impact on business opportunities of the following four aspects:

- the average performance of businesses in the studied area,
- the availability of factors of production, with a specific emphasis on human capital,
- local culture and the political system and, finally,
- the presence of different contexts capable of formulating and disseminating knowledge and ideas.

Higher-than-average business performance involves a shift along the supply curve, while the other factors cause the displacement of the curve itself. In particular, in this regard it is useful to mention the so-called New Economic Geography (NEG), which by focusing on the specific aspects of urban agglomeration and taking into account assumptions about consumption, production etc., provides useful insights into entrepreneurship. As an example we can take the model proposed by Glaeser, Rosenthal and Strange (2010), who starting from the hypothesis proposed by Krugman (1991), suitably amended and supplemented with suggestions from Abdel-Rahman (1988),

Fujita (1988) and Rivera-Batiz (1988), and focusing on a single small town in an open economy, give a clear indication of the local factors that have a positive impact on the success of entrepreneurship. Among these emerge:

- the proportion of the population of working age;
- the availability of inputs;
- the existence of a venture capital market;
- the existence of government policies that prevent crime, and effective regulatory policies;
- the presence of many small businesses;
- the level of education and training found in the area.

Based on these factors, the authors manage to indicate which of them have the greatest impact on business development. Indicators used in these studies are the average number of small businesses, the annual rate of start-up, the rate of technological innovation (measured by the number of patents) and the ability of businesses to survive moments of shock. All these factors, which outline the characteristics of entrepreneurship in an area, offer insights into its impact on the country's economic growth.

Even more recent and specific is the contribution by Kim et al. (2012), who note the impact that the components of the Triple Helix model (university, industry and government), along with the local context, have on innovation and entrepreneurship. Specifically, they study the correlation between the above-mentioned factors and the birth and demise of firms in the United States in 2000-2004. The study uses a panel of 250 ‘year-state’ observations and divides the United States into 4 areas, the West (13 states), the Midwest (12 states), the South (16 states) and the Northeast (9 states), developing a multivariate analysis of the data using the ‘Feasible Least Squares’ technique. The authors highlight the regional factors that affect the birth of enterprises, focusing on the impact of expenditure on research and development in the different spheres of the helix. Finally, they divide the sample into two groups, based on enterprise birth rate, and extrapolate the determinants of the high or low level of entrepreneurship in the region. As expected, the results show that a low level of taxation and a high level of education encourage entrepreneurship, while the effect of spending on R&D varies depending on whether it is funded by business, universities, or the state. In the first case

the correlation between R&D and the creation of new businesses is strong and positive, in the second the effect is negative, probably because universities are more focused on basic research (Campbell and Guttel, 2005) and because the academic world withholds from the market specialized 'brains' that would be helpful to it and the creation of new businesses. Finally, as regards state expenditure on R&D, no impact on the birth rate/death rate of start-ups was detected.

Moving on to analyze the role of innovation as an expression of the entrepreneurial phenomenon, it is natural to ask how to combine the preference for a pattern dominated by small and medium-sized enterprises with the need to implement effective plans for research and development in order to foster continued innovation. As is well illustrated by Ortega-Argiles et al. (2009), the paradox of research and development in small businesses is real, as indeed there have been many cases in Europe of research policies aimed at small and medium-sized enterprises which have led to the desired results. The study asks whether the funding of research and development should be directed specifically to certain categories, in this case small and medium-sized enterprises, or be general and addressed equally to all businesses: much empirical evidence justifies the use of specific policies. Finally, the authors stress the need for these policies to support the creation and development of SMEs, based on the contributions demonstrated as being significantly positive over time.

Aghion and Howitt (1992) show that the intensity of competition in research is the engine of growth. Other studies show that small businesses, with under 500 employees, promote innovation through knowledge spillovers (Karlsson, Friis and Paulsson 2004), and Acs et al (1994), through an empirical study based on data on 1982 the United States, suggest that the close link between universities and small businesses, for example, can be a source of great innovation. Similarly Vivarelli and Audretsch (1996), using data referring to an observation period of nine years for 15 Italian regions, reach the same conclusions.

Almeida and Kogut (1997) and Almeida (1999), in an empirical analysis carried out on the semiconductor industry in the United States, show that large companies, which focus strongly on the need to patent continuously, try to concentrate on aspects of technology which have already been explored, going to make only incremental changes to what already exists, while small businesses are started up with the specific possibility

of identifying unexplored aspects of technology in mind. In this sense, new entrepreneurship fosters innovation and at the same time continuous search for innovation allows for the growth of new entrepreneurs. To generate this virtuous circle, scientific and cultural training are crucial, together with facilitating factors in the local context, such as institutional networks, an efficient capital market, and the spread of organizational features that make the emergence and spread of new ideas within companies possible.

1.4.2 The entrepreneur's personal traits

For many years researchers have focused their efforts on attempting to understand what an entrepreneur is, what he does and which personal traits make it easier for him to recognize an entrepreneurial opportunity, but they have failed to reach a general consensus on what these salient features are. As pointed out by Machlup (1967), these aspects need analyzing separately, although this is not a simple task; however, it is particularly with Behavioural Theory that the focus of entrepreneurship analysis shifts to the cognitive aspects making individuals become entrepreneurs, and thus comes to concentrate primarily on the intrinsic characteristics distinguishing entrepreneurs from all other people in the system. As already seen, some assumptions have been made with regard to specific aspects of entrepreneurs' characters (high self-confidence, willingness to take risks ...), to certain personal experiences (level of education, previous work experience, ...), to some aspects related to their background (family ties, relational networks, ...), as well as with regard to other variables considered potentially incisive in leading an individual to choose entrepreneurship. Many authors have contributed to the debate, insisting mainly on the aspects of ambition, self-confidence and desire for independence, and searching for empirical evidence in order to give significance and solidity to their claims.

Starting from the considerations of other researchers, Mueller and Thomas (2001) summarized well and analyzed further the various factors that influence the actions of the entrepreneur. Their contribution is particularly relevant because through a survey of a large sample of students in their third and fourth years of 25 universities in 15 different countries, the two researchers were able to find a relationship between some

personality traits and cultural background. The interviews, consisting of 62 closed questions, were structured to investigate the existence of four factors:

1. level of creativity (innovativeness, as measured using the index proposed by the Jackson Personality Inventory Manual, 1994);
2. ability to direct the events in their lives (locus of control, as measured by the Modified I-E Rotter Scale, 1966);
3. entrepreneurial predisposition (entrepreneurial orientation, defined as the sum of the two preceding traits);
4. background (culture), identified as their levels of uncertainty avoidance and individualism (as proposed by the Hofstede Culture Index, 1980).

The authors formulate three hypotheses, the first aimed at investigating how individualistic cultures have a positive impact on the subjects' internal locus of control, the second to verify the relationship between low uncertainty avoidance and the innovative orientation of the interviewee, and lastly the third, which aims to check how far entrepreneurial predisposition is favoured by individualistic cultures with low uncertainty avoidance. With a multivariate regression using the SAS Logistic Procedure (including gender as a control variable), they show that it is possible to accept the first and third hypotheses, so that in a country characterized by a culture of individualism and not plagued by uncertainty, it is much more likely that individuals develop a high locus of control and a strong focus on innovation. The authors emphasize the need for a culture capable of supporting the entrepreneurial phenomenon, not only in political, social and economic terms, but especially through personal education: potential entrepreneurs must have access not only to technically sound instruments for facilitating their work (skills in accounting, marketing, finance, ...), but also an approach that will provide them with the opportunity to develop self-confidence, independence, creativity and a critical and flexible way of thinking.

Ultimately, as suggested by Mueller and Thomas (2001), among the factors that influence the process of opportunity recognition and which can be grouped into the four macro-categories introduced above (mental processes, experience, knowledge, environment), the empirical studies have generally verified the impact of alertness, risk tolerance, cognitive heuristics, experience and environment. Kaish and Gilad (1991), and Cooper et al. (1995), had already tried to give a specific and reproducible definition

to the phenomenon of alertness; they worked with a sample of 1,100 entrepreneurs, conducting interviews and focusing their questions on: (a) the amount of time and effort required to promote a flow of information on business opportunities, (b) the selection of information sources to be included in the flow, (c) the clear signals that in the reference context may indicate the presence of an opportunity. Comparing the two different types of respondents, corporate executive and new venture founder, it is evident that the latter are more likely to activate a broad flow of information, including non-conventional information, and focus principally on risk signals rather than on market signals, while the former trigger different processes. This view stands in stark contrast to a widespread perception of alertness that sees it as a special gift of some particular persons, able to seize opportunities without looking for them. The real problem, therefore, is to identify this particular ability which is present in certain mindsets, regardless of entrepreneurial activity.

To investigate this issue, Gaglio and Katz (2001), developing the stream of research set out above, tried to describe the mental process of an individual gifted with alertness and then use this in an empirical study through targeted interviews. The result of the survey showed that *'Alert people engage in counterfactual thinking that undoes causal sequences; non-alert people engage in counterfactual thinking that undoes the unusual cause only'* (Gaglio and Katz, 2001, p. 103). Therefore, as emerges from interviews with the different entrepreneurs, during the mental journey that drives them to orient themselves and decide in various situations, alert individuals have a greater propensity to break the mould defined by the causal means-ends link as fixed by the market, while non-alert individuals will not do so.

Risk propensity

De Carolis and Saparito (2006) use a model to seek to demonstrate that social capital and cognition interact and together influence the discovery and exploitation of opportunities. They show that a person's behaviour is influenced simultaneously both by the existence of social networks and by his or her personal traits, the latter including cognitive schemas and risk propensity. The authors believe that a different approach to risk, an approach that is almost totally determined by the orientation of reference social networks, changes individual cognitive schemas. Therefore, the two scholars focus their

investigation on those factors that influence individuals' risk perception, identifying three fundamental characteristics:

- *Overconfidence*: entrepreneurs generally overestimate their chances of being right, and this often causes them to take on a new challenge without attempting to reconsider it constantly, to review plans and change their initial idea. This high level of confidence reduces the perception of risk;
- *Illusion of control*: generally entrepreneurs are more confident than other individuals in their ability to control future situations. They are aware that they can predict what will happen to a greater extent and therefore react appropriately, or indeed act in advance;
- *Representativeness/Believing in the law of small numbers*: this factor relates to the ability of entrepreneurs to rely on a relatively small number of sources of information to make a decision. This reduces the perception of risk.

Specifically, the two authors believe that the growth of networks, institutional or otherwise, with which the individual comes into contact, increases his or her ease of access to a greater amount and a wider variety of information. This results in an awareness of having a better knowledge of the outside world, which can lead to making choices without having checked carefully the real validity and significance of the information received. All this confirms entrepreneurs' typical tendency towards overconfidence and illusion of control.

Simon et al. (1991) had already tested empirically the impact of these three characteristics on the decision to undertake a new business. The authors, starting from a sample of 191 interviews conducted with students attending a Master in Business Administration, tried to capture their cognitive biases, their risk propensity and their desire to create a business, asking them a series of questions about a case study describing the possibility of an entrepreneurial initiative resulting from the discovery of a revolutionary product for the market. The indexing of the variables was obtained by assigning a score to each answer given by respondents, and through four successive regressions it emerged that:

- there is a significant negative relation between the perception of risk and the decision to start a new business, while risk propensity does not seem to be linked

to entrepreneurial initiative. Therefore, there is a substantial difference between risk perception and risk propensity, which instead are often confused;

- illusion of control and belief in the small numbers law significantly affect the perception of risk, in an inverse proportion;
- there is no significant relationship between overconfidence and risk perception.

From the empirical evidence above, it appears that to a large extent it is the perception of risk that determines the decision on whether to open a business activity, a perception which is influenced by the illusion of control and representativeness, but not by overconfidence and other aspects such as optimism, risk propensity, flexibility and other controlling factors.

Cognitive heuristics:

Entrepreneurs see ways to put resources and information together in new combinations. They not only see the system as it is, but as it might be. They have a knack for looking at the usual and seeing the unusual, at the ordinary and seeing the extraordinary. Consequently, they can spot opportunities that turn the commonplace into the unique and unexpected. (Mitton, 1989, p.12)

This feature, absolutely crucial in opportunity recognition, denotes the entrepreneur's ability to activate his mental processes so as to see something new in what everyone else considers normal. On this last aspect interesting insights had already been proposed by some cognitive psychologists (Chase and Simon, 1973), who by means of a study of chess players showed empirically that the different choices and performance of experienced individuals and beginners can be traced to the different mindsets they activate before actual events or imaginary stimuli, and which distinguish these two categories of people. This empirical analysis shows that the habitual use of different mindsets over time enables their automatic triggering, without any need for a deliberate decision to do so. This would explain why alert entrepreneurs are able to discover business opportunities without specifically looking for them.

Experience

Experience is fundamental for three specific reasons: the possibility of accumulating knowledge, skills, and tacit abilities difficult to obtain if not in the field; the opportunity to enter into a sector which could lead to new business opportunities; and the possibility of forming social networks which are often relevant in the

opportunity recognition process. In particular, recalling Rondstadt (1988), several empirical studies have focused on the analysis of the spin-off tendency, spinoffs being closely linked to the concept of the corridor principle. For example, Lenzi and Mancusi (2009) propose an empirical study, based on interviews carried out in 2006 with the founders of young and very young (up to five years since start-up) new technology-based firms. The work investigates the real incidence of certain factors facilitating new entrepreneurship proposed in the American literature, and applied to the European context. The aspects observed are: human capital and intellectual assets of the founder (measured as his/her level and type of education, as well as employment previous to the entrepreneurial activity), access to sources of financing (measured through the use of external capital, distinguishing between banks and venture capital), intellectual property rights (represented by patents) and, finally, participation in networks and partnerships with other companies and institutions (measured by the number of contractual agreements with other companies, universities and research centres and the number of patent citations). The sample, consisting of 99 companies, (46 German, 16 Danish and Swedish, 10 French, 21 British and 6 Italian), mainly active in the fields of biotechnology, pharmaceuticals and electronics, revealed two major trends. In Germany and Northern Europe there is a very wide prevalence of founders with higher-level university degrees and post-graduate qualifications (PhD or equivalent) whose employment before the foundation of the new technological enterprise was that of researcher or equivalent in universities or private or public research centres, while only a small proportion were employed by private companies. The opposite is true for the Latin European countries. All this shows that technology transfer, through spin-offs but not only, is an effective mode of exploitation, dissemination and commercialization of research results; indeed, the number of successful technology companies is much higher in Germany and Northern Europe, while this mechanism spreads with more difficulty in the Latin European countries, and what is most worrying is the fact that this phenomenon also involves the newly-established firms.

Another way of looking at the impact of experience on the recognition and exploitation of new opportunities, is to investigate how any previous business experience affects the optimism of the entrepreneur compared with the optimism shown by non-entrepreneurs (Cooper et al., 1988; Fraser and Greene, 2006). Over time opposing beliefs have

developed in this regard: some economists argue that the entrepreneur gradually learns from experience and, starting from an initial over-optimism typical of individuals who intend to start a business, they re-settle on lower levels of optimism in order to avoid any failure (Jovanovic, 1982). In contrast, cognitive studies suggest that people with past entrepreneurial experience typically have a bias in the evaluation of their work, in that they over-generalise the limited information available to them, becoming gradually more and more overconfident in their judgments. This tendency delays the opportunity to learn gradually and sequentially from one's own behaviour (Tversky and Kahneman, 1974, Braley, 2001).

Ucbasaran et al. (2010) try to resolve this contradiction through an empirical study based on interviews carried out by means of structured questionnaires, of which only 576 are selected and then used, in order to comprehend the relationship between the running of a business and the resulting skills and knowledge acquired by the entrepreneur, and subsequent changes in his/her level of optimism. They introduce two types of entrepreneurs and also two types of experience: sequential entrepreneurs (i.e. those who start from the recognition of a business opportunity and then recognize several subsequent ones closely connected to the first opportunity exploited) and portfolio entrepreneurs (entrepreneurs who recognize several entrepreneurial opportunities of different types, distinct from each other) (Ucbasaran et al., 2006), and experiences of success and experiences of failure (McGrath, 1999).

Despite the possibility of acquiring further experience through entrepreneurial activity, the survey results show that entrepreneurs, both sequential and portfolio, who have not experienced failure, and sequential ones who have experienced failure, are more optimistic than non-entrepreneurs; only the portfolio entrepreneurs who have experienced failure have a reduced level of optimism compared to non-entrepreneurs. Thus entrepreneurs reveal a great ability to learn from their own experiences, but evaluate the positive experiences as being of greater importance than the negative ones. In general and according to the studies reviewed, this attitude, if widespread, could promote the desire for entrepreneurial initiative in the population, increasing the chances of national development and growth.

Social Environment

One of the most useful analyses on the subject is that provided by Granovetter (1985), who highlights the importance of weak ties over strong ties. This sociologist argues that through strong ties important and stable relationships are established, which permit in-depth sharing of all the relevant information on an ongoing basis; conversely weak ties, more temporary and random, allow contact with people who tend not to be part of the same network of relationships and are therefore able to provide new information, difficult to obtain in one's own restricted environment. This theory supports the thesis that the more numerous and disparate relationships an individual builds during his life, the more information he or she will have access to, and therefore the more potential opportunities he or she will be able to seize.

Larson (1992) presents a model that describes the process of network formation and highlights the importance of reputation, trust, as well as interdependence and reciprocity in relationships. He takes this consideration to extremes, elaborating the theory of partner networks, according to which a social network made up of companies operating in the same sector could be considered as a sustainable and more flexible alternative to vertical integration. In the light of this strong potential, Dubini and Aldrich (1991) support the assertion that the network should be subject to systematic and targeted planning in order to guide its strategic development.

In this sense, Singh et al. (1999) investigate the importance of the characteristics of the social networks which entrepreneurs under observation belong to, in order to understand their influence in the process of opportunity recognition. The authors collected 256 questionnaires submitted by entrepreneurs in the field of Information Technology, using a regression to test six hypotheses about the impact of the size of the network and the strong and weak ties within it on new business ideas recognized and opportunities exploited. Some control variables were used, such as age, level of education, previous work experience and the age of the firm, in order to give significance to the findings, which highlight the positive and significant relation between the size of the network and the number of weak compared to strong ties and, therefore, with the identification of new business ideas.

In addition, it should be noted that using a large sample of individuals, Arenius and Minniti (2005) attempt to investigate which variables have a significant impact on the

decision of a person to become an entrepreneur. In addition to the economic and demographic characteristics of the individual, the researchers added the so-called perceptual variables: alertness to opportunities, fear of failure and confidence about one's own skills. The results show a high and significant correlation of these variables with the creation of new businesses, across countries and independently of the person's sex. In fact, it can be noted that:

- *Confidence in one's skill and ability* is an important factor, since the individual's decision to embark on an entrepreneurial venture, so complex and full of uncertainty, depends on his self-confidence and awareness of how his actions are crucial to the achievement of success;
- *Fear of failure* highlights the level of risk aversion. It is important to emphasize that entrepreneurs should not be considered gamblers; rather, they have a lower level of risk aversion than non-entrepreneurs in that they are probably better able to calculate and manage it;
- *Knowing other entrepreneurs* emphasizes the importance of psychological support, and from a cost point of view, highlights the importance of observing reality from several points of view in order to reduce its ambiguities;
- *Opportunity Perception* is the entrepreneur's optimism in his knowledge that profitable business opportunities may exist in his area.

At this point a brief aside on the impact of demographic variables is useful. Specifically, of the different variables proposed by Arenius and Minniti (2005), it seems appropriate to investigate the impact of being male or female on the process of entrepreneurial opportunity recognition. As we have already pointed out, the prevailing cultural beliefs in a society affect personal characteristics, influencing or discouraging certain types of behaviour. This is also true with regard to the role of women in society and hierarchical evaluations with respect to typically masculine or feminine traits useful in entrepreneurial initiative (Crannie-Francies et al., 2003; Marlow and Patton 2005). Indeed, as suggested by Langowitz and Minniti (2007), this could be one explanation of why women evaluate themselves and their know-how less favourably, in that an entrepreneurial environment does not always guarantee equal opportunities. This is ironic if one bears in mind that a woman's decision to become an entrepreneur is

potentially favoured and driven by obvious difficulties in entering the labour market (Heilman and Chen 2003).

In most studies, the role of gender is only detected by the control variables (mostly binary), while very few authors investigate the interaction between gender and the perceptual variables in play, relegating understanding of gender effects to the role of a mere given fact. Instead, García-Díaz and Jiménez-Moreno (2010) try to highlight to what extent gender affects a person's entrepreneurial intentions[10].

Other scholars have tried to prove the opposite: De La Cruz Sánchez-Escobedo et al. (2011) performed a regression analysis (univariate and bivariate) on data collected through interviews with 400 students participating in a course called 'From University Student to Entrepreneur', run by the University of Extremadura in Spain over the year 2007-2008. From this survey it was found that males and females are comparable in terms of their appreciation of entrepreneurs in society and their positive intentions with respect to entrepreneurship, but in confirmation of findings from previous studies, the desire set up a new business and the perception of the possibility of doing so are generally lower in females than in males.

All these considerations highlight the prominent role played by education in influencing and determining entrepreneurial decisions, both directly by working on personal traits, and indirectly, by influencing the cultural context. It is no coincidence that a significant increase in entrepreneurship courses offered by universities in all the world's most advanced countries confirms the underlying idea that you can teach someone how to become an entrepreneur (Matlay and Carey, 2006), or rather, that it is possible to develop some aspects of the personality that can guide people towards an entrepreneurial attitude. The basic contradiction lies in the aim of such courses and, therefore, in the results they achieve. The literature and empirical research do not always agree on any significant and positive impact that these teaching approaches can offer either the individual entrepreneur, or, as a result, the wider context: *"Often such programmes equate entrepreneurship with new venture creation and/or small business management and educate 'about' entrepreneurship and enterprise rather than educating 'for' entrepreneurship; only rarely the focus is on developing in their*

[10] Of the few empirical works that use this approach we cite Kickul and Krueger (2005), and Wilson et al. (2007).

*students the skills, attributes and behaviour of the successful entrepreneur" (*Kirby 2004, p. 514).

Indeed, Johannisson (1991) had already stated that the training which predisposes a person not only to engaging in entrepreneurial activity, but also to becoming a businessman, goes far beyond the scope of business schools in terms of both time and method, and that generally the latter teach skills essential to but not sufficient for creating a successful entrepreneur. Matlay (2008), through telephone interviews with students, sought to analyze the impact of university courses run in the UK (in particular, a course specifically designed to train entrepreneurs) on the birth of new enterprises. The data refer to students enrolled in the third year or above of college and for a period of ten years, from 1997 to 2006. The author tried to investigate the intentions and skills regarding running a business enterprise, possessed by the students before graduation and after graduation, and at one, five and ten years after the end of studying. The results show that the university courses did increase their competences, and this induced students to consider the possibility of starting an entrepreneurial career. Ten years after graduation, nearly all the respondents were working as freelancers, partners of small and large businesses, or entrepreneurs. This confirms the idea that hearing about entrepreneurship as a possible job opportunity, and consciously training for this purpose, has a considerable effect on individuals.

In conclusion, it seems useful to focus briefly on those aspects affecting - even if only indirectly - the entrepreneurial opportunity discovery process and the flourishing of entrepreneurship in different countries. We mean all aspects concerning managerial, organizational and financial issues, which serve to develop an activity sustainably and so inevitably affect entrepreneurial choice and, therefore, the phenomenon as a whole. Of these we consider the studies on corporate entrepreneurship, entrepreneurial orientation, strategic management and entrepreneurial finance.

With regard to the now generally-accepted concept of corporate entrepreneurship, this refers to entrepreneurial actions and initiatives that are able to transform organizations continuously through strategic processes of renewal, or penetration of new markets or technological areas, permitting steady expansion of a firm's scope (Guth and Ginsberg, 1990). Companies with this imprinting are typically very dynamic and flexible, ready to seize and exploit new opportunities. They tend to be open to continuous exploration of

new markets, ready to deviate from routines and find new combinations of resources to achieve innovation and, therefore, new life for the entrepreneurial activity (Morris et al., 2008). Clearly, this capability should not be limited to the top of the organizational hierarchy, but must be widespread and integrated throughout the organization and in any strategy implemented (Burgelman, 1983).

It is for this reason that Goodale et al. (2011) compare the activities of corporate entrepreneurship (specified using the so-called 'corporate entrepreneurship assessment instruments') with ordinary control activities and show how the presence of the former in an enterprise is the true source of its long-term success. Using a sample of 177 United States companies[11] operating in various sectors, the authors investigate the effect of corporate entrepreneurship assessment instruments on innovation. These instruments are specifically: management support, autonomy in work, rewards, time availability and organizational structure. The results show that only the presence of management support tools directly and significantly influences innovation, as they render the ordinary means of control more flexible and adaptable, increasing their effectiveness.

A more European approach, useful because it is based directly on new technology based firms, referred to the information and communications technology sector, is that recently proposed by Bojica and Fuentes (2011). The two authors extend analysis in an attempt to understand the impact any alliances, partnerships and outside opportunities exploited in order to increase knowledge, can have on business performance. Specifically, they aim to demonstrate that the enterprise's belonging to institutional networks of relationships, networks specifically designed to support connections on the market and spontaneous exchange of knowledge, increases performance. However, the results emerging from the empirical survey are conflicting: the acquisition of new knowledge has a statistically significant effect on the relationship between corporate entrepreneurship and performance but does not affect the latter directly. In practice, a greater amount of knowledge and information does not increase performance directly and immediately, but does at least lead to better use of corporate entrepreneurship tools, so that the latter have an effective impact on the business's results.

When it comes to entrepreneurial finance, this deviates from traditional financial theory, 'because financial economists have begun to recognize that the financing of

[11] These firms have sent their managers to specialist courses on subjects such as strategic change, innovation and entrepreneurship and strategic human resource management for at least two years.

entrepreneurship involves two issues that lie at the basis of the major theories of corporate finance: the principal/agent issue and information asymmetry' (Meoli, 2009, p. 121); therefore the above line of research focuses on the different forms of contract available for the financing of entrepreneurial activity and the impact that the presence or lack of these issues has on the flourishing of new businesses and exploitation of business opportunities.

Many empirical studies investigate the contribution of venture capital and business angels to entrepreneurship; these grant access to capital markets to entrepreneurs even though they do not yet have an operating business or, as a result, any tangible assets or information on profits. The empirical evidence suggests the main reasons why these parties are indispensable to the market: both for access to capital otherwise denied by traditional forms of financing, and due to the professionalizing effect they have on start-ups, which are monitored, guided, included in networks of relationships and nurtured until they become independently viable. These players, if institutionalized, facilitate entrepreneurial activity by feeding the virtuous circle between environmental factors, impact on entrepreneurship and so again change in the environment itself.

To conclude this chapter, the contribution made by empirical studies to the understanding of opportunity recognition adds another stepping stone to the path of theoretical study, although these studies have shown how difficult it is to model the process of entrepreneurial opportunity recognition. In the following section of this work our empirical contribution, unlike the majority of the works presented above, is based on a relatively small sample of entrepreneurs; however, this very characteristic, giving us direct contact and the chance to listen to their histories and experiences, enabled us to grasp the impact of factors that are now considered crucial to entrepreneurial opportunity recognition, as well as to add some further considerations.

CHAPTER 2

Entrepreneurial opportunity recognition in high-tech industry: a qualitative and quantitative analysis

Introduction

An insight in recent entrepreneurship research shows an increasing number of contributions and a considerable academic interest for the phenomenon. This new discipline has emerged as one of the most vital and dynamic not only in management science and economics but in many other social sciences. Amongst all the possible questions emerging in entrepreneurship research, this work concentrates on the existence, discovery and exploitation of entrepreneurial opportunities.

We approach the topic recalling the debate between the two main views of opportunity formation, that present themselves as the discovery and the enactment approaches, two paradigms viewed for long time in contraposition but, recently, reconciled in many attempts that are still under scrutiny and not always encompassing each other.

In order to deepen the process of opportunity formation and recognition our contribution considers a set of fifty-two entrepreneurs operating in technological fields and investigates, through detailed interviews, exactly the process through which the individual becomes entrepreneur. At the end we fit all the considerations into some theoretical models that jointly consider the role of entrepreneurs and of opportunities.

2.1 The opportunity recognition process

Many contributions on entrepreneurship concentrate on the process after an opportunity has been discovered and analyze the different steps of a new venture creation, instead our interest is towards the process of opportunity recognition (OR) in the attempt to

investigate those factors influencing the entrepreneur in identifying and exploiting such opportunities, showing that concentrating only on the individual traits or on the new firm fails to fully understand this complex phenomenon. This process appears to be a more fruitful area of research because it acknowledges that opportunity recognition is a multifaceted phenomenon influenced by numerous factors that may be critical to its outcome.

"Why, when and how do some people and not others discover and exploit opportunities?" (Shane and Venkataraman 2000, p. 218) is one of the major questions for the entrepreneurship research to address.

Recently, many authors have attempted to reconcile the diverse approaches to opportunity recognition (Azevedo 2002, Chiasson and Saunders 2005, Alvarez and Barney 2007, Vaghely and Julien 2010, Mole and Mole 2010) to avoid the risk of a too fragmented knowledge that often prevent a fruitful synthesis. "Numerous dichotomies in entrepreneurial research point to irreconcilable differences in the nature of entrepreneurship: independence vs. dependence, process vs. personal attributes, revolution vs. evolution, vision vs. action, and social vs. business orientations […]. The challenge of theoretical and methodological diversity is not unique to entrepreneurship. Management topics and social sciences disciplines deal with similar concerns" (Chiasson and Saunders 2005, 749)[1].

Therefore, in the debate, the suggestion that individuals interpret reality and create an opportunity reconciling their ideas with what emerges from the environment makes sense. Then, exploiting opportunities changes the reality and gives the possibility to other opportunities to be discovered and created by the individuals, again modifying the structure and so on.

Following this advice we decided to go directly to the roots of the phenomenon and, listening to the personal experience of the entrepreneurs, we attempt to relate the individual, with his personal traits, to the formation/recognition process of a profitable entrepreneurial opportunity. This matching attempt (for more in depth considerations

[1] Our contribution does not describe in details the different attempts of reconciliation between the discovery and the enactment viewpoint. In Chiasson and Saunders (2005) the structuration theory is the tool to dissolve the dichotomy, in Vaghelt and Julien (2010) is the combination of algorithmic and heurist information treatment, while Azevedo (2002) proposes the so called "evolutionary realistic approach" in which the reality is independent from the individual, but it poses some limits to the human actions according to the interpretation given to it.

see the chapter 1) considers, on one side, the different sources for innovative opportunity, as pointed out by Drucker (1985) and, on the other, several traits of human personality which seems to be connected with a greater chance to start a new venture.

In particular, we used the model introduced by Lumpkin, Hills and Shrader (1999) and its developments to entangle the peculiarities of any opportunity recognition process, and some insights suggested by Mueller and Thomas (2001), to highlight the principal aspects able to influence the opportunity recognition process (mental processes, knowledge, experience and environment). Moreover, we also referred to Park (2005) to high technology firms, in order to evaluate the role played by technology. This allows us to distinguish the innovating from the firm organizing entrepreneurs and to identify the role of scientific and technological knowledge acquired during either advanced education or previous work experiences.

The likelihood of certain individuals discovering opportunities is affected by both the availability of the necessary information for locating an opportunity and the cognitive skills necessary for evaluating this information.

Thus the dispersal of information not only allows opportunities to exist, but it also influences the capability of potential entrepreneurs to identify them. All individuals hold a set of specific information that depends on their life experiences; by virtue of such information they develop a certain type of mindset that enables them to be more creative and to evaluate new information that complements prior knowledge (Cohen and Levinthal, 1990).

The ability to create links between specific types of information depends on a set of skills, aptitudes and circumstances that are not evenly distributed among individuals. Prior work experiences, educational background, hobbies and social networks are the main information channels for acquiring knowledge, allowing the individual to gather data on marketplace conditions, on the way to serve it and on consumer needs. According to Shane (2000), these factors are particularly important for launching a business venture.

So far, there is debate about the possibility to train aspiring entrepreneurs by simply displaying the achievements of successful entrepreneurs. Particularly, according to the prevailing view, the best school for an individual is the professional experience within a firm, seen as the best incubator for a new venture. But, following Fiet (2002), the idea

of teaching how to make a purposeful systematic search has gained more credibility and the propensity to invest in risky activities seems to be stimulated by a major self-confidence and a better ability to calculate and be aware of business risk (Noel 2001). According to Ehrlich et al. (2000), attending entrepreneurship schools affects students' perception of their own capacity to successfully start and manage a business. In particular, by the end of the course the students are more confident of their own skills and more determined to embark on an entrepreneurial career, even though they may also have become aware of the complexity of the entrepreneurial experience and of the risks involved.

While the methodology of these empirical studies may be questionable, these findings seem to strengthen the idea that teaching entrepreneurship subjects can constitute an important tool for developing the necessary skills in those individuals embarking in an entrepreneurial career.

In the following part, we approach the opportunity recognition process by a qualitative analysis. Our sample of entrepreneurs will allow us to achieve a more comprehensive description of the process through a combined analysis of the diverse factors involved that have mainly studied separately. The interviews gave us an enormous set of information and, subsequently, using the tools suggested by the literature, we have classified all these information and had the opportunity to reach a better comprehension of this complex but intriguing phenomenon.

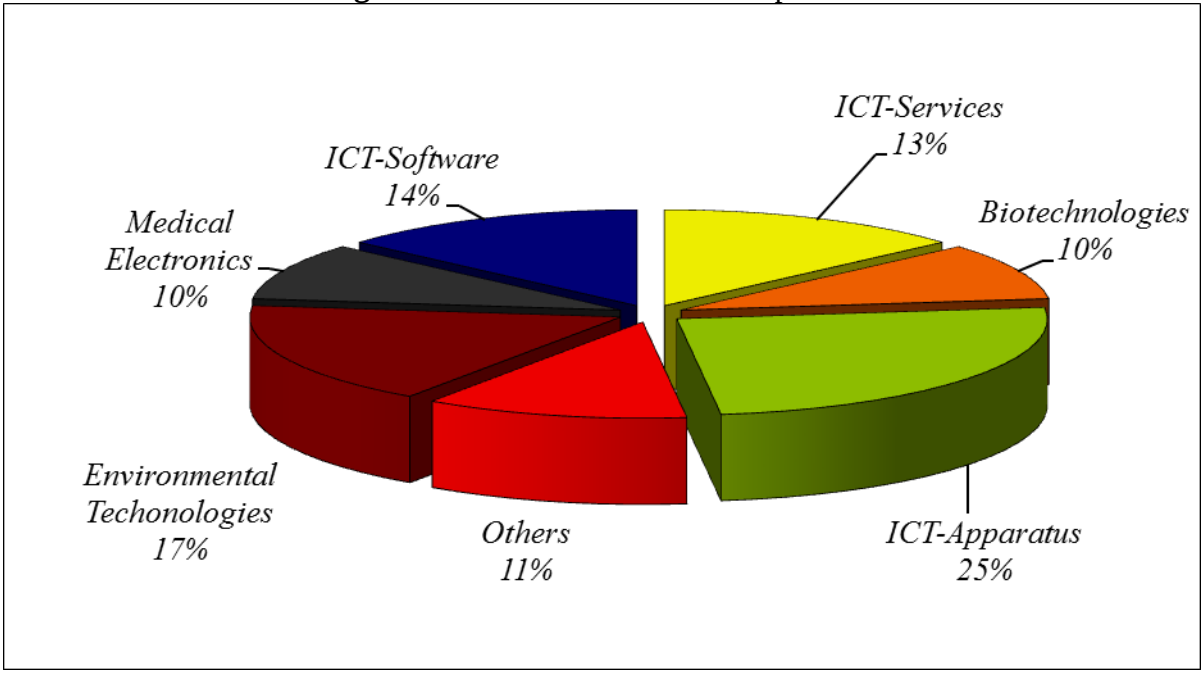
2.2 Some empirical evidences in the high tech industry

2.2.1 Data set and methodology

The sample is made up by 52 entrepreneurs and the information used in the paper have been collected through personal interviews performed in the last years. To identify the entrepreneurs we used different sources: some venture capitalists, a community of first generation entrepreneurs and the Confederation of firms in Lombardy. The research has mainly taken place in Lombardy, a rich and industrialized region in the north of Italy, especially along the area of Milan and neighborhoods. In the sample of technology

based firms there are both recently born firms and some less recent, we also have few serial entrepreneurs entering in the sample with only one venture.

Fig. 2.1 - The industries in the sample



Source: our elaboration.

Using the sample we want to investigate both the profile of the entrepreneurs outlining their main features and, if possible, to point out some regularities concerning the opportunity recognition process. Our concern has also been to highlight the elements that can help institutions, public and private, to develop and refine policies and support programs for entrepreneurship.

The respondents were asked to tell their story, initially the narration was totally free but, step by step, the individuals were plied by some specific questions guided by a scheme expressly created in the attempt to highlight the key steps on the way through the discovery and the exploitation of the entrepreneurial opportunity.

The pattern of the interviews followed the advices emerged from the main literature available at the state of the art. In detail, as to the description of the distinctive personal traits influencing the opportunity recognition process, we referred to the classification suggested by Mueller and Thomas (2001). They selected four basic areas connected

with the recognition of an opportunity: (1) the mental processes, (2) the knowledge, (3) the experience and (4) the environment surrounding the entrepreneur.

The mental processes pertains to all the aspects linked to the individual personality, his creativity, need for achievement and locus of control, his tolerance and ability to take advantage from ambiguous and complex situations and, finally, a risk perception below average. In particular, we have investigated the role played by the networks and eventually by teams in supporting the entrepreneurs in the new venture. Referring to networks, Granovetter (1973, 1995) points out that the ability to create new ideas comes, in general, from being a member of a network, especially if people are connected by weak ties. Teams play a different role and their relative importance shows a more or less need for support by the respondents. This allows us to classify our entries as "solo entrepreneurs" or "network entrepreneurs". We also investigate the motivation to the entrepreneurial career: if the search was internally or externally stimulated and if the process of discovery was guided by alertness or awareness.

According to concern (2) and (3), we explore the sources of information and prior knowledge mastered by our entrepreneurs, in particular previous working experiences can represent a corridor principle for the discovery of the opportunity or, at least, can create a set of competencies useful to identify some interesting opportunities invisible to others.

Knowledge and experience play a pivotal role in the OR process in high-tech industries. The ability to develop, utilize and adapt knowledge, in particular technical knowledge, is critical for a firm operating in such high-tech environment (Oakey 2003; Park 2005). Therefore, during the interviews we investigate the importance of technology in exploiting an opportunity; as a matter of fact many contributions focus on the knowledge of the market, leaving mostly unexplored the specific role of technical knowledge. Furthermore, concerning the nature of the opportunity, we also attempt to evaluate the degree of connection between the new opportunity recognized and the previous ones exploited by the entrepreneur (Holcombe 2003).

The last area explored concerns the impact of the environment on the OR process, precisely we look at the particular familiar background of the entrepreneur and focus on the specific moment in his/her life when a strategic window has opened the horizons on new possibilities.

Finally, sharing the position of researchers about the limits of an investigation based mainly on entrepreneurial traits and, therefore, agreed upon the idea that identifying opportunities is a several steps process over time, we asked the entrepreneurs to distinguish the elements of the creative process they went through and, if possible, to identify the stages during the process of opportunity recognition. More precisely we propose the five different elements pointed out by Hills, Shrader and Lumpkin (1999), and previously by Wallas (1926) while identifying a creative process, as preparation, incubation, insight, evaluation and elaboration.

After listening to the entrepreneurs' experiences and reconciling them with the theoretical background suggested by the literature, we have reached some evidences about the following main areas of interest:

I. the typology of opportunity, how it appears in the market and how someone can discover it;
II. the personal characteristics of the entrepreneur;
III. the way the individual relates to the opportunity in the specific process that highlights clearly the indissoluble individual-opportunity nexus.

Before starting analyzing data, it is important to understand who are the firms and the relative entrepreneurs composing the sample. The following table allows an overview on that.

INDUSTRY	N.	FIRM	LOCATION	DATE OF BIRTH	ENTERPRENEUR
ICT-Software	***1***	Bizmatica Spa	Milano	2000	Piol
	2	Docebo Consulting Srl	Biassono (MB)	2005	Erba
	3	Etnoteam Spa	Milano	1978	Polillo
	4	I.Net Spa	Milano	1993	Quintarelli
	5	IT Software Spa	Milano	1993	Grande
	6	Saga Spa	Milano	1993	Ghianda
	7	TXT E-solutions Spa	Milano	1989	Braga Illa
ICT-Services	***8***	Ayperos Spa	Milano	2007	Marrara
	9	Baloo Srl	Milano	2007	Sepe
	10	Buongiorno Vitaminic Spa	Parma	1999	Del Rio
	11	Grafo Ventures Srl	Milano	2010	Sica
	12	MOL Spa	Milano	2000	Pescarmona
	13	Terashop Spa	Lainate (Mi)	1999	Lembo
	14	Volagratis Spa	Milano	2004	Cannavale
ICT-Apparatus	***15***	Accent Srl	Vimercate (MB)	1993	Vanzi
	16	Access Media Spa	Milano	1997	Pezzotta
	17	Aethra Spa	Ancona	1971	Viezzoli
	18	Cias Elettronica Srl	Milano	1974	Gasparini
	19	DMT Spa	Lissone (MI)	2000	Falciai
	20	Elemaster Spa	Lomagna (LC)	1978	Cogliati
	21	Fagrel Srl	Verderio Inf. (LC)	1986	Faviani
	22	Global Service Sas	Agrate Brianza (MB)	1988	Castelletto
	23	Netsystem Spa	Trezzano sul Naviglio (MI)	2000	Artom
	24	SBS Srl	Miasino (NO)	1994	Sappa
	25	Selta Spa	Piacenza	1972	Bertolini

	26	SIO Spa	Cantù (CO)	1997	Cattaneo
	27	Technoprobe Spa	Cernusco L. (MI)	1995	Crippa
Biotech	***28***	AAT Srl	Piacenza	2005	Elli
	29	CTI Spa	Bresso (MI)	1998	Spinelli
	30	Newron Spa	Bresso (MI)	1999	Benatti
	31	Nicox Srl	Bresso (MI)	1995	Garufi
	32	Vicuron Spa	Gerenzano (VA)	1996	Parenti
Environmental technologies	***33***	Citiraya Spa	Agrate Brianza (MI)	2001	Gullifa
	34	Deparia Engineering Srl	Calolziocorte (LC)	1990	Costa
	35	Ecodeco Spa	Giussago (PV)	1975	Natta
	36	Enerpoint Spa	Nova Milanese (MB)	2001	Viscontini
	37	G.I. Renewable	Milano	2008	Franceschetti and Geminiani
	38	Robur Srl	Zingonia (BG)	1965	Guerra
	39	Solar Ventures Spa	Milano	2005	Appendino
	40	Solarélit Spa	Milano	2007	Faini
	41	T.I.A s.r.l	Milano	2005	Dubini
Medical Electronics	***42***	Ab Medica Spa	Lainate (MI)	1984	Cerruti
	43	Dasit Spa	Cornaredo (MI)	1982	Fracassi
	44	Digitec Srl	Lecco (LC)	1985	Re
	45	Inpeco Srl	Segrate (MI)	1980	Pedrazzini
	46	MedicAir Spa	Pogliano (MI)	1986	Moscatelli
Others	***47***	Arcomdis Srl	Concorezzo (MB)	2001	Sala
	48	Costume National Spa	Milano	1986	Capasa E.
	49	Golf'us Spa	Milano	1987	Vittadini
	50	Intercos Spa	Agrate Brianza (MB)	1974	Ferrari
	51	Omet Srl	Lecco (LC)	1963	Bartesaghi
	52	Onama Spa	Milano	1964	Bianchi

2.2.2 The discovery of the opportunity

The interviews allow us to make useful considerations about the motivation driving the individual in the opportunity discovery process, the point in time and the way in which these opportunities arise and the individual attitude, i.e., the potential entrepreneur is simply alert or he decides to search the right opportunity and to exploit the so called "strategic window"? The concept of strategic window was firstly introduced by Abell (1978), to describe when a critical juncture in people life exactly meets the market needs, thus the individual is strongly pushed to start a new venture. For example, it happens in relation to peculiar situations such as graduation, first job, economic independence, displacement, retirement and so on. In such situations, as well as when a new technology enters the market or a new market comes out, people feel a more favorable environment to try an entrepreneurial career. Therefore, it is important to look at these "strategic windows" and to be able to exploit them purposefully.

Moreover, it is also important to point out some facilitating factors, such as technology, networks and teams, in the discovery process.

Finally, following Holcombe (2003) and the idea that the individual ability of discovering something new is a cumulative phenomenon, in our sample we noted that most of the opportunities under scrutiny are related to a previous one that had been discovered or almost known and exploited by the same individual. Kirzner theory about alertness, that underlines the casualty of the discovery in absence of a formal search, is not completely confirmed in reality (Muller and Thomas, 2001). Actually our entrepreneurs showed a very developed attitude to observe the environment, to capture some signals, to look for some details and all this makes the difference from a common interpretation of the surrounding: 65% of the sample admitted to be more aware than alert, supporting the result that 63% of the respondents found the opportunity after a systematic search and not just thanks to a fortuitous discovery. We can state that our entrepreneurs have an accurate view of reality, raw data, or resources and give them a different meaning from other's interpretation.

Alsos and Kaikkonen (2004), classified four possible types of opportunity recognition behaviors emerging from the matching of the knowledge previously possessed by the individual with the nature of the opportunity (already existing in nature or specifically

created by the individual). These behaviors emerge from an active-passive attitude of the individuals (serendipity or deliberate search) and the subjective-objective nature of the opportunity (objective reality or subjective creation), and they have been classified as:

- opportunity discovery (passive-objective),
- opportunity search (active-objective),
- opportunity creation (active-subjective) and
- opportunity occurrence (passive-subjective).

According to these results, we have found that more or less 40% of our sample has fallen into the case of opportunity creation, that is subjective opportunity and active search, but all the other typologies exist, even if with smaller entries.

These results support our assumption about the centrality of the individual knowledge and initiative in the OR process and that the systematic search is more fruitful than just waiting for luck. Therefore, alertness can be considered as a first step, as an entrepreneur attitude, a sort of necessary but not sufficient condition to discover an opportunity; while being aware gives more guarantees for a successful outcome.

Some attempts of reconciliation between the two views about the role of alertness and awareness in the OR process are the ones proposed by Kaish and Gilad (1991), Cooper et al. (1995) and Gaglio and Katz (2000). These authors empirically try to test the relevance of alertness for the discovery process. Actually they compare the attitude of entrepreneurial individuals with the one of other people, for example new venture founders in contraposition with corporate executives. The former set counterfactual thinking that undoes causal reasoning, consequently they often break the usual means-end relations to use creativity and find out original patterns.

Tab. 2.1 - The engine to the process of opportunity recognition

INDUSTRY	N.	RECOGNITION		DECISION TO START		HOW TO START	
		%		%		%	
		ALERT	AWARE	INTERNALLY STIMULATED	EXTERNALLY STIMULATED	RESEARCH	DISCOVERY
ICT- SOFTWARES	7	43	57	57	43	86	14
ICT-SERVICES	7	43	57	43	57	86	14
ICT-APPARATUS	13	23	77	38	62	38	62
BIOTECHNOLOGY	5	20	80	80	20	40	60
ENVIRONMENTAL TECHNOLOGIES	9	56	44	78	22	56	44
MEDICAL ELECTRONICS	5	40	60	60	40	80	20
OTHERS	6	17	83	50	50	83	17
TOTAL	**52**	**35%**	**65%**	**56%**	**44%**	**63%**	**37%**

In particular Gaglio and Katz (2000) propose four typologies of individuals: assessing (the fully alert individual), discounting (the marginally alert individual), dismissing (the uselessly alert individual) and uninterested (the non-alert individual). For the two authors only the first two categories can be considered entrepreneurs. According to these definitions most of our entrepreneurs can be considered alert people, they admit an ability to watch reality in a different manner with respect to their relatives or friends, but they were not so sure to have the type of alertness introduced by Kirzner, in fact only 35% of our sample defined itself alert, meaning something near to the original kirznerian concept.

In about 70% of the interviews the opportunity recognition process was facilitated by some factors, such as technology (68%) and strategic windows (71%). Technology seems to have a specific role in opportunity discovery, but, as stated by Park (2005), it is mostly seen as a factor able to develop new markets on its own, while in the author opinion, it is just one of the components of the OR process together with the founding entrepreneur and the managerial knowledge able to combine and exploit other resources while responding to business opportunities. Many of the 52 opportunities investigated would not be discovered without a new technology able to change the mindset about the habits to do some production processes or services. Technology has been both a push and an enabling factor, but the new opportunity is exploited as the result of the dynamic interaction with other factors and not as generated by a stand-alone technical knowledge.

Tab. 2.2 - Factors facilitating opportunity recognition

INDUSTRY	N.	STRATEGIC WINDOW (71%)				IMPORTANCE OF TECHNOLOGY	
		%	%	%	%	%	%
		MARKET	TECHNOLOGY	PERSONAL	NONE	YES	NO
ICT- SOFTWARES	7	29	43	14	14	86	14
ICT-SERVICES	7	29	14	14	43	100	0
ICT-APPARATUS	13	31	54	0	15	100	0
BIOTECHNOLOGY	5	0	0	20	80	60	40
ENVIRONMENTAL TECHNOLOGIES	9	67	11	22	0	67	33
MEDICAL ELECTRONICS	5	0	40	20	40	60	40
OTHERS	6	50	0	0	50	0	100
TOTAL	**52**	**33%**	**27%**	**11%**	**29%**	**68%**	**32%**

Recalling Holcombe (2003), who feels that step by step the entrepreneurial process continuously leads to the discovery of other opportunities to exploit, we can confirm that many of the opportunities investigated are strictly related (67%) to the previously discovered ones. Only very innovating entrepreneurs try to move from a field to another just for the pleasure to discover something new and become a portfolio rather than a serial entrepreneur. The latter attitude could seem less risky than the former one, but being a portfolio entrepreneur allows to share the risks among different and unconnected activities and to reduce the danger of breakdown and failure. Westhead, Ucbasaran and Wright (2003), analyzing the differences among novice, serial and portfolio entrepreneurs, point out that "on average portfolio entrepreneurs may offer more attractive growth prospects than other entrepreneurs". […] They are "more likely to exhibit several competencies that provide greater understanding surrounding why and how they own several business at the same time." (Westhead, Ucbasaran and Wright 2003, 198).

Tab. 2.3 - Opportunity related or unrelated

INDUSTRY	N.	RELATED	
		%	%
		YES	NO
ICT- SOFTWARES	7	57	43
ICT-SERVICES	7	14	86
ICT-APPARATUS	13	85	15
BIOTECHNOLOGY	5	80	20
ENVIRONMENTAL TECHNOLOGIES	9	67	33
MEDICAL ELECTRONICS	5	80	20
OTHERS	6	83	17
TOTAL	**52**	**67%**	**33%**

Networks are another very important source of opportunity recognition. Gartner (1985) identifies the external environment as a key influencing factor in the foundation process of a new firm. Most of the entrepreneurs in the sample take part in many different types of networks, both institutional and informal. Many successful entrepreneurs find market information through their continuous interaction with people in their markets (Hills et al. 2005) and their behavior often changes as they gain experience and knowledge through interaction with the world around them. Networking behavior is a complement of the existing knowledge base and business knowledge contained within one's personal networks increases the probability of entrepreneurial opportunity recognition.

In many of the experiences analyzed, networks have been the key factor to open new horizons, to look at the reality from a different point of view and to combine ideas and whishes coming from distant worlds. We can confirm that the existence of informal networks, especially the ones characterized by weak ties, leads to the generation of new ideas, to the creation of a dialogue among different worlds that can suggest innovative solutions or can highlight many situation previously unknown (Granovetter, 1973). Moreover, networks play a different role in the phases of the business venturing process: they seem crucial in the implementation phase (75%), but also during growth (60%) and in the recognition (52%).

Tab. 2.4 - Typology and role of networks

INDUSTRY	N.	RECOGNIZING				STARTING				GROWTH			
		IN TOTAL 52% ARE IN A NETWORK				IN TOTAL 75% ARE IN A NETWORK				IN TOTAL 60% ARE IN A NETWORK			
		%	%	%	%	%	%	%	%	%	%	%	%
		informal	financial	industry	no	Informal	financial	industry	no	informal	financial	industry	no
ICT-SOFTWARES	7	43	14	14	29	29	13	29	29	29	14	14	43
ICT-SERVICES	7	71	0	0	29	71	15	0	14	43	29	0	29
ICT-APPARATUS	13	15	0	10	75	23	7	8	62	8	15	15	62
BIOTECH	5	20	0	0	80	20	80	0	0	20	80	0	0
ENVIRON. TECH.	9	78	11	0	11	78	0	0	22	67	0	0	33
MEDICAL ELECTRONICS	5	40	0	20	40	60	0	40	0	40	0	0	60
OTHERS	6	17	0	17	67	33	0	67	0	17	33	17	33
TOTAL	**52**	**40%**	**4%**	**8%**	**48%**	**44%**	**14%**	**17%**	**25%**	**31%**	**21%**	**8%**	**40%**

Often the entrepreneur is considered as a bright individual that suddenly has an insight and discovers something new, all by himself. Our stories show the opposite: without being part of a network many entrepreneurs would not have recognized any opportunity and, during the recognition and the venturing phases, 70% of our respondents proceed in team not only due to need of integrated competencies, but mainly for the value added generated by the teamwork. Alone, they would not have started their entrepreneurial career and, even if it is difficult to find the right partners, it is positive to share the work experience and responsibilities in order to find new stimuli. Teams were present in about 70% of our entrepreneurs.

Tab. 2.5 - The importance of teams

TEAM SUPPORT									
INDUSTRY	**N.**	**OPPORTUNITY RECOGNITION**		**BUSINESS VENTURING**		**NEED FOR SUPPORT**		**MOTIVATION (36/52= 70%)**	
		%	**%**	**%**	**%**	**%**	**%**	**%**	**%**
		INDIVIDUAL	**COLLECTIVE**	**INDIVIDUAL**	**COLLECTIVE**	**LOW**	**HIGH**	**WILL**	**NEED**
ICT- SOFTWARES	7	71	29	14	86	43	57	67	33
ICT-SERVICES	7	86	14	14	86	43	57	17	83
ICT-APPARATUS	13	69	31	46	54	62	38	57	43
BIOTECHNOLOGY	5	0	100	0	100	80	20	20	80
ENVIRONMENTAL TECHNOLOGIES	9	33	67	22	78	56	44	29	71
MEDICAL ELECTRONICS	5	80	20	80	20	20	80	0	100
OTHERS	6	67	33	33	67	67	33	25	75
TOTAL	**52**	**58%**	**42%**	**30%**	**70%**	**53%**	**47%**	**31%**	**69%**

We can conclude that networks generate good teams and teams are the sources of novelty and entrepreneurial success. Thus the ability to work in teams should be fostered and improved from the earlier stages of life.

2.2.3 The personal traits of the entrepreneur

The personal characteristics of the entrepreneur have been thoroughly investigated both theoretically and empirically. Our analysis focuses on some aspects linked to the familiar background, the level of education, the work experience, the risk propensity, the ability to be innovative rather than simply organizer and the eventual experience abroad.

First, it is interesting to note that, in contrast with the common sense, the familiar background is not so important as one can think. Half of the respondents did not have any entrepreneurial background, 25% had someone in the family (not parents) with an entrepreneurial attitude and the remaining 25% includes sons of entrepreneurs.

According to Cohen and Levinthal (1990) and Davidsson and Honig (2003) individual's education may enhance opportunity recognition through facilitation of access to knowledge, in particular prior knowledge gained from education facilitates the

acquisition and integration of new knowledge and strongly contributes to the individual ability to recognize opportunities[2].

In our sample 72% of the entrepreneurs have a high or very high education level, university or more (MBA or PhD); this supports the idea that education can deliver the right competencies and ability not only to manage an individual activity, but also to build new knowledge and discover opportunities. Following our entrepreneurs, prior knowledge is crucial for looking at the market in a purposeful way, to understand the technological possibilities and to discover some market signals. Education is important not only for acquiring mere knowledge, but also to nourish the talent of a person and to foster creativity, in a word to be enterprising.

In Matlay (2008), an empirical investigation referred to a group of student before, during and after their master courses in entrepreneurship showed that the students acquired business competencies that, step by step, pushed them more and more towards an entrepreneurial career. Most of them decided to join the courses having already in mind to try a business venture and in this way they could gain a better knowledge of useful tools to manage the business. Therefore, Johannisson (1991) suggested that business schools correctly supply some economic and financial tools, but they are not enough to develop some specific human features needed by the entrepreneur, first of all the ability to explore new initiatives, to be self-confident, to manage the risk without any fear and so on. In particular, this does not help free thinking and originality, anyway, even only highlighting the possibility to choose an entrepreneurial career as a valid alternative to a subordinate job, is a relevant result. Many respondents underlined that in our culture the role of entrepreneur is mostly unknown and far from been popular amongst the occupational alternatives. They also believe that just enlarging the debates on the topic can make entrepreneurship a viable option for more people.

Strictly related to education, there is the role played by the previous work experience in the opportunity recognition process. "People recognize those opportunities related to information that they already possess" (Venkataraman 1997, p.121). Shane (2000) has identified three dimensions of prior knowledge instrumental to the process of

[2] The first known course on entrepreneurship was taught at Harvard University in 1947, since then the academic interest in the topic has grown, but only a small number of universities offer advanced studies in entrepreneurship, therefore, those currently active in the profession have a variety of disciplinary background.

opportunity identification. These are prior knowledge of markets, prior knowledge of the ways to serve markets, and prior knowledge of customer problems. The literature on knowledge and its role in opportunity identification (Shane 2000, Ucbasaran et al, 2003) contains robust empirical evidence of knowledge asymmetries between individuals as an important determinant of who identifies opportunities and what these opportunities are. Such knowledge does not result in automatic opportunity identification; the individual must possess the ability to value and utilize it.

Our research, thus, suggests that as individuals become more knowledgeable at a particular task through experience, they become increasingly efficient to focus on the key dimensions that better contribute to a successful venture. About 85% of our sample declared that their previous job experience, mainly in terms of competencies and contacts, was crucial for their new initiative. For more than a half of our entrepreneurs the prior knowledge of the market was useful to recognize and then exploit an opportunity, and for the remaining 35% the specific knowledge acquired in previous working experiences allows the individuals to enter the so called "corridor principle"[3]. Ronstadt (1988) found that working in a specific industry and context, allows people to see things otherwise imperceptible. Other contributions (Becker 1993, Fiet 2002, Fiet et al. 2004) have explored the links between human capital and opportunity recognition, making, for example, a distinction between general (education and work experience) and specific (managerial and technical capabilities) human capital, defining the former as easily transferable across industries and the latter less transferable and, therefore, with less applicability outside the industry. In particular, Ucbasaran, Westhead and Wright (2008) highlighted that specific human capital was significantly associated with a higher probability of recognizing and pursuing more opportunities. In this study, the results about technical knowledge were particularly interesting, showing a less significant association with the stage of opportunity identification, while a considerable impact in the pursuit one.

[3] The individual prior knowledge creates a knowledge corridor allowing to recognize only some opportunities and not others. Ronstadt (1988) points out that being in business and working in an industry tends to lead to more opportunities: only through the comprehension of the specific dynamics internal to a given market an individual improves its ability to recognize entrepreneurial opportunities. This type of knowledge inserts the individual in a corridor and acts as a facilitator in the OR process. This statement recalls the concepts of technologic regime or sectorial system of innovation that are fundamental in the evolutionary theory of the firm and have the task of reducing the risk related to innovation.

Half of our interviewees recognized the opportunity only thanks to their previous work experience. In details, some of the respondents discussed with colleagues about new business ideas and when some of these ideas did not appear interesting for the firm itself, they decided to exploit the opportunity recognized on their own. We can also confirm the principle that specific knowledge plays an important role in the exploitation stage, but has a minor impact in the recognition one. In other word, education, work experience and creativity help to recognize the opportunity, then, when needed, the individual looks around for specific knowledge. From our sample clearly emerges that both capabilities, with various degrees and roles in the different steps, are needed in the entrepreneurial process, therefore the entrepreneurs circumvent their lack of specific knowledge by involving in the process other individuals with complementary profiles generating an entrepreneurial team to manage the new venture.

Another factor, besides education and work experience, fostering entrepreneurship is the experience abroad. 60% of our sample is made up by people who had almost one experience, study or work, outside their native country, and for almost everyone (90%) this experience has been crucial to discover an entrepreneurial opportunity or to consider entrepreneurship as a possible alternative job. Moreover, this aspect recalls the importance of belonging to a network and in particular to an international one, both in the opportunity recognition process but also all long the firm life.

Tab. 2.6 - Personal characteristics of the entrepreneur

INDUSTRY	N.	BACKGROUND		EDUCATION			EXPERIENCE ABROAD (31/52=60%)		WORK EXPERIENCE (43/52=83%)	
		%	%	%	%	%	%	%	%	%
		YES	NO	FIRST LEVEL	SECOND LEVEL	UNIVERSITY AND BEYOND	YES	NO	CORRIDOR PRINCIPLE	ACQUISITION OF COMPETENCIES
ICT-SOFTWARES	7	57	43	0	29	71	100	0	57	43
ICT-SERVICES	7	57	43	0	0	100	75	25	20	80
ICT-APPARATUS	13	8	92	8	38	54	100	0	55	45
BIOTECH.	5	40	60	0	0	100	80	20	0	100
ENVIRON. TECH.	9	92	8	0	11	89	67	33	43	57
MEDICAL ELECTRONICS	5	60	40	0	60	40	100	0	50	50
OTHERS	6	83	17	0	50	50	100	0	25	75
TOTAL	**52**	**57%**	**43%**	**1%**	**27%**	**72%**	**89%**	**11%**	**35%**	**65%**

Looking at our entrepreneurs and having in mind the two categories of individuals defined by Baumol (1993), the innovating and the firm organizing entrepreneur, we can state that 60% of our sample is made up by organizing entrepreneurs, i.e. individuals that apply something known to new fields or combine in a different way solutions already in use.

The last personal trait investigated is risk perception. Usually, many people associate the entrepreneur to a gambler, someone who loves to dare, to launch himself into some new adventures without any fear of the risks, or maybe to someone who does not even perceive risk[4].

From the experiences of our entrepreneurs clearly emerges that they do not love risk at all, simply they try to asses risk and the congruence between risk level and expected returns. Actually, many of them pointed out the importance of promptly react to problems, to tolerate ambiguous situation turning them into something profitable and to look at reality with an optimistic approach taking into account their capabilities and attitudes. This behavior does not affect risk per se, but it improves some individual features, such as overconfidence (certainty to be always right), illusion of control (consciousness to be able to react successfully in any situation), representativeness (believe in the law of small numbers, few events are enough to take correct decisions) that do not push individuals to overestimate risk (as often happens to non-entrepreneurial people, transforming risk into uncertainty that is difficult to tolerate) and make them able to face the new business venture.

In our sample, only 56% has a high risk propensity while the others do not. There are two different aspects linked to risk and they are often confused: risk perception and risk propensity. From our study, it is clear that, while risk perception has a strong negative impact on the decision to start a new venture, risk propensity has no such negative impact on it. Thus, for example, individuals who are highly risk adverse may become entrepreneurs (notwithstanding this aversion) because this attitude combined with the fulfillment generated by the opportunity exploitation makes entrepreneurial action to be more desirable than organizational employment. This because the entrepreneurs are generally characterized by cognitive heuristics: they do not see the system as it is but as it might be. They are able to treat the ordinary as extra-ordinary; they are able to

[4] Risk refers to a non-deterministic outcome with a known probability distribution, whereas uncertainty refers to a nondeterministic outcome with unknown probability distribution.

activate such mental processes capable to change normality into something new and original, as already suggested by Mitton (1989).

Tab. 2.7 - Further personal characteristics of the entrepreneur

INDUSTRY	N.	RISK PROPENSITY		TYPOLOGY	
		%	%	%	%
		MODERATE	HIGH	INNOVATING	ORGANIZING
ICT- SOFTWARES	7	29	71	43	57
ICT-SERVICES	7	43	57	86	14
ICT-APPARATUS	13	69	31	38	62
BIOTECHNOLOGY	5	60	40	20	80
ENVIRONMENTAL TECHNOLOGIES	9	22	78	33	67
MEDICAL ELECTRONICS	5	20	80	40	60
OTHERS	6	50	50	17	83
TOTAL	**52**	**44%**	**56%**	**40%**	**60%**

Networks are crucial also to this regard, facilitating the flow of information between individuals they reduce risk as well.

2.2.4 The steps in the opportunity recognition process

Concerning the aspects related to the way an individual faces the opportunity in the course of a specific process, we can say that it is very difficult to look at the evolution of this phenomenon ex-post since our respondents had many difficulties to identify different steps in the opportunity recognition process. Anyway, we have been able to collect from the interviews some elements helping us to identify some steps in the process. Thus, we can say that almost three quarters of the sample have lived the preparation, insight and elaboration phases, while for what concerns the incubation period, we can say that it strictly linked to the preparation and it is difficult to distinguish among them. Referring to evaluation, it emerges a closed correlation with the entrepreneur characteristics; the low risk perception of many of our entrepreneurs does not push them to look for all the information to correctly evaluate their idea. Once the idea comes into their mind it seems immediately feasible.

Giving this difficulty of testing ex-post the opportunity recognition model proposed by Lumpkin, Shrader and Hills (1999), other contributions have tried to observe ex-ante the behavior of some potential entrepreneurs. In particular, Hansen and Lumpkin (2009) investigated, for a period of 31 weeks, the behaviour of four groups of MBA students while elaborating a project for a new product for four firms already existing on the market. The results showed the existence of four and not five steps: incubation has not been considered by anybody, moreover, the process does not look linear, but circular and iterative. In particular, inside every step a similar, even if smaller, process is reproduced and every phase consequently takes place in each single one.

Tab. 2.8 - The steps of the opportunity recognition process

INDUSTRY	N.	PREPARATION		INCUBATION		INSIGHT		EVALUATION		ELABORATION	
		%	%	%	%	%	%	%	%	%	%
		YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
ICT- SOFTWARES	7	100	0	57	43	86	14	29	71	100	0
ICT-SERVICES	7	100	0	57	43	86	14	43	57	100	0
ICT-APPARATUS	13	77	23	54	46	77	23	23	77	100	0
BIOTECHNOLOGY	5	80	20	40	60	80	20	60	40	100	0
ENVIRONMENTAL TECHNOLOGIES	9	67	33	44	56	78	22	44	56	100	0
MEDICAL ELECTRONICS	5	60	40	20	80	100	0	100	0	100	0
OTHERS	6	50	50	50	50	17	83	17	83	100	0
TOTAL	**52**	**77%**	**23%**	**48%**	**52%**	**75%**	**25%**	**40%**	**60%**	**100%**	**0%**

2.2.5 The quantitative approach

The process of recognition seems to be fostered by some aspects that are common to all the entrepreneurial stories that we have listened. We hypothesize that they can be linked to education (educational and professional), to some crucial behavioral features (need for achievement and internal locus of control) that impact also on risk perception and to the existence of networks which give stimuli on the attitude to be alert and to look at reality in a creative manner.

These recurring themes in the entrepreneurial experience seem to correspond to latent factors that do not directly impact on the choice to become entrepreneur and do not distinguish an enterprising individual from a non-enterprising one, but they seem to be

some enabling characteristics that allow entrepreneurship to emerge. That is why we decided to set up a quantitative analysis using a common factor analysis recalling the methodology introduced by Spearman in the past century. He was studying the correlation among the results showed by a group of students in three different subject at school and he hypothesized that the correlation among this three variables in reality could have been explained by the correlation with a unique latent variable, that is unobservable, for example intelligence or special predisposition for certain subjects and so on and so forth. In his book, Spearman wrote:

> *"This is the first comprehensive synthesis and general implications of the two-factor theory of cognitive abilities, which states that when the "tetrad difference" (between the cross-products in a rectangle of coefficients between four abilities) does not depart significantly (as judged in the light of its probable error) from zero, these abilities may be separated (mathematical proof is presented in the appendix) into a general factor* g, *common to all the abilities, and special factors* s, *appertaining to each separately. After several historical and critical chapters opposing the general-ability ("monarchic"), faculty or type ("oligarchic"), and average or general-level ("anarchic") concepts of cognition, the sequelae of the tetrad equation are explored. This is accurately satisfied by a majority of mental-test abilities, but not by physical measurements, etc. In cases where agreement is not close due to overlapping* s's *("group factors") further inquiry brings to light other general factors besides* g, *such as* c, *the obverse of mental inertia or perseveration, "oscillation," apparently a fatigue function, and* w, *a semi-temperamental function akin to volition. The* s's *which remain are believed to be related to the particular sensory or motor apparatus involved—the "engines" in which* g, *the quantity of "energy" (of which the inertia and oscillation are also attributes) is expressed. The "engineer" is a requirement of the system to which the conative* w *concept seems to be fitted. Several chapters show the applicability of the two-factor concept to the elements of the author's analysis of cognition, such as education, clearness and speed, span, etc.; retentivity, however, was found to be independent of* g*"* (Spearman, p.415).

The underlying idea of this method is that the correlation among a group of *p* variables X_i e X_j (in our research the entrepreneurial careers) can be explained by the linear relation between them and a group of *m* variables f_1, f_2,…, f_m.

In general:
We define a set of equation as follows:

$$X_1 = \mu_1 + \lambda_{11}f_1 + \ldots + \lambda_{1k}f_k + \ldots + \lambda_{1m}f_m + u_1$$
$$\ldots$$
$$X_i = \mu_i + \lambda_{i1}f_1 + \ldots + \lambda_{ik}f_k + \ldots + \lambda_{im}f_m + u_i$$
$$\ldots$$
$$X_p = \mu_p + \lambda_{p1}f_1 + \ldots + \lambda_{pk}f_k + \ldots + \lambda_{pm}f_m + u_p$$

Where μ_i is the average of variable X_i.

Determining the delta coefficients of f_k, the so called "weighted factors", allows to measure the influence of each latent factor on the total variance of the system, to understand which factors are really relevant. The set of equations written above is clearly similar to a multiple regression model, actually the real difference is that all the elements on the right of the equal sign are represented by unknown quantities, not directly observable.

Consequently:

If **X** is a random vector (with px1 dimension), with average equal to μ and variance-covariance ∑; a factor model is specified by the following linear relation:

$$\mathbf{X} = \mu + \Lambda\mathbf{f} + \mathbf{u}$$

Where Λ (*px*m) is a constant matrix (weighted factors) and **f** (*mx*1) e **u** (*px*1) are random vectors.

$$\begin{bmatrix} X_1 \\ \vdots \\ X_h \\ \vdots \\ X_p \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \vdots \\ \mu_h \\ \vdots \\ \mu_p \end{bmatrix} + \begin{bmatrix} \lambda_{11} & \cdots & \lambda_{1k} & \cdots & \lambda_{1m} \\ \vdots & \ddots & \vdots & & \vdots \\ \lambda_{h1} & \cdots & \lambda_{hk} & \cdots & \lambda_{hm} \\ \vdots & & \vdots & \ddots & \vdots \\ \lambda_{p1} & \cdots & \lambda_{pk} & \cdots & \lambda_{pm} \end{bmatrix} \begin{bmatrix} f_1 \\ \vdots \\ f_k \\ \vdots \\ f_m \end{bmatrix} + \begin{bmatrix} u_1 \\ \vdots \\ u_h \\ \vdots \\ u_p \end{bmatrix}$$

Stated that **f** and **u** have average equal to zero, **f** has variance equal to unit and are linearly independent**,** while Ψ_{ii} are the uncorrelated variances of **u**.

In our specific case we wanted to investigate if there are some specific latent factors that can explain the existence of an entrepreneurial attitude that is the main characteristic of our sample made by 52 entrepreneurs, consequently we draw a specific database considering all the available information collected with the interviews about team, location, background, experience abroad, education and professional experience. We had some a priori expectations on these variables, thinking that there are some behavioral characteristics that have an impact on the approach to those variables and consequently we hypothesize that there are some latent factor underlying the entrepreneurial behavior.

Listening to the stories told by the entrepreneurs in the sample, we have understood that there are some specific personal traits, that are really difficult to measure (consequently they are unobservable), that have a specific impact on those behavior that seem to increase the probability of recognizing and exploiting an entrepreneurial opportunity.

So we can say that, in our opinion, three personal traits are really relevant to incentivize the predisposition toward the ability to recognize an opportunity and consequently an entrepreneurial career, and we try to highlight what kind of relations (in terms of direction, positive or negative) link this unobservable personal traits (latent factors) with the observable behaviors that have been identified as crucial in any personal stories (team, location, background, experience abroad, education and professional experience). Brockhaus reviewed a number of trait studies and identified three consistent attributes associated with entrepreneurial behavior: need for achievement, internal locus of control, and a risk-taking propensity (Brockhaus, 1982). Following his research we identified the three hypothesized latent factors that are the internal locus of control, the

animal spirit (that is close to the need for achievement but seems to be more coherent with the figure of the entrepreneurs) and the risk perception.

The a priori expectations on the relations are:

- Internal locus of control: Rotter (1966) made a significant contribution to this tradition with the development of a "locus of control" construct. According to Rotter, an individual perceives the outcome of an event as being either within or beyond his or her personal control and understanding. An "internal" believes that one has influence over outcomes through ability, effort, or skills. On the other hand, "externals" believe that forces outside the control of the individual determine outcomes (Rotter, 1966). We hypothesize that an entrepreneur has an internal locus of control and consequently we can say that the relations are as follows:
    - Team (+/-): the more self-confident the higher is the attitude to face big challenges confronting himself with other people and being able to collaborate even if maintaining a proper identity (positive relation), even if in this case the relation can be ambiguous, because it is possible to look at this factor in the opposite way saying that the more a subject is self-confident, the more he/she will be individualistic (negative relation);
    - Location (+): the bigger the location, the weaker the ties with others, consequently an individual has to develop himself strongly (positive relation);
    - Background (+): the more the person feels comfortable with a previous entrepreneurial context, the more he/she can feel strong to face similar experiences (positive relation);
    - Experience abroad (+): if a person has a high level of internal locus of control is willing to experiment hard experiences such as a life period abroad (positive relation);
    - Education (+): the higher level of education implies a higher level of culture and increase the level of self-confidence (positive relation);

- Experience (+/-): if a person has collected several previous work experience he can have bigger lenses to watch the reality and be able to face numerous complex situations (positive relation), even if in this case the relation can be ambiguous because the abundance of work experiences can be due to a difficulty in finding himself and some personal attitudes to spend in a specific job and this can reduce the personal self-esteem and consequently have a reduced locus of control (negative relation);

- Animal spirit: "*Animal Spirit equilibria is equilibria indexed by the consumers' optimism or pessimism*" (Weil, 1989), in this sense the animal spirit is an attitude comparable with optimism together with need for achievement and willingness to embark in unknown but challenging experiences. "Animal spirits" was originally a medical term, introduced by Galen in the second century, a physician that devised a theory of pneumata in which he explained the role of animal spirits in causing movements of the body against the rational willingness of people. Consequently it was not an economic category. This is why firstly Descartes and later Keynes decided to apply this concept to economic theory, saying that animal spirits lead people to act independently of reason or even contrary to it, and they may lead to error. However, there is a subtle difference, a sort of joke that Keynes made in his choice of the term animal spirits. "In Descartes' theory, the errors caused by animal spirits lead to regret and repentance. In Keynes's theory, they induce investment". Therefore in later studies, it was argued that positive investment generally occurs because of a mistake by the investor, a mistake undertaken because of animal spirits. In fact Keynes argued that since entrepreneurs are immobilized thinking how to make rational economic decisions, "animal spirits are needed to leapfrog rationality and bolster the economy" (Koppl, 1991). Consequently *"a large proportion of our positive activity depends on spontaneous optimism".* An entrepreneur takes action as a result of what he calls *animal spirits – "a spontaneous urge to action rather than inaction, and not as the outcome*

of a weighted average of quantitative benefits multiplied by quantitative probabilities" (Keynes 1973, p. 161). We hypothesize that only if reasonable calculation is supplemented and supported by animal spirit an individual can become entrepreneur, thus the expected relations are the following:

- Team (-): the initiatives coming from the animal spirit are difficult to be coordinated with other people in the right moment (negative relation);
- Location (-): we have no clear expectations on this but we think that having strong ties allows help in case of difficult decisions thus living in a smaller context creates more strong than weak ties, but weaker ties are helpful for the opportunity recognition process (negative relation);
- Background (+): the animal spirit can be learnt or inspired by the familiar education (positive relation);
- Experience abroad (+): People who are equipped with animal spirit tend to look for challenging experiences such as a life period abroad;
- Education (-): generally the more the person is educated the less the instinct is free to express (negative relation);
- Experience (+): the more experienced the person, the more is able to grab signals and create new opportunities (positive relation);

- Risk propensity/risk perception: as already written in the above, there is a certain tendency in confusing the risk propensity and the risk perception. In the entrepreneurial debate, the researcher have shown a prominent interest in the concept of risk propensity, often comparing an entrepreneur with a pure gambler that loves risk. While in our interviews we have recognized that the difference among an enterprising individual and a non-enterprising one is the ability to face complex situations and to have a certain ambiguity tolerance that allows a better comprehension of the risky situation and an easier comparison between the benefits and the

fear of entrepreneurial investments. Thus we expect that the relations are as follows:

- Team (-): as for the animal spirit the perception of risks is difficult to be coordinated with other people in the right moment (negative relation);
- Location (-): we do not have clear expectations on this relations but we think that bigger context with several complex ties are more difficult to be understood and consequently the risk perceived is higher because of the higher level of unknown variables (negative relation);
- Background (+/-): expectations are ambiguous in this case;
- Experience abroad (+): living unknown and risky situations allows to get ready and fit to manage risk (positive relation);
- Education (+): calculating risk is possible, education supplies tools to improve the risky evaluations (positive relation);
- Experience (+): experience works in the same sense of education (positve relation).

We built the factor analysis using STATA. The results are shown in the table below:

Tab. 2.9 - Factor loadings (pattern matrix) and unique variances:

Variable	Factor1	Factor2	Factor3	Uniqueness
team	0.3413	-0.3420	-0.1106	0.7544
residenza	0.4321	-0.0383	-0.0558	0.8087
background	0.1050	0.3063	-0.2862	0.8133
estero	0.4235	0.2833	0.1077	0.7288
education	0.4430	-0.0212	0.2215	0.7542
experience	-0.1502	0.0633	0.3453	0.8542

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	0.71241	0.41547	1.0023	1.0023
Factor2	0.29693	0.01979	0.4178	1.4201
Factor3	0.27715	0.30718	0.3899	1.8100
Factor4	-0.03003	0.23464	-0.0422	1.7678
Factor5	-0.26467	0.01637	-0.3724	1.3954
Factor6	-0.28104	.	-0.3954	1.0000

LR test: independent vs. saturated: chi2(15) = 18.66 Prob>chi2 = 0.2294

We accept the hypotesis that there are latent factors because p>0.05 and in this case the factors are three.

As it is shown in table 2.9 there are three latent factors that are unobservable but they have strong relations with some observable variables that have been collected in our database and that represent the characteristics of a successful discoverer of entrepreneurial opportunities and thus real entrepreneur. It is really difficult to catch the magnitude of locus of control, animal spirit and risk propensity using interviews, but we can highlight the magnitude of these unobserved variables on the probability of becoming entrepreneur because we can see what impact (in terms of direction of the relation and weight) they have on the crucial elements that foster any entrepreneurial process and that we have discovered during the qualitative analysis and verified with the literature.

"To be motivated to act, potential entrepreneurs must perceive themselves as capable and psychologically equipped to face the challenges of a global, competitive marketplace. Business education can play an important role in this regard by providing not only the technical tools (i.e. accounting, marketing, finance, etc.), but by also helping to reorient individuals toward self-reliance, independent action, creativity, and

flexible thinking" (Mueller e Thomas, 2000). This entrepreneurial education is the key to allow people think originally and feel strong to face risky challenges. Moreover, it is the better way for young people to understand that there is a viable alternative to subordinate job and to choose it.

The bulk of entrepreneurship research and theorizing about factors which stimulate new venture creation would seem to suggest that all that is needed is a supportive infrastructure or economic incentives to provide the motivation to initiate new ventures. However, as we have argued, an adequate pool of entrepreneurially oriented individuals must also be available. Since the culture of a country influences the values, attitudes, and beliefs of its people, we can expect variety in the distribution of individuals with entrepreneurial potential across cultural contexts. Extending this logic leads to the proposition that the greater the frequency of the entrepreneurial orientation among the population of a country, the greater the stock of potential entrepreneurs, and hence (ceteris paribus) the higher the rate of new venture formation. The use of personal characteristics such as locus of control in entrepreneurship studies has been questioned (Gartner, 1988). Much of the criticism of the traits approach to the study of entrepreneurship is based on the implied assumption that traits are acquired at birth or an early age. The use of the term "personality" in many traits studies also implies that such characteristics are immutable and unaffected by experience or circumstance. However, characteristics such as locus of control and creativity are not necessarily imprinted at birth or at an early age and may be acquired at a later time due to experiences in the work place, education, exposure to role models, parents, and social setting (culture) which shape values and beliefs. Therefore we think it is appropriate to investigate those characteristics, whether learnt or innate, for which there is a theoretical basis for predicting an increase in the likelihood of venture initiation. A general education and a more specific one should thus improve the use of methodologies able to increase the level of internal locus of control, of the animal spirit and consequently reduce the level of risk perception.

CHAPTER 3

The role of regulation in enhancing entrepreneurial investments: A case study investigating the interconnection in the electric market

Introduction

Following the path of this research, the second part of the study aims to identify suitable regulatory frameworks and business models for transmission investment to enable new entrepreneurship involving international exchange and local use of renewable energy across the EU and MENA regions.

The European objectives to reduce CO2 emissions by 80-95% until 2050 require a decarbonisation of the power sector based on a portfolio of technologies exploited across many different regions. The renewable energy portfolio in North Africa is complementary to the resources in Europe. According to DII (2012), an integrated approach could lead to cost savings of up to €33 billions p.a. by 2050.

However, a key requirement for this would be significant extensions and reinforcements of the transmission grids within and between the EU and MENA region. Currently, the extent of interconnectivity between the two regions is rather low with only one interconnector of 1.4GW thermal capacity between Morocco and Spain.

As an initial milestone, the current Ten Year Network Development Plan of European TSOs (ENTSO-E, 2012) foresees the construction of two new interconnectors with a total net transfer capacity of 1.5 GW between Tunisia and Italy.

A cooperation in the electricity sector needs to respect the different market and regulatory structures persisting between countries in the European and MENA regions. In European countries generation and transmission have been unbundled and are now owned by different companies. In most EU countries several generation companies are

competing. In the MENA region usually one incumbent utility owns generation and transmission assets, and the few generation assets owned by third parties sell power on long-term power purchasing agreements to the incumbent utility. With the absence of a competitive wholesale power market there is no short-term power price as basis for international power trade. Instead incumbent utilities negotiate with neighbouring utilities. In the case of the Morocco-Spain interconnector, the Morocco's state-owned utility, l'Office National d'Electricité (ONE), uses the transmission capacity to buy and sell power on the Spanish power exchange.

Both European and most MENA countries have established regulators for the energy sector. The text book objective of energy regulators is to independently decide on tariffs so as to ensure fair remuneration of grid investments while limiting costs for consumers. In practice the level of independence and resourcing of regulatory agencies varies across EU countries. This impacts the confidence of investors in the future remuneration for their investments. In the MENA region independence from the political process and resourcing of regulators is lower, and hence investments are only pursued by either incumbent state owned utilities or third parties that have a long-term contractual guarantee.

Both European and MENA countries have set national renewable energy targets. About RES targets, however among the surveyed countries, only Algeria has a remuneration mechanism to incentivise investments in generation, while Tunisia and Morocco rely on indirect incentives, e.g. tax and tariff arrangements. Neither of the countries has established a comprehensive transmission framework which is necessary to guide investments in interconnectors; e.g. Algerian and Tunisian international connections frameworks are lacking rules for allocation of capacity and congestion management and, furthermore, the regulation does not allow merchant lines. Similarly, Morocco does not have capacity allocation rules nor common congestion management rules, however under Loi 13-09-IPP Moroccan regulation allows merchant lines for export subject to a concession regime.

The project investigates whether and what regulatory developments are required to support the entrepreneurial investments in transmission grids which are required to unlock the renewable energy portfolio of North Africa - for local use and for international exchange.

The analysis explores how policy frameworks can support the entrepreneurial investment in the realization of individual transmission lines and their use to support renewable project investment and energy transport in the short-term.

Recalling what is in the introduction of the present thesis, we first assessed issues associated with transmission investment in general and related to transmission in the context of desert power projects. The analysis was based on a review of existing literature and conducted interviews with 36 experts and stakeholders from Spain, Italy, UK, Netherlands, Scotland, Morocco, Algeria and Tunisia. They were selected based on their experience with different business models for interconnection projects. These include regulated transmission investment with an example of Morocco-Spain interconnector, merchant investment with an example of BritNed, and concession based transmission investment with an example of the UK offshore grid investments. Based on the stakeholders' experience with the current situation in Morocco, Algeria, Italy and Spain they provided us with insights relating to the EU-MENA cooperation linked to desert power. The following summary reports on the issues that were identified most frequently by the experts and in literature with regard to desert power projects in general, interconnection projects related to desert power projects and in relation to three different business models for the construction of an interconnector.

Just to allow an overview of the main issues faced during the research we want to summarize them in the following list:

I. Issues associated with desert power projects in general

- *Lack of national interest:* for most countries, the goals of meeting their local demand, diversifying their supply, and building a local industry which generates revenues and employment are equally or more important than the profits which could be obtained from electricity exports. This can limit interest to advance interconnection projects.
- *Building trust between countries:* governments are cautious about electricity imports as they fear that this could introduce dependencies. In many instances a stronger basis for trust will have to be developed as basis for – and perhaps in the process of – increased interdependence of power supply. A possibility in interruption of

electricity import-export activity due to political reasons may be a major concern for EU consumers and utilities. The Western Sahara conflict is still one of the major obstacles to necessary cooperation of Morocco and Algeria, hampering regional trade between them and with Tunisia.

The report discusses a set of policy responses to address these concerns including options to unlock full value of transmission to enhance the benefits of cooperation, sowing and highlighting the benefits of cooperation on an economy wide level and developing and demonstrating political commitment, in a domestic setting and through international cooperation.

II. Interconnection specific issues of international desert power projects

- *Opposition of selected stakeholders:* transmission projects involve both government and utility actors, and in the case of interconnectors - also of several countries. Even if only one of these stakeholders does not benefit from the project, this can create indefinite delays, therefore all stakeholders have to be supportive or at least neutral towards a new transmission project.
- *Co-ordination of generation and transmission investments:* interdependencies in location, timing, contracting and financing aspects need to be considered, but can create challenges given different project durations, planning and permitting processes, and actors.

Interviewing partners and reviewing literature led to various approaches for how to address these issues. They can include coordination and integration of national responsibilities, transparent processes, compensating specific stakeholders and anticipatory investments in transmission.

The following three business models are applicable to investments in transmission:

In a regulated approach, a regulator typically approves construction of a line and, as result of this, new transmission assets become part of the regulatory asset base of a regulated transmission owner.

In a concession based approach, the government, regulator or some entity on their behalf tenders a long-term concession contract for a new transmission line.

In a merchant based approach, a company invests into a transmission line against the future revenue from selling transmission rights to market participants.

III. Issues with specific business model:

i. Regulated investments

In this case investments in interconnection capacity are pursued by transmission owners in neighboring countries and included in their regulatory asset base. They are financed against revenues that will be determined by respective national regulatory authority. The three most prominent issues reported were:

- *Limited motivation for TOs to invest in new interconnectors:* ownership structure and history may imply that TOs have limited focus on growing their business with new investments, an effect reinforced in case of complex and more risky interconnectors.
- *Access to capital:* European TOs might have to raise additional equity which can be challenging where they are government-owned, as this either requires cash from budget constrained governments or acceptance from the government that private investors co-invest. In MENA countries, tariff deficits create dependency on government support undermining credibility with financial markets.
- *Difficulty to decide on cost allocation:* the capital and operational costs for the lines to the extent that they are not recovered from transmission fees are added to usage fees for customers of the investing Transmission Owners. Regulators and governments thus need to agree on how to share these costs. In addition to the difficulty of

negotiating the cost allocation ex-ante the distribution of costs and benefits may change over time – an effect that needs to be addressed at the design stage to avoid risks to regulatory and thus investment certainty.

Several solutions are being applied to address these issues. They include granting higher and additional revenue, able to repay the increasing risk perceived, to encourage TOs to advance projects and linking the allocation of benefits for a line to the cost-sharing principles.

ii. Concession based investment

In this case the authorities of neighboring countries initiate a tender for the construction of a new line and grant the winner of the tender a long-term guaranteed remuneration in exchange for the provision of the interconnection. This approach again faces, like regulated investments, the difficulty *of cost allocation between countries*, and in addition challenges in the:

- *Specification of quality requirements:* repair of sub-sea interconnectors is expensive and can imply long and thus costly interruptions. Hence careful construction and suitable technology are necessary, and need to be suitably specified in the concession process.
- *Operation and expansion flexibility:* concession holders want to ensure a stable and predictable operation of their asset to avoid risks. But also system benefits of a flexible operation and options for future development need to be considered.

Options to address these concerns involve inclusion of third party technical expertise and development of generic norms and standard provisions for concession contracts.

iii. Merchant based investment

The concept of merchant based transmission investment envisages that private investors develop and implement a transmission project in expectation of the revenue they achieve by selling transmission capacity in the market. The separate ownership and

contracting structure again raises concerns with regard to the *operation and expansion flexibility* in addition to concerns on:

- *Under-sizing:* the scarcity value of transmission assets declines with the available transmission capacity. Thus merchant investors face incentives to under-size capacity so as to maximize profitability.
- *High cost of capital:* the value of transmission, and thus revenue for merchant investors, depends primarily on the price difference between markets which tends to be difficult to predict and inherently uncertain. Returns can therefore be highly uncertain and require investors that accept large risks but typically require high returns.

The most prominent approach to mitigate these concerns is an open season during which merchant investors offer transmission capacity on long-term contracts to interested parties. This does however require a market and regulatory environment for long-term transmission contracts.

Irrespective of the business model, the successful implementation of an interconnection project requires a comprehensive set of actions by governments, regulators and project developers to address difficulties. In the detailed discussion of this chapter we describe various options for how these issues can in principle be successfully addressed. Their implementation will however require sufficient political support to ensure that public authorities (government, regulator etc) pursue them in a timely manner.

IV. A comprehensive approach to unlock transmission investments

In order to unlock the potential of the desert power projects, renewable energy remuneration schemes and the rules for transmission investment need to be coherently designed to create a clear-cut business case for investors.

In the course of this study we held four meetings with EU and MENA stakeholders from generation and transmission companies, project developers and finance institutions. In the course of these meetings we have developed three options for potential EU-MENA energy cooperation combining transmission related aspects with a

broader perspective on renewable remuneration mechanisms. The summary presented in this paper reflects the perspective of the authors of the study informed by these discussions.

Option 1: Regional RE tender with regulated/concession based transmission

Illustration: Italy and Germany run joint tender for import from Algeria to Italian border. Italian TSO builds an interconnector to Algeria as part of its regulated asset base. Winners of the tender can purchase transmission rights on the interconnector.

Option 2: EU RE tender with merchant based transmission

Illustration: Group of EU countries tenders for import from any MENA country to the EU. Project developers plan and build interconnectors. Participating EU countries are responsible for the power once landed to the EU system, and need to acquire transmission rights to deliver it to their consumers.

Option 3: EU premium/ certificates with merchant based transmission

Illustration: EU adopts a premium or certificate scheme for import from any MENA country. Project developers plan and build interconnectors and acquire transmission rights within the EU so as to sell the energy to their consumers.

These three options presented for a renewable remuneration and transmission investment framework illustrate how risks, benefits, profits and responsibility for coordination can be differently allocated between public and private actors. They inherently offer different advantages and disadvantages that we evaluated against the following four criteria.

Criteria A: Coordination

Successful RE projects with export component in a MENA country need to off-take and transmission access within the country, develop an interconnector, link up with RE remuneration mechanisms in EU countries and deliver energy across the EU network to final customers. All these activities depend on strong abilities

to sequence and align processes of transmission permitting, generation investment, local political engagement, transmission construction timeline, etc. In option 3 the project investor has to coordinate all these dimensions and needs to put them in place simultaneously to secure financial closure. Coordination requirements for private investors are reduced if governments or regulators take responsibility for energy transmission and off-take in the EU (option 1 and 2) and responsibility for the development of the interconnector (option 1). This can help project developers to gather experience in the still challenging commercial and technological environment. As experience and scale of activity increases, the additional coordination requirements of option 2 and 3 will be easier to tackle while option 1 remains viable.

Criteria B: Initiative

Multiple risks and subsequent challenges have been identified in this study for international exchange and local use of renewable energy in the EU-MENA region. This raises the question: which of the discussed options is most likely to encourage actors to take the necessary initiative to address these challenges. We find that both public and private initiatives are essential in all options, therefore this criteria does not allow for much differentiation between options.

Criteria C: Competition

Many actors are involved in EU-MENA energy projects, and will aim to capture some rent for the services provided. Thus competition can be essential to balance these interests and avoid excessive costs for consumers. Option 1 might offer the highest level of competition for RE project while the overall number of projects is still low. In the longer-term, as the scale of the EU-MENA energy cooperation and the number of RE and transmission projects increases, the matching between generation and transmission projects is less challenging, and therefore also options 2 and 3 can offer for a competitive environment.

Criteria D: Access to finance and financing costs

> The economics of wind and solar projects are dominated by up-front investment costs. Therefore access to capital to finance the investments, and the associated cost of capital are essential for the execution and competitive operation of RE projects. They are determined by the risk associated with the investment. In the current market environment, options 1 and 2 provide long-term stable revenue streams and thus facilitate access to lower cost finance which translates to lower costs for consumers. The differences will reduce as energy technology mix stabilizes and thus the value of energy delivered can be better projected.

We thus find that for the initial RE projects with EU export component, a transmission and renewable remuneration framework as outlined in option 1 is most effective in addressing coordination requirements, ensuring competition, and facilitating access to low cost finance.

In the longer-term, this choice will have to be re-evaluated. In principle, option 1 can remain a viable option. If the number and scale of export oriented RE project increases in the MENA region and continues to be closely linked to interconnection projects, option 2 could also become a viable option. If the state of energy markets in EU and MENA increase predictability of future power prices, option 3 can also become viable.

In all cases, the efficient utilization of interconnection assets is possible. Currently, this requires appropriate administrative procedures but if markets on both sides are liberalized, the line needs to be integrated in the market arrangements. This should be anticipated in regulatory approval process for merchant lines and contracts with concession projects.

Our approach allows for the development of a perspective extending beyond the discussion of individual concerns and for an initial prioritization of issues that need to be addressed and options to tackle them. However, we would like to point out that the number of interviews that we could pursue per country and stakeholder group is too small to allow for a discussion of country specific solutions. We hope that our analysis can instead help to provide a structured basis to facilitate the more detailed technical analysis and political process to advance thus cooperation on the regional level.

A theme that was emphasized across our interviews and stakeholder workshops was the importance of the overarching policy framework. Issues common across all business models can only be addressed if participating countries are committed to the desert power strategy and to interlinking electricity networks. To this extent the analysis, design and communication of specific policy choices to enable the EU-MENA transmission and RE projects needs to be embedded in the energy- and economic policy strategies of the participating countries.

The results are presented in the following. Paragraph 3.1 focuses on issues of interconnection investment specific to the three main business models: regulated, concession based and merchant based transmission investment. Paragraph 3.2 characterises issues that are related to desert power projects in general and issues that are associated with interconnection specific issues not specific to individual business models.

Both of these paragraphs first describe the issues that have been most frequently mentioned in interviews and literature, and then discuss for each of the issue the solutions options. Solutions are typically accompanied by a set of enabling components, e.g. specific administrative or regulatory actions to implement a solution that are then described. Often enabling components are part of a solution for several issues, and are in this case discussed in detail at their first occurrence.

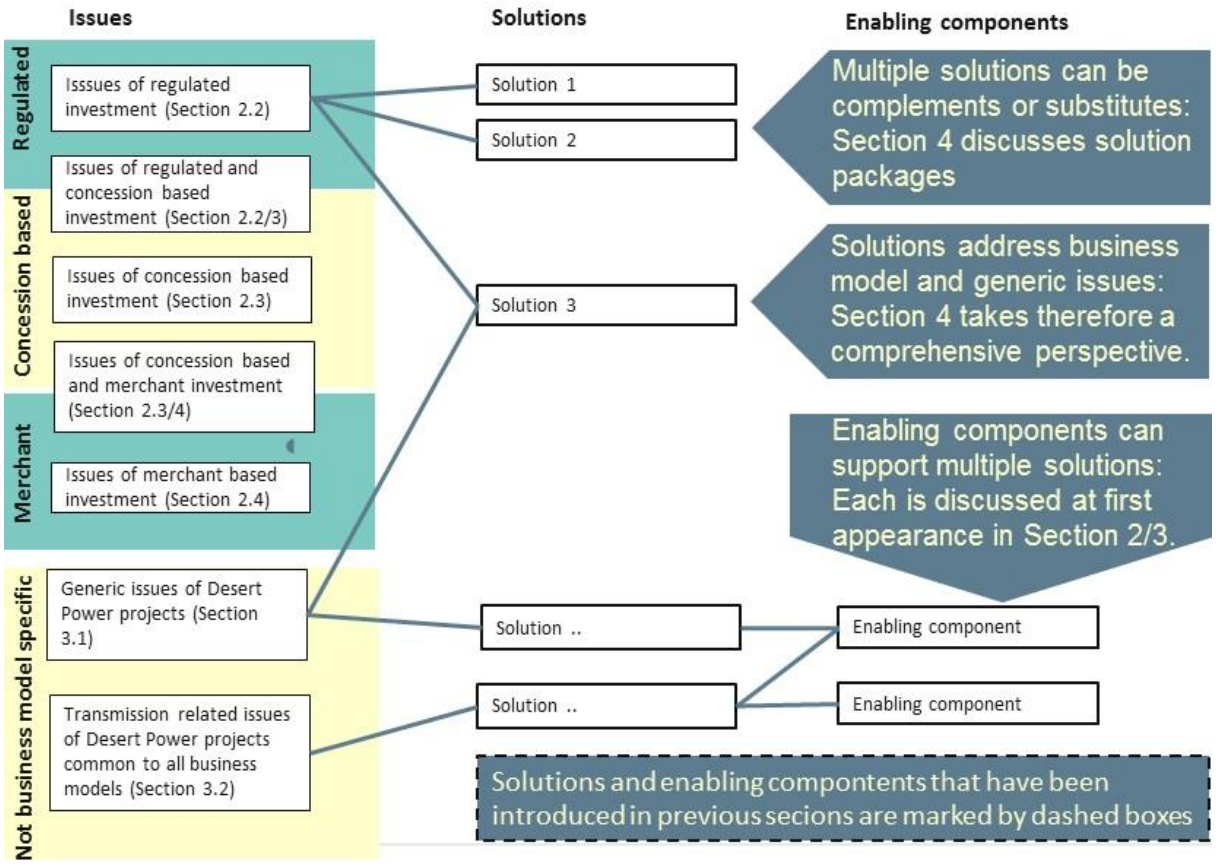
The analysis showed that, irrespective of the business model, the successful implementation of an interconnection project requires a comprehensive set of actions by government (national, EU), government agencies (regulator and possibly public banks like EIB and KfW) and project developer to address difficulties.

In the second phase of the project, three options for a potential EU-MENA energy cooperation were developed, combining transmission related aspects with a broader perspective on renewable remuneration mechanisms. They were discussed with a group of EU and MENA stakeholders from generation and transmission companies, project developers and finance institutions. The summary presented in this report reflects the perspective of the authors.

The results are presented in the final part of this research. It describes the three options in detail and develops criteria for their assessment. The paragraph also discusses a set of

cross-cutting aspects relevant for all options: the role of long-term contracts, and the framework for efficient operation taking into account the concern of carbon leakage.

Figure 3.1 - Structure of issues, solutions and their enabling components.



3.1 Aspects for interconnection investment specific to business model

As mentioned in the introduction, several existing business models are applicable for developing and operating transmission interconnection lines. The most widely used approach is the investment by regulated transmission owners. In the EU and in some MENA countries (e.g. Morocco) also third parties can construct an interconnector. This can involve a merchant investor that recovers investment costs by selling the right to use the interconnector to market participants, or it can be concession holder that

participates in a tender to provide an interconnector and receives a contractually guaranteed remuneration for e.g. 20 years.

The business models differ in terms of motivating actors to invest into a line, access to and cost of capital, the allocation of cost, and the flexibility of future network operation and investment.

Within the following sections we will describe the main challenges and opportunities linked to each business model along with suggestions and concrete examples how the shortcomings can, and indeed have been, overcome in the past.

Existing business models

Depending on rules about the ownership of and revenues from transmission lines we can distinguish three generic business models. We classify them as regulated, concession-based or merchant models.

In a regulated approach, the regulator typically approves the investment in a line and, as a result of this, new transmission assets become part of the regulatory asset base of a regulated transmission owner (TO). The regulator determines the allowed revenue to meet operational and capital costs of TO in periodic (usually 4-5 year) price review. The transmission owner can recover the allowed revenue from transmission users through usage fees.

In a concession based approach, the government, regulator or some entity on their behalf tenders for a new transmission line. Several companies compete to offer the line at the lowest annual price. The winning company then obtains a license agreement securing the revenue stream for 20-30 years.

In a merchant based approach, a company invests into a transmission line and against the future revenue from selling transmission rights to market participants. The line typically requires regulatory and planning approval, but does not obtain regulatory guarantee securing future revenue. As a result, merchant TOs are exposed, both to the cost recovery risk due to under-utilisation and some risks of regulatory changes.

All models have been extensively discussed and compared in the literature. (Biggar, 2009; Brunekreeft et al., 2005; Frontier Economics, 2009a, 2009b; Glachant and Pignon, 2005; Green, 1997; Hogan et al., 2010; Pérez-Arriaga and Olmos, 2005; Rious et al., 2008; Vazquez et al., 2002).

In practice, some aspects of these clear theoretical models can be combined. In particular, we observe that during the regulatory approval process for merchant lines profit and loss sharing agreements have been negotiated that shift both downside risk and some up-side profit opportunities from the merchant investor to consumers (BritNed, Text Box 3).

The connection of interconnection lines to national transmission systems typically also requires some reinforcements of the national system. Therefore also some provisions have to secure that the national Transmission Owner can pursue necessary investment. To accommodate the different needs it is therefore proposed in the case of the Serbia-Montenegro- Bosnia-and-Herzegovina interconnector, that the capacity is split up in shares that are subject to different business models (Vujasinovic and Illiceto, 2012). This is argued to help to reach an agreement between the neighbouring regulators, but also increases the complexity of the project.

Both regulated and merchant based approaches are institutionalised in the EU region, with some exceptions, e.g. Spanish regulation does not allow merchant line investments. On the contrary, most of countries in the MENA region are still lacking the legal basis for merchant line investments (except Morocco).

Following subsections will focus on the assessment of pure business models. Questions of their practical implementation will be addressed the following.

3.1.1 Regulated investment

Within the EU, regulated investment by regional Transmission Owners (TO) is clearly the dominant business model. In Europe, except for Scotland, the regional transmission owners are also responsible for the operation of the system, and therefore commonly referred to Transmission System Operators (TSO).

In our interviews and in literature we have identified a set of challenges for a regulated approach to investment, along with the potential solutions which are listed in Figure 3.2. For each of the issues on the left hand side, the importance attributed to the issue has been assessed through a combination of literature review, stakeholder interviews and expert assessment. It is reflected in the share of the circle that has been filled. The estimated effort required to address each issue is indicated by the colour of the circles.

There is a transmission link connecting the Spanish transmission grid with the transmission grid in Morocco between Puerto de la Cruz (Tarifa) and Melloussa (Fardiuoa).

The process of building a first link of 700 MW was initiated as early as 1986 and led to a first contract between Red Electrica Espanola (REE) and the Office Nationale d'Électricité (ONE) in July 1993 for delivery starting in 1996 (F. Mossadeq, 1998a). The link was completed in 1997.

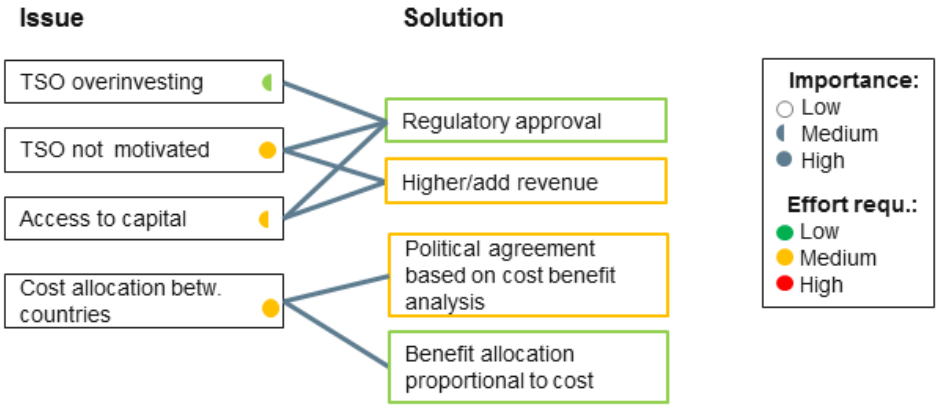
However, the project faced local opposition, in particular by fishermen in Tarifa, which led to significant delays in the construction and triggered the renegotiation of the contract by ONE. The terms of the new contract which was signed in 1998 were more favourable for Morocco, reducing the contract price for energy imports from Spain below the price of power production at the most expensive Moroccan plant at Jerrada (F. Mossadeq, 1998b). The renegotiation of the contract was allegedly influenced by the interest of Spanish companies to participate in the construction of a power plant at Tahhadart (F. Mossadeq, 1998b). A second cuircuit of 700MW was added in 2006.

The commercial flows on the interconnector are a result of ONE's purchases and sales of electricity in the Spanish spot market (MIBEL) and adjustments by REE in case of grid constraints within Spain. Depending on the direction and resulting flows, ONE pays a transmission access tariff (per MWh) to REE which is passed on to consumers. The sum of these payments plus the capital expenditures is passed on the consumers of both countries on the cost-sharing basis.

Text Box 1 - Spain-Morocco interconnector as an example of regulated based investment.

Issues associated with regulated investments

Figure 3.2 - Issues and solutions for regulated investment.



The set of issues for the construction of regulated investment are depicted in Figure 3.2. Based on the interviews, particular importance was attributed to the concerns that TOs might not be sufficient motivated to advance the interconnector and difficulties on allocating the costs between countries. Concerns about access to capital for TO pursue extensive investment programs were also mentioned, and the literature frequently lists concerns that TOs might overinvest in capacity.

Limited motivation for TOs to invest in new interconnectors

TOs may only have a limited incentives to investing in large interconnector projects, as their specific situation discourages them from realising large growth opportunities for their business for two reasons. First, they have been asked in recent years (after market liberalization/unbundling) to focus their effort on minimising costs while securing system stability. Therefore the organization might not be set up to deliver large investment projects. Secondly, private shareholders usually have decided to invest in TOs to obtain stable and low-risk revenue streams and might thus not support the CEO in shifting the company towards a growth strategy that might offer higher returns, but also involves higher risks for example from large scale investment projects.

TOs face furthermore incentives to prioritise domestic transmission projects over international interconnectors for two reasons. First, TOs are operating within the national legislation frameworks which inherently are focused on national transmission

system. Thus TOs are expected to prioritize investment projects to alleviate domestic transmission constraints over alleviation of international bottlenecks. In the UK for example the TO was operating for many years under a regime where costs of domestic congestion was shared between consumers and the TO, thus creating strong incentives to alleviate domestic bottlenecks.

In the case of Norway, additional interconnections with EU countries would increase North-South congestions within the country. The reinforcement of the internal network has therefore been a priority for the Norwegian TSO prior to expanding interconnections with the EU. Also in Italy transmission constraints within the country are frequently binding, as can be easily observed by the different zones for wholesale price levels defined within Italy. As a result, dependent on the landing point of an interconnector to Italy, significant domestic grid reinforcement would be necessary to avoid situations where the interconnector contributes to additional congestion within the country.

A second reason for the prioritisation of domestic transmission lines is that implementation of interconnection projects requires co-ordination across more partners and is exposed to political uncertainties in multiple jurisdictions, and thus increase the effort required and the risk of delays and failures that could create costs for the TO and negative reputation for the involved managers. These risks are further increased by less established technology uncertainties, e.g. in the case of using high-voltage substations for offshore installations. Thirdly, once an interconnector has been implemented, it can increase the complexity of operating the power system due to the need to anticipate, coordinate and manage flows from outside of the domestic grid. This can create additional risks for system operation that is often integrated with transmission ownership (TSO) (Frontier Economics, 2008).

Difficulty to decide on cost allocation between countries

In the case of regulated investment, the costs for the lines are included into the regulated asset base of the participating national transmission systems. Regulatory authorities in both countries need to agree about cost sharing principles between the TOs, and thus ultimately between the customers connected to the entire network which paying usage

fees for the transmission network that allow the TOs to recover the investment costs over the lifetime of the asset (Frontier Economics, 2008; PJM, 2010).

According to the standard approach for cost sharing in the case of regulated or concession based investment for short-distance cross-border lines, each country constructs and bears the costs for that part of the interconnector which is on its own territory, while the revenues from the interconnector are split in half. In cases where the main part of costs occur in one country and/or the line is long, the TOs and regulating agencies in the neighbouring countries may negotiate individual splitting rules. However, these individual cost-agreements are difficult to establish and have in many cases not been solved (Hou and Pfeifenberger, 2011). Hence the EU Infrastructure package (EC, 2011) proposes the use of a cost-benefit analysis to inform the negotiation of cost allocation between countries involved in and benefitting from projects of common interests, e.g. internationally relevant transmission expansion projects. However, these calculations are complex yet and due to dynamic changes of European energy system (e.g. due to RES-E) may not be stable over time and could thus trigger subsequent renegotiations of provisions.

In the case of the Cobra cable between the Netherlands and Denmark, according to the standard approach, the construction costs would have to be borne by the Netherlands and Denmark, while a large part of the benefits occur on the German territory, because the cable would offer a bypass to the congested link between Denmark and Germany. As the investment has been shown to create benefits to the European society it was offered EU support of 86.5 Million EUR (through European Energy Programme for Recovery). Currently the Cobra project is awaiting a reassessment of the business case and discussions on the preferred route of the cable between the Dutch and German authorities (European Commission (EC), 2012).

The allocation of costs to regulatory asset base of a TO can be further complicated where the investment is pursued on the territory of a third country without necessary benefiting this third country (CEER, 2006).

Access to capital

In several countries of the MENA region power prices are set below the full cost of the system and as a result the utilities incur losses that need to be covered by transfers from

the national government. This dependence on discretionary financial support from the national government reduces the credibility of the utilities and their ability to access private debt markets.

In the EU, TOs are both publicly owned like TenneT and privately owned like National Grid. In principle TOs can offer an attractive investment opportunity for investors of which many are looking for stable and long-term returns. However, in practice TOs can only raise 2 units of debt for one unit of equity. If they would raise more debt, then rating agencies and investors consider the investment more risky and would downgrade or reassess investing in the TO. Thus for TOs, if they are to engage in large scale investment projects, can not only raise debt but also have to issue additional equity.

Again, TOs should in principle do not face difficulties in raising additional equity, given their strong and stable track record and business model. In practice, a public owner of a TO might be reluctant to accept that raising additional equity requires either providing cash to acquire the newly issued equity or accepting a dilution of ownership if private investors acquire the newly issued equity (Neuhoff et al., 2012).

One of the most recent examples of such difficulties is TenneT's inability to timely access the capital that would be required for the connection of offshore wind-parks to the grid since 2011, despite the applications and efforts spent by the developers and urge placed on the TSO by the national authorities.

Concerns that TSOs might be overinvesting

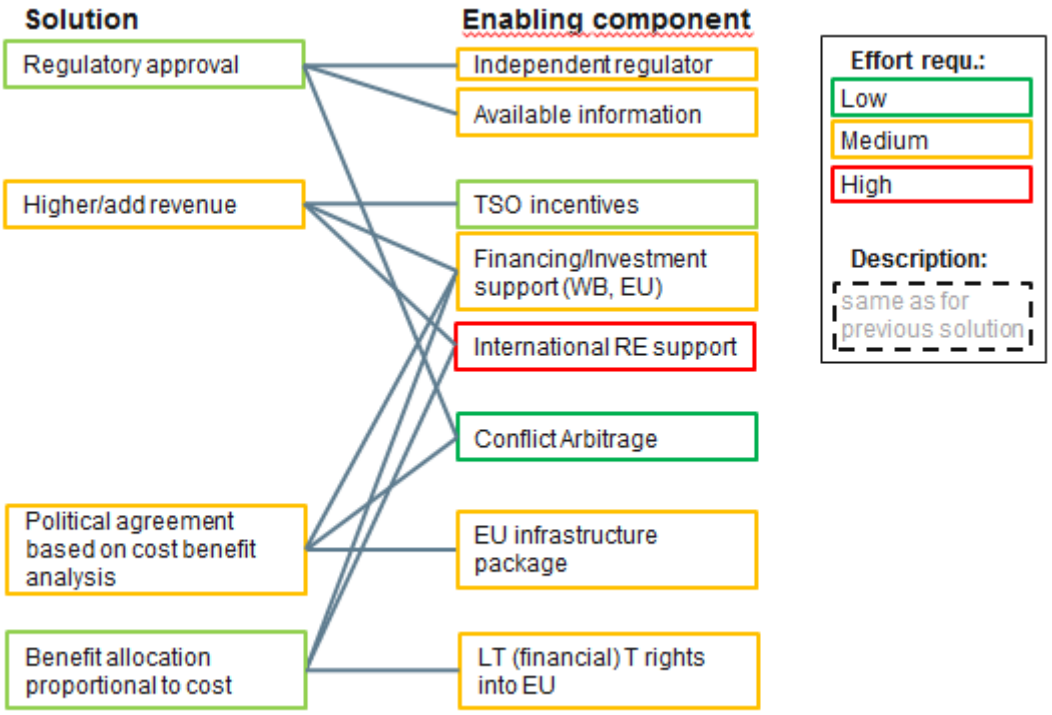
In the past we have observed that European utilities could pass all costs to consumers with limited incentives to reduce their costs. For investment projects that were approved, utilities often would recover all costs from consumers and in addition obtain a regulated premium. Thus TSOs had an incentive to build lines even if they would not be needed (Cambini and Rondi, 2010; Littlechild, 2011). As inclusion of lines into the regulatory asset base requires regulatory approval and additional incentives to limit costs are provided in countries with incentive based regulation, overinvestment is currently not considered to be a major concern.

Solutions for regulated investments

To address the issues discussed in the above we propose the following solutions (as graphically shown on Figure 3.3 together with their corresponding enabling components):

- regulatory approval;
- higher/additional revenue;
- political agreement based on cost benefit analysis;
- benefit allocation proportional to cost.

Figure 3.3 - Solutions and enabling components for regulated investment.



I. <u>Regulatory approval</u>

The requirement of regulatory approval for the inclusion of investments into the regulatory asset base and in some countries for the investment budgets of new transmission lines can help to address the problem of TO's incentives. The regulator may decline the construction of lines for which the costs exceed the benefits – and the

problem of TO motivation – because regulators can take a broader perspective and recommend the construction of interconnectors that would not have been considered by the TO. The detailed design of regulatory control has been discussed extensively in many articles (Borrmann and Brunekreeft, 2011; Cambini and Rondi, 2010; Joskow, 2008; Petrov et al., n.d.; Rammerstorfer, 2009; Vogelsang, 2006). Currently transmission regulation regimes are very different across the EU. Thus definition and eligibility of cost components differs, increasing complexity, transaction costs and ultimately risks for international investors.

Within our case studies, Morocco is the only country where the investment in new lines currently does currently not require the explicit authorisation by a regulator.

Increasing the (perceived) credibility of the regulator reduces uncertainty attributed to future TO revenue streams and can thus facilitate easier access to capital. Both European and MENA regions in principle have an interest to enhance their overall regulatory credibility. When assessed by international investors as one group of countries, a serious regulatory failure in one country affects the perceived regulatory credibility of all countries in the respective region. In addition, the heterogeneity of the regulatory regimes within Europe complicates the assessment of investment options in new transmission lines or transmission owners potentially limiting the interest of investors because of the resources and time that would be necessary to inform an investment decision.

The following enabling components can help to increase the effectiveness of the regulatory approval process and credibility of the regulator:

Independent regulator

A dedicated and independent national authority can increase effectiveness of the regulatory approval. Contributing to the regulator's independence are: a stable source of funding, usually on the basis of fees that are paid by utilities, an irrevocable appointment of the regulator for a fixed term, appointment procedures involving the parliament, and clearly defined legal powers, including the right to impose sanctions (Larsen et al., 2006). Independence from the regulated industry increases if the regulator neither has a financial nor other personal interest in the industry, for example by prohibiting the employment of regulatory personnel by the industry or restricting the

type of information that may be shared on pending decisions (Larsen et al., 2006). There have been various consultations and studies on the design of a regulatory agency in Morocco since 2002. A new consultation has been launched in November 2012 and, at present, the introduction of a regulator is planned for 2014. However, so far, the institutional design has not been decided and further consultations could be launched in the future. In the case of Algeria on the other hand, a regulatory agency has been established, however, with limited powers as evident from the fact that the transmission system operator (SONELGAZ) can still ask the Ministry of Energy to subsidize projects in excess of the regulatory allowance.

Conflict Arbitrage

The credibility of regulation could further be increased by an independent agency that can be called upon in the case of dispute about allowed revenue or tariff levels. Of particular value could be guiding principles and political support if they can avoid the need for a lengthy and expensive legal process. It will be interesting to observe how the newly established agency for cooperation of European Energy Regulators, ACER, can play this role.

Alternatively, the European Energy Community might serve as an example of an international framework that also facilitates conflict arbitrage for its contracting parties including Balkan countries, Moldova and Ukraine. Since 2008, infringement processes may also be started by a complaint by any public or private party to the secretariat of the European Energy Community, and may be escalated from a so called 'opening letter' to a 'reasoned opinion' and a 'reasoned request' to the Ministerial Council (see Box 4). Furthermore, Mediterranean Regulators for Electricity and Gas association have announced to create a Mediterranean Energy Community by 2020 in its action plan (MEDREG, 2012). Establishing a similar or extending the existing framework may be arguably relevant for strengthening the interconnectedness between the EU and MENA regions.

Available information

Current discussion on the method for determining the costs and benefits of the transmission lines as part of the EU infrastructure package illustrate the scope of

information necessary for regulatory approval of, and cost sharing agreements for transmission expansion. For the multi-criteria cost-benefit analysis the following seven benefit categories need to be considered: market integration, competition, system flexibility, sustainability, interoperability and secure system operation (EC, 2011).

For such an analysis, asymmetry of information is of major concern for regulators. Without independent modelling of the transmission and energy system, the regulators struggle to make a robust assessment of the need for and benefit of an additional transmission line. This remains a challenge in the EU and in the MENA region.

This can be illustrated by the example of the 400kV line between Algeria and Morocco. Due to transmission constraints within the countries, only a fraction of the 2800 MW (at 400kV) and 480 MW (at 220kV) thermal interconnection capacity can be used for commercial transactions. However, the link also reduces the need to operate power stations at part load which can provide responsiveness to maintain grid stability within the countries. This is due to the fact that the interconnection can be shared between the countries. Arguably, this was one of the main reasons for constructing the 400kV interconnector (Bouchahdane et al., 2011).

II. Higher or additional revenues for TOs

Transmission projects comprise of high up-front capital costs that provide benefits over many decades. Therefore the focus of any solution towards higher and additional revenue is typically on the revenue stream over the live time of the project, as this avoids the difficulty to impose large on-off costs on rate-payers or public budgets.

Allowing higher revenues for interconnection lines increases the motivation to pursue investment projects and to overcome the bias towards investment in less risky, onshore transmission lines within each country (Frontier Economics, 2008). However, also the risks inherent in such an approach need to be considered. It could result in a bias towards international interconnectors, or necessitates a subsequent increase of revenues for domestic investments.

Creating additional revenue streams (besides the revenues from the transmission tariffs) to recover the costs for the investment reduces need to increase in the future transmission tariffs for domestic consumers (that traditionally cover the costs of an

interconnector). This will therefore reduce the concerns of TOs that regulators will cut the allowed revenue for existing lines to balance increases of allowed revenue for new lines.

Increasing revenue on interconnection projects (TO incentives)

In order to increase the attractiveness of investments regulators can pursue a set of options. First, to reflect the additional effort necessary to initiative, plan, permit, construct and finance new transmission lines, the weighted cost of capital that determines the allowed revenue relative to the existing capital base can be increased. For example Swissgrid has been granted an increase in allowed revenue to allow for higher weighted cost of capital from January 2013 and the UK regulator Ofgem granted higher weighted costs of capital for new transmission lines. Second, investment budgets can be defined by the regulator, ensuring that costs of new transmission can be directly included into the calculation of the tariff base (example Germany).

The complexity involved in agreeing on planning, permitting and execution across multiple jurisdictions or the additional technology uncertainty of under-see cables could create incentives for TSOs to prioritise other investment projects. This can be compensated with additional incentives. For example, the current regulation in Spain uses two different tariff regimes. For onshore or standard AC links, standard cost factors (per km, per MW) from yearly audits of REE by third parties are used. For offshore or newer technology/DC links on the other hand, special calculations are carried out, mainly based on international benchmarks or offers by manufacturers.

A final option could in theory be the use of incentive regulation. The total costs incurred by a transmission operator could be benchmarked against an optimal network design (envisaged in German regulation for future regulatory periods) or a set of comparable transmission networks. If the reference and comparison networks comprises beneficial interconnection lines, then the total costs for a TSO that fails to implement such lines would increase – hence Totex benchmarking could in theory provide incentives to advance beneficial grid projects. In practice the difficulty of defining optimal reference networks, finding sufficient comparable networks and the costs of financing investment projects against such uncertainty need to be considered.

Providing Financing or investment support

Inside the EU, the Connecting Europe Facility (CEF) of the European infrastructure fund has foreseen a total of €9.1 billion for the improvement of energy grids of European interest ("Projects of common interest", PCI) between 2014 and 2020 (European Commission (EC), 2011), during Council negotiations for the EU budget (multiannual financial framework) this has been reduced to 5.1 billion as per European Council conclusions from Council 8/9 in February 2013. Considering estimates of the required volume of electricity transmission investment for this period of up to 100 billion (Roland Berger, 2011a), and the fact that this amount is shared across electricity, gas, oil and CCS infrastructure projects, this amount is relatively small. Hence the resources might be most effectively applied if targeted to innovative project types, or to early stage project costs (grants for studies) that might be difficult to cover otherwise.

TSOs in the MENA region on the other hand, often have access to preferential loans from public sources, such as the European Investment Bank (EIB) or the World Bank which can reduce financing costs. However, access to and utilisation of such funding has to date only been taking place at a very modest rate. In the case of Morocco, many investments in the electricity infrastructure are supported by loans from public sources with a WACC between 0.5% and 4%. The selection of projects by the funding organisations can therefore increase the motivation of TSOs to engage in cross border projects, such as in case of the Morocco Spain interconnector, which was built with financial support among others by the French Development Agency (AfD) and the EIB.

Integration with international renewable energy remuneration mechanism

Where renewable energy investments in a country are dedicated to exports to be remunerated in another EU country (MENA-EU but possibly also Joint Projects within EU), the investors in a generation project will need to acquire long-term transmission rights to use the line at the time of their renewable energy production. Thus the price paid for the renewable energy delivered will not only remunerate the production of the renewable energy but also the use of transmission. Thus an additional revenue stream is created for a transmission line. This increases the total revenue for a transmission owner without the need to increase transmission tariffs charged to domestic consumers. Thus the additional revenue stream helps to avoid domestic concerns about increases of

transmission fees. Thus also concerns are avoided that more stringent regulatory reviews could be triggered to limit costs for consumers. Ultimately the international revenue stream therefore can increases the preparedness of the TSO to take forward the investment project.

III. Political agreement based on cost-benefit analysis

An agreement about cost allocation/sharing among different countries is a key aspect of a solution to unlock international transmission investment. The benefits (access to lower-cost generation, higher revenue for generation, security of supply) of new interconnection capacity do not always coincide with the physical location of the infrastructure. For example a transmission expansion within a country could (i) alleviate constraints in neighbouring countries or (ii) allow for additional transfers between third countries. Therefore as part of the methodology for the design of [transmission] PCI the EU infrastructure package outlines a process (including model-based analysis of energy system) to determine the allocation of investment costs for transmission lines that are jointly proposed by several countries. The process also includes a cost benefit analysis, with more precise methodology yet to be proposed by ENTSO-e, but recognizes that it is ultimately a political agreement among the project proponents that is needed, and that might be mediated by the Agency for the Cooperation of Energy Regulators (ACER). For interconnectors between EU and MENA countries this points to the potential need for alternative bodies to mediate a process that can decide on a cost allocation approach.

IV. Cost allocation proportional to benefit

Several different cost sharing rules exist, e.g. according to benefits in terms of voltage levels and reliability or economic investments for achieving better electricity price from the import-export activities. Typically, the cost sharing principles are established ex ante the investment as a general rule (rather than on a case-by-case basis).

If the revenues from transmission rights are allocated in proportion to costs, then the net cost of benefit to be born is lower and therefore the cost allocation is simplified. A

successful example for the result of such a negotiation is the interconnector between Italy and Montenegro, where governments of both countries agreed to share the capacity of the cable and thus potential revenues from its use in a ratio of 80:20 reflecting the costs borne by the Italian TSO for the interconnector and the cost born by Montenegro's TSO network reinforcement to accommodate the interconnector.

3.1.2 Concession based investment

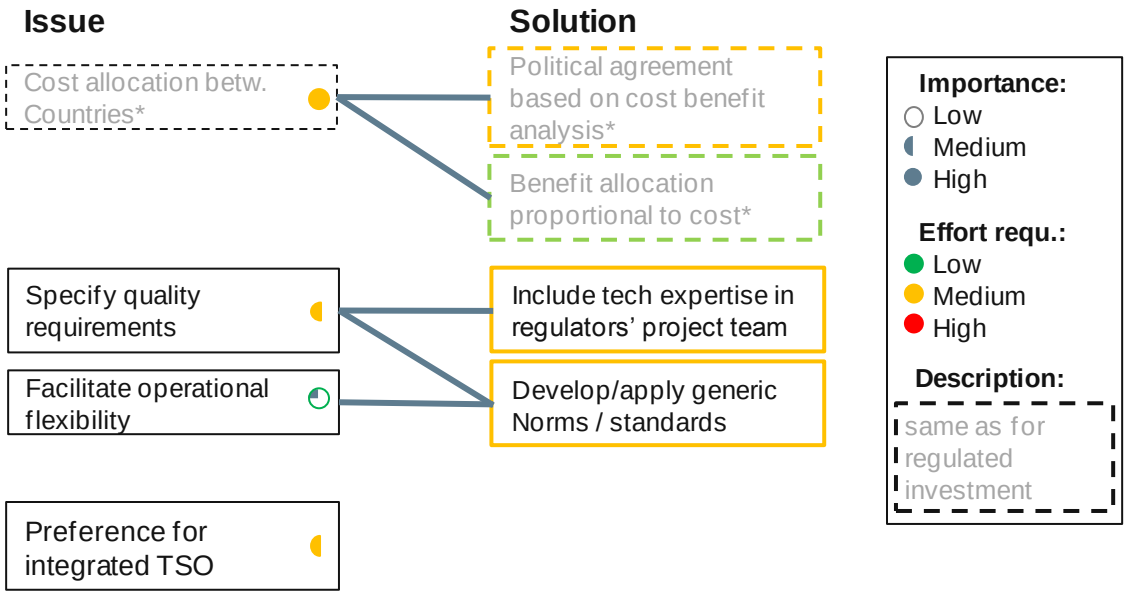
Concession based investment has been used in the EU context predominantly in the recent past and therefore leads to a more limited set of understood challenges. Certain advantages however are noteworthy to highlight, e.g. faster access to financial capital and wider range of ownership structures, including those from the private sector.
The main difference between the TSO-based and concession-based regulated investments is that in the first case an interconnector is part of the regulated transmission network of the TSO while in the second - it allows for other forms of ownership, e.g. by private investors who contract the third entity to operate their assets subject to the same regulatory framework. By conducting interviews and literature review, we have identified a set of challenges for the concession based approach of interconnector investments. They are listed in Figure 3.4 together with a set of solutions to address them.

Issues associated with concession based investments

The following issues have been identified as creating key obstacles for the concession based investment in transmission interconnections (as specified in Figure 3.4):

- cost allocation between countries;
- specification of quality requirements;
- facilitation of operational flexibility;
- preference for an integrated TSO.

Figure 3.4 - Issues, solutions and enabling components for concession based investment.



Cost allocation between countries

In the case of concession based investment, the concession fee to be paid to the transmission owner is recovered mainly from transmission fees on the line paid typically by transmission users as opposed to the charges passed on to the consumers in their bills as in the case in the TSO-based approach. If transmission users acquire long-term access rights, then the revenue for the line will be stable and likely to be close to the initial investment cost. If transmission users acquire access rights on shorter time frames, then revenues can exceed or fall short of the concession fee. Also, if the decision on the construction of the line precedes the issuance of long-term contracts for the entire capacity, a residual risk of under-recovery and opportunity of surplus recovery remains. The balance will then be passed on to transmission tariffs, in the same way as in the case of regulated investment. The problem of cost allocation and the options to address these are then similar to that in case of regulated investments.

Specify quality requirements

Future repair of sub-sea interconnectors is expensive and can result in long, and therefore expensive, periods during which the cable is not operational. Hence careful construction and high quality materials are important which is typically addressed in the respective tendering processes. In principle, risks associated with the future operation could be fully allocated to the concession holder so as to create the incentives for appropriate technology choice and maintenance. In practice, it might be difficult to judge whether faults are related to operation, maintenance, third party influence or initial construction mistakes. Also, if liability is fully allocated to the concession holder, the unknown risk profile might preclude financing from pension funds or other financing sources that offer low cost capital for low risk investment opportunities. Hence, it might be necessary to specify the quality requirements prior to the tender so as to allow for some level of risk sharing between concession holder and the public counterparty.

An alternative approach to secure adequate quality in interconnector technology choice and construction process was pursued in the case of transmission links to UK offshore-wind turbines, by allowing the wind project developers to also build the transmission lines. The transmission assets were only auctioned to concession holders after they had been commissioned (See Box 2). Because each line was connecting a particular wind-farm, the project developer of that farm had an interest both to ensure the quality of the line – because he needed it to transfer electricity to the grid – and to keep the costs low – because he remains liable to pay connection charges that include the capital costs for the line.

The specification of quality requirements is also important in the case of regulated transmission investment. Typically the TO will as part of the investment process tender for technology and construction services, and at this stage as well as by monitoring the construction process will secure the quality of the assets. As the TO is subsequently responsible for the operation – and is a visible actor in the public discourse in case of failures of the assets – the TO is incentivised to ensure quality of the project. But in the case of regulated investment, the decisions are pursued within the TO organisation and thus require less regulatory supervision. Also, the risks of technical failures will be partially born by the TO and might be dependent on the precise definition of the incentive regulation, passed to a smaller or larger share on to consumers. Large deployment of offshore wind-farms along the coast of Great Britain in the recent years has required the construction of undersea cables connecting the wind-farms to the on-shore transmission grid. Between 2009 and 2011 alone, 1.9 GW of wind farms have been constructed and connected to the grid and it is expected that a total of up to 13GW will be developed by 2020.

Under the current regime in the UK, the cables can either be built by the wind farm developers (generator build) or by independent offshore transmission owners (OFTO build).

- Under the *generator build option*, the generator will obtain the connection agreement from National Grid and take responsibility for all aspects of design, pre-construction, procurement and construction of the transmission infrastructure. After the generator has completed construction, the ownership of the line is transferred to an OFTO in a competitive tender. In addition to financing benefits, also European unbundling requirements on ownership of transmission and generation assets are addressed. The OFTO will operate, maintain and decommission the transmission assets.[1]
- Under the current *OFTO build option*, the generator will obtain the connection agreement from National Grid and undertake high level design and pre-construction activities. Then the generator will run a tender for developing the connection that can be responded to by OFTOs. The OFTO will undertake detailed design work in accordance with the high level requirements that were specified by

[1] (Ofgem, 2012)

the generator in the tender document, undertake the procurement with suppliers, negotiate and finalise construction contracts, and will deliver the build programme. The OFTO will operate, maintain and decommission the transmission assets.[2] Although this option has been designed in more detail, so far no transmission line has been built by an OFTO.

In both models the OFTO winning the tender receives a guaranteed revenue stream from the wind farm owner(s) at the level determined in the tender for a duration of 20-years in return for an up-front payment to cover the construction costs, and operating and maintaining the cable. At the same time, generators pay the transmission fee proportional to the costs of the line (concession). Therefore, they have an incentive to minimize the costs of the line from early on ensuring higher efficiency of the investment as seen both from financing (as access to transmission investment and operatorship is open to private entities), development (the design is being adequately made by the developer of the wind park to ensure sufficient quality of the line) and from the regulatory standpoint (optimisation of the transmission fees). It is however important to mention that bringing third party investors to own an OFTO may have effects on the operational flexibility of the line, as the former typically would prefer to not deviate from the initially contracted usage pattern so as to avoid transaction costs and potentially implied risks that are difficult to evaluate for investors that lag the in-house expertise of a TSO. Therefore, this may lead to inefficiencies in the OFTO line utilisation. The approach however has been successful at attracting additional low-cost finance into transmission development.

Text Box 2: UK Offshore Transmission Owners as an example of concession based investment.

Facilitate operational flexibility

Concession agreements envisage typically a very specific operational and maintenance schedule for the asset. The concession holder has no incentive to deviate from this schedule. Where the schedule had been the basis for risk assessments used by equity and debt investors, it is also complex to reconfigure the schedule. As a result, in the UK,

[2] (Ofgem, 2012)

the lines operated by an OFTO could not be used to offer fast response that would technically be possible through short-term operation above nominal capacity. Some of the value which the asset could have provided for the system had therefore not been utilized. More generally, this illustrates the difficulties that might be incurred if separate transmission assets are to be effectively operated under evolving market arrangements.

Preference for an integrated TSO

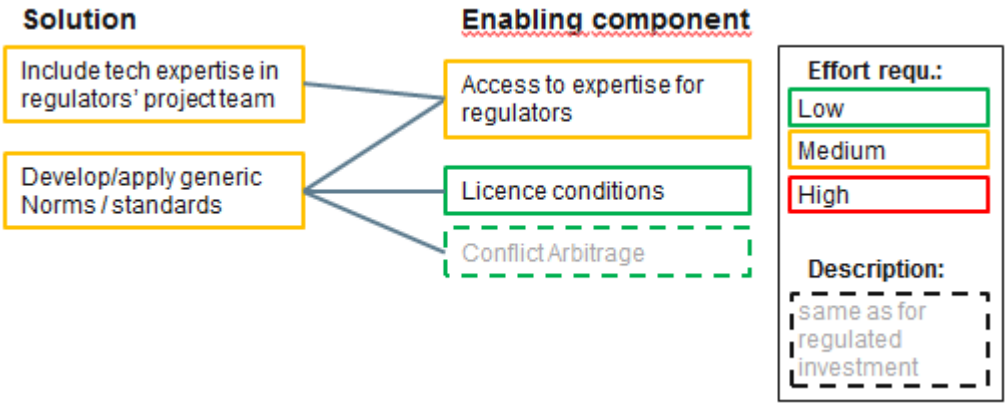
Some countries prefer to allocate all responsibility for the development and operation of the transmission system to a single entity. This raises the question whether individual lines that are constructed and financed on a concession based approach could be integrated under the overarching responsibility of the TSO. The compatibility of the two models will both depend on the design of the concession contracts and on the expectations with regard to the TSO.

Solutions for concession based approach

The following solutions have been identified to address the main challenges with the concession based approach to transmission interconnection development (as depicted on Figure 3.5):

- include technical expertise in regulator's project team;
- develop and apply generic norms and standards.

Figure 3.5 - Solutions and enabling components for concession based investment.



In addition to the various solutions that have been suggested and can be transferred from the discussion of regulated TSO investments, for concession based approaches the technical expertise of the regulator can be strengthened to execute the tenders for the concession, and generic norms and standards can simplify both the tasks for the regulator and the participation of investors in the tender for the concession.

I. Include technical expertise in regulator's project team

If the technical specifications are too narrowly defined in the tender, then ultimately only one company can deliver the respective DC cable and converter stations. Therefore, to enhance competition, some flexibility has to be offered for the bids. In this case the regulator's project team which is running the tender will need the technical expertise to compare the bids.

A panel of experts that is recruited early in the process can provide independent advice to the regulatory bodies. This can include national actors and other TSOs not participating in the tender, international organizations or academia.

II. Develop/apply generic norms and standards

To ensure that new lines fulfil quality and flexibility requirements, it is important to develop and use standards and generic norms for cross-border transmission connections.

A panel of experts could support the design of suitable licence conditions. For example in the UK OFTO auctions, external advice on certain technical and financial aspects was provided by consultants.

Licence conditions for the concession based transmission project could include a standardised description of the different usage modes, e.g. conditions and additional remuneration possibilities for temporary usage of the line above its nominal capacity. The use of standardised term-sheets provides enhanced confidence to all parties involved in concession agreements and financing of investment (see e.g. Kerf et al., 1997).

In the case of UK OFTO auctions, additional capacity above the Transmission Entry Capacity (TEC) is currently remunerated on the basis of additional capacity incentive adjustments (ACA) or incremental capacity utilisation adjustments (ICUA). ACA are case-by-case cost estimates and are used if major investments to the line are required. ICUA are fixed payments per kW of additional capacity and are used in case only minor capital expenditures are required. Ofgem is currently considering to abolish the ICUA payments and is in favour of a case-by-case assessment of the cost for providing additional capacity in order to increase flexibility in the respective incentives (Ofgem, 2012).

3.1.3 Merchant based investment

Merchant based investment has been very prominently discussed in the academic literature but the number of projects realised under this business model have remained very low (one implemented – UK/Netherlands, four approved lines in Europe, one line in Australia, several in the USA).

Merchant based investment provides flexibility in terms of the ownership structures, utilisation governance and capacity allocation methods. The main attraction attributed to the business model is the ability to allow third parties to advance investment projects that might have been ignored by incumbent TOs. For example if transmission and generation are vertically integrated, a vertical integrated utility might dislike an interconnection because the imports create competition and thus reduce profitability of generation. In principle, merchant investors would not be concerned about such

impacts, and thus more willing to advance the project. In practice extensive regulatory support is necessary to ensure that such a merchant interconnection project can secure adequate access to grid, ensure its fair reflection in security assessments, and can sell its capacity for use in energy and ancillary service markets.

As some TOs might be privately owned such as in the UK, merchant interconnectors between France and the UK (IFA) and Netherlands and UK (BritNed) are constructed by the affiliates of regulated transmission owners in neighbouring countries.

The BritNed cable, which is connecting the Dutch transmission grid with the transmission grid in Great Britain, between Isle of Grain (GB) and Maasvlakte (NL), started operating on 1 April 2011 with a capacity of 1GW. The cable is owned by BritNed Development Limited[3], which is a 50:50 joint venture of National Grid Holdings One PLC (GB) and TenneT Holding B.V. (NL).

Initial talks about the cable were started by the system operators in 1999 on the basis of the joint economic interests between the two countries, leading to the planning phase in 2004. As the TSO in the UK is not allowed to invest in interconnectors as to increase its regulated asset base, this led to a merchant approach being chosen for BritNed. Initial pre-construction activities begun in early 2007. The regulators in Netherland and Great Britain provided an exemption for the line from tariff regulation. This allows the owners of the cable to sell transmission capacity on a commercial basis on day-ahead implicit auctions and longer-term explicit auctions (annual and monthly), subject to the following conditions:

a. Obtain prior approval for auction design and capacity products

BritNed is free to develop suitable products and design the auctions for selling explicit transmission rights, but needs to obtain permission from regulatory authorities prior to implementing changes.

b. Use it or sell it clause

Transmission rights which are not used need to be auctioned during implicit day ahead auctions to avoid capacity withholding.

c. Firmness of the transmission rights

Transmission rights which are sold during implicit day ahead and intraday auctions are by definition firm.

d. Auction Reserve price

BritNed is granted a reserve price during explicit auctions to cover the cost of the auctions. Reserve prices are changed by BritNed on cost base. Current reserve prices

[3] Company website: www.britned.com.

are increase from 1EUR /MWh to 2.5Euro/MWh with the share of the capacity sold.

e. Operate independently from NG and TenneT holding

In their role as system operators, NG and TenneT are not allowed to re-dispatch the system in a way that maximises the un-regulated revenues of the BritNed interconnector.

f. Observe congestion management guidelines

Current congestion management guidelines do not allow the adjustment of interconnection flows in order to balance the national system.

Subsequent to the national authorities, the EU Commission also had to approve the exemption of the line from tariff regulation. The EU Commission was concerned that the cable may be undersized. As part of this approval decision on 18 October 2007 it therefore required that if the average revenues by 2017 exceed the revenues that were projected by BritNed in their application for exemption by more than 1%, BritNed will be given the choice to return the additional revenues or increase the transmission capacity[4].

Currently, BritNed cable has been in use almost 2 years with high availability (95%) and most power flows in the direction from the Netherlands to the UK.

Text Box 3**:** BritNed interconnector as an example of merchant investment.

The set of challenges with regard to the merchant approaches to transmission infrastructure investments we identified in literature and interviews are listed in Figure 3.6. To address these challenges, a number of regulatory solutions and enabling components can be used which are shown on the same graph and explained below.

Issues associated with merchant investments

The main concerns associated with merchant investments relate to the high cost of capital for investors to pursue merchant investments and the tendency to undersize the

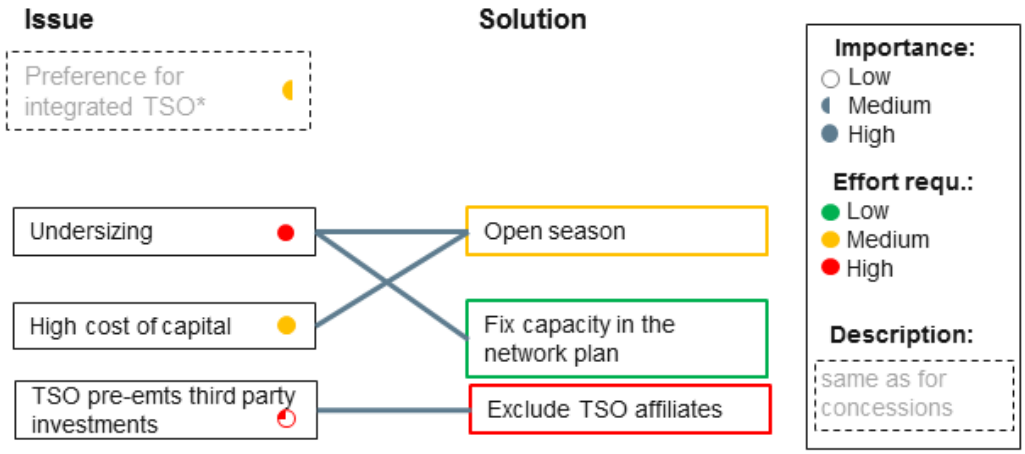
[4] [Glachant, Pignon, 2005]

capacity of the transmission link relative to welfare optimal choices. In addition, concerns were voiced that incumbent TOs from neighbouring countries have information and other advantages allowing them to preempt the participation of third party investors thus leading to monopolistic situations with only limited regulation.

Undersizing

If a merchant investor constructs a line to be financed from future congestion revenue, then commercial interests are to size the transmission so as to maximise future congestion revenue. As typical for monopoly situations, less capacity than socially optimal is provided so as to maximise profits (DeVries et al., 2009; Léautier and Thelen, 2009; Levêque and Brunekreeft, 2007; Paul Joskow and Jean Tirole, 2005). The effect can be avoided if, at the time of construction contracts for the future use of the line, are issued in an 'open season:' all demand for contracts is collected and the total demand is used to set the capacity to be constructed. Such contracts could be used by investors to make the export of power from renewable energy projects credible "bankable".

Figure 3.6 - Issues and solutions for merchant investment.



High cost of capital

In principle the revenue of merchant investors depends on the price difference between the markets connected by the interconnector. Prices in both markets are volatile and subject to various drivers that are difficult to predict, including regulatory developments. Therefore revenue uncertainty for a merchant investor is in principle very high (De Jong et al., 2007). As a result, higher shares of expensive equity are required in the financing structure increasing the overall cost of capital (Léautier and Thelen, 2009). There is an additional risk for future revenue streams, for example if parallel to the merchant line a regulated line is being built and reduces the scarcity value of the line, as it took place in Australia.

In practice merchant investors will aim to sell access to the transmission line on long-term contracts. To the extent that they succeed in signing such contracts they can secure future revenue streams and reduce the uncertainty about future revenues. However, in the current European environment power contracts rarely extend for more than four years, so it would be difficult to find counterparties that would acquire access to transmission beyond this horizon.

In case the cross-border interconnection is built between one or more non-liberalised markets, the merchant investor of the interconnector will need to negotiate grid usage and payment prior to construction. This is because without a competitive market there is no reference power price for a market, and therefore there is also no price difference between the two ends of the interconnector that determines the value of the interconnector. Hence the construction of an interconnector to one, or between two, markets that are not liberalised can only be initiated once a long-term agreement secures the future revenue for the interconnector.

TSO preempts third party investments

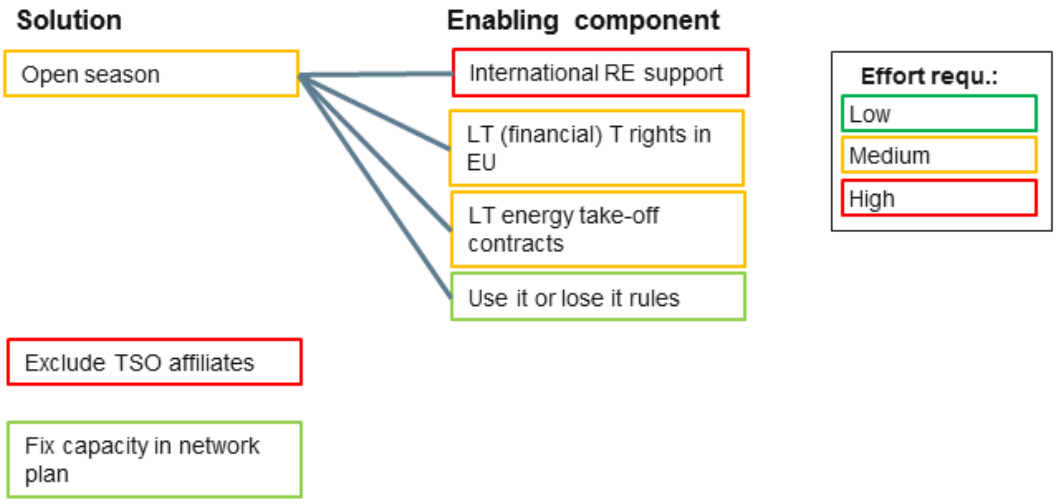
TSOs are typically much better informed about power flows and potential future bottlenecks on lines linked to their network. If they are allowed to undertake merchant projects, they could therefore preempt third party investors or select the most profitable opportunities. This increases the risk for third parties of winning the tender only in the

case if the project is not profitable (winners curse) or of incurring early project development costs with very low probability of succeeding in delivering a project.

Furthermore, the revenues of a merchant TO depend on the dispatch of the system. If the dispatch is controlled by an integrated incumbent TSO, independent merchant investors may be discouraged to construct additional lines, because the dispatch of the incumbent TSO will influence whether congestion rents are accrued within the system, or on specific interconnectors (De Hauteclocque and Rious, 2009; Glachant and Pignon, 2005).

Solutions for merchant investments

Figure 3.7 - Solutions and enabling components for merchant investment.



Three primary options have been proposed to reduce concerns associated with merchant investment. Open seasons to issue long-term contracts prior to the construction, exclusion of TOs of neighbouring countries with their affiliates, and fixing the capacity that a line needs to reach in network development plan.

Beyond this, a suitable regulatory framework for merchant transmission projects is essential. In Italy, for example, the debate about the creation of a regulatory framework concerning interconnections has started with the Reg. CE n. 1228/2003, and (Art. 32, Law 23/07/2009) which set out conditions for accessing the network for cross-border

exchanges in electricity, however, many details are still missing within its implementation. E.g. until recently Italy has been under an infringement procedure from the EU for not having established congestion management mechanism that is necessary for both an efficient cross-border trading and providing incentives for merchant interconnector investments.

I. Open season

During an open season, merchant investors sell long-term contracts for the capacity which they intend to provide. This has two advantages. First it provides long-term contracts that secure the revenue for the merchant investor. Second, the market demand for transmission capacity influences the capacity of the transmission line. Holding an open season before the construction of the transmission can thus help to reduce the problem of under-sizing, because additional market participants might sign a long-term contract.

Open seasons comprise two phases. During the first phase, the sponsor assesses market needs and, during the second, offers capacity to the participants and completes deals with those who offer best bids. Open season is publicised by the sponsor to attract higher interest from third parties and provides as much information about the needs as possible. Different methods may be used to allocate the capacity, however NRAs must assure that the chosen one is transparent and non-discriminatory. Once binding agreements are signed and the investment is decided, all non-sensitive information about the investment is made publicly available (ERGEG, 2007).

If market participants exist, that can sign long-term contracts in the open season to secure transmission for energy they own or have contracted, then this can in principle stabilize revenue streams and thus reduce the risk for the merchant investor. However, in practice the counter-party risk involved in such long-term contracts remains a concern that complicates financing and is somewhat lower in cases when RES remuneration mechanisms are driving investments.

Historic long-term contracts had been an obstacle for a competitive European energy market. Therefore the Directorate General for Competition of the European Commission is only granting exemptions to allow for the use of long-term contracts in

narrowly defined situations. In cases such as the merchant East-West interconnector between the British and Irish electricity with the commissioning date in 2019, European Commission granted the allocation of long-term contracts over more than 20 years in an open season. One of the key arguments for their decision was the existence of the regulated EirGrid interconnector which is running in parallel to the merchant lines and has been commissioned in late 2012 (European Commission (EC), 2008).
To create the demand for long-term transmission contracts to facilitate open seasons for transmission access the following enabling components are necessary.

International RE remuneration
In case of transmission lines which are built in order to import renewable energy, renewable power generators will only buy a long-term transmission right if there is an international RE remuneration mechanism that provides sufficient confidence that renewable imports will be sufficiently remunerated for the duration of the energy imports.

Long-term energy take-off contracts
Beyond the delivery point of the renewable energy remuneration mechanism, generators will only buy long-term transmission rights for the amount of energy sold on long-term contracts to consumers in Europe.

Long-term financial transmission rights within the EU
If power is to be sold by the project developer to users outside of the EU country which harbours the interconnector, then hedging against any congestion (cost) is necessary and requires that transmission contracts match the length of energy off-take contracts. Currently however such contracts are typically restricted to one year, and as long as EU congestion management approaches are not consistent with the physical nature of the networks and do thus not provide a credible long-term perspective, the opportunities for long-term transmission contracts remain restricted.

"Use-it-or-lose-it" rules

Long-term physical transmission contracts raise concerns that owners of the transmission contracts strategically or accidentally withhold transmission capacity that they are not utilizing. "Use-it-or-lose-it" provisions aim to secure in such instances that transmission capacity that will not be utilized has to be returned to the system operator so that it can be made available to other market participants.

In the case of the East-West interconnector between UK and Ireland, the European Commission highlighted that one of the conditions for the exemption was the introduction of “use-it-or-lose-it” rules for the long-term transmission rights (European Commission (EC), 2008). In absence of "use-it-or-lose-it" requirements, strategic actors could buy long-term transmission rights in order to shield themselves against competition from the neighbouring markets. In order to obtain an exemption from the European Commission, other merchant interconnectors will need to comply with the "use-it-or-lose-it" rules.

II. Exclude TO affiliates

If the national TO and its subsidiaries of a country linked to the interconnector would be precluded from pursuing a merchant transmission line, this would reduce information asymmetry and could thus attract additional project developers. This could increase the level of interest in the development of a merchant line. Obviously this would be at the expense of losing the incumbent TO or its affiliate as a merchant investor.

Excluding the TO and its affiliate from the pursuit of a merchant transmission line could create a second advantage. It could increase the motivation of the TO to pursue the same line as a regulated transmission investment, as (i) potential additional revenues that might be obtained due to a merchant line are no longer disincentivizing regulated investments and (ii) the TO could be further motivated to take forward the regulated investment to avoid the prospect of third parties owning and operating adjacent asset.

III. Fix capacity in the network plan

Another solution to the concern that there may be strategic undersizing of transmission capacity in a merchant based model is fixing the capacity in the network plan. Therefore, if the investor would build the line, it needs to meet the envisaged capacity. This however raises a question as how to allocate the right to build the merchant line if it is already prespecified; e.g. is the line granted to the investor who has best links to the regulator and TSO so as to early participate in the process and to be the first in submitting the proposal?

3.1.4 Summary of interconnection aspects specific to business model

Table 3.1 summarizes the most prominent issues that need to be addressed to facilitate transmission investment under the different business models discussed in this section.

Table 3.1 - Summary of most frequently mentioned concerns by interviewees and in literature

Frequency of concerns mentioned	Regulated investment	Concession-based invest.	Merchant investment
Business model related concerns			
TO not motivated	High	-	-
Access to capital	Medium	-	-
Cost allocation between countries	High	High	-
Define quality for T line	-	Medium	-
Operation and expansion flexibility	-	Medium	Medium
Under-sizing	-	-	High
High cost of capital	-	-	High

Given the limited attention that was to date dedicated to concession based business models, it might be worthwhile to further explore their advantages. Namely, they provide for opportunities to attract and facilitate use of the private financial capital to develop the transmission infrastructure projects and could thus also avoid bottlenecks in

financing or project development and execution faced by incumbent TSOs. Should an increasing number of lines be built on a concession base, then underpinning contractual arrangements need to be carefully designed so as to create flexibility for efficient operation and further development of the network. Otherwise the interests of concession takers for protection from regulatory and other risks could dominate the structure of such contracts.

The formulation of concession agreements and execution of the tender requires trusted technology expertise that might typically be concentrated within the incumbent TOs. This raises the question on the role of incumbent TOs. One might consider a process in which the incumbent TO would first be consulted on its interest and capacity for a quick implementation of a project in a regulated approach. In case of agreement the TO would be requested to commit to a firm delivery schedule. If this is not obtained, then a concession could be tendered. Given the additional information available to the incumbent TSO, its participation will increase the risk of a winners curse for third parties participating in such a tender. Hence it should be considered to then exclude the incumbent TSO from a tender for a concession and instead built on its expertise in the design and execution of the tender, thus also ensuring that the concession line can be effectively integrated in the transmission system.

3.2 Aspects of interconnections investments beyond specific business models

Having discussed the challenges with the existing business models for investment in cross-border transmission capacity, we further turn to address generic issues in relation to developing power projects in the MENA region.

Within the following sections we discuss issues that apply to both transmission and non-transmission investments.

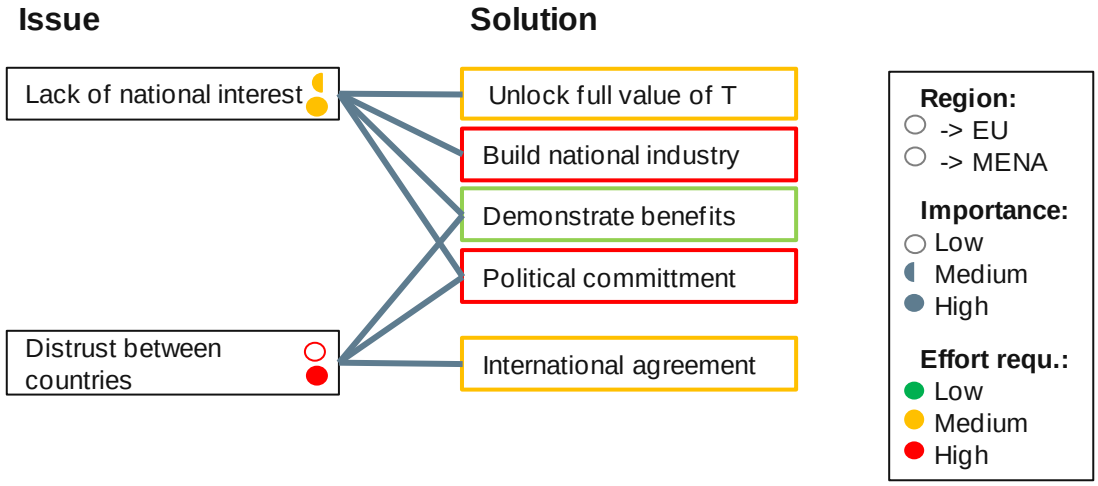
3.2.1 Desert power in general

International desert power projects are faced by a number of problems that are not only relevant for the construction of transmission lines but also for the implementation of an international renewable energy remuneration mechanism. An overview of the problems as well as potential solutions and their enabling components is given on Figure 3.8 and explained below.

Issues associated with desert power projects in general

The perceived lack of national interest in an export oriented desert power strategy is according to our interviews, the strongest obstacle for desert power projects in general. Also some level of distrust between countries can inhibit the implementation of the strategy.

Figure 3.8 - Generic Issues and solutions for international desert power projects.



Lack of national interest

For most countries, the goals of meeting their local demand, diversifying their supply and building a local industry which generates revenues and employment are equally or more important than the profits which could be obtained from electricity exports or transit (Brunekreeft, 2004). Unless desert power projects address these policy

dimensions, the governments of potential export countries may therefore not be interested in collaboration.

For example Supersberger and Abderrahmane argue in 2010 that in order to stimulate interest in export oriented renewable projects in Algeria it is necessary to demonstrate local benefits (Supersberger and Abderrahmane, 2010).

The situation in some of the potential transit countries is similar: the renewable energy from the deserts is competing with the energy they could produce locally and export. Such an incentive could for example explain why recent negotiations on exporting renewable energy from Morocco to Northern Europe through Spain failed. They did not envisage the construction of additional interconnection and thus limited export capacity from Spanish generation to Northern Europe.

Distrust between countries

If the relationship between neighbouring countries is influenced by unresolved historical disputes, governments are often very cautious about engaging in joint projects or opening up their borders for electricity trade relations because they fear that this could introduce dependencies or lead to a re-negotiation of historical disputes in other areas. To a large extent national borders within MENA are still characterised by a significantly depressed effect on electricity trade. This is even more evident in the south-south route (direction) connection, where physical connection is already in place, but the rate of utilization of the existing capacity is extremely low. This does not take into consideration yet, due to its scarce volume, the effects of deployment of RES power generation.

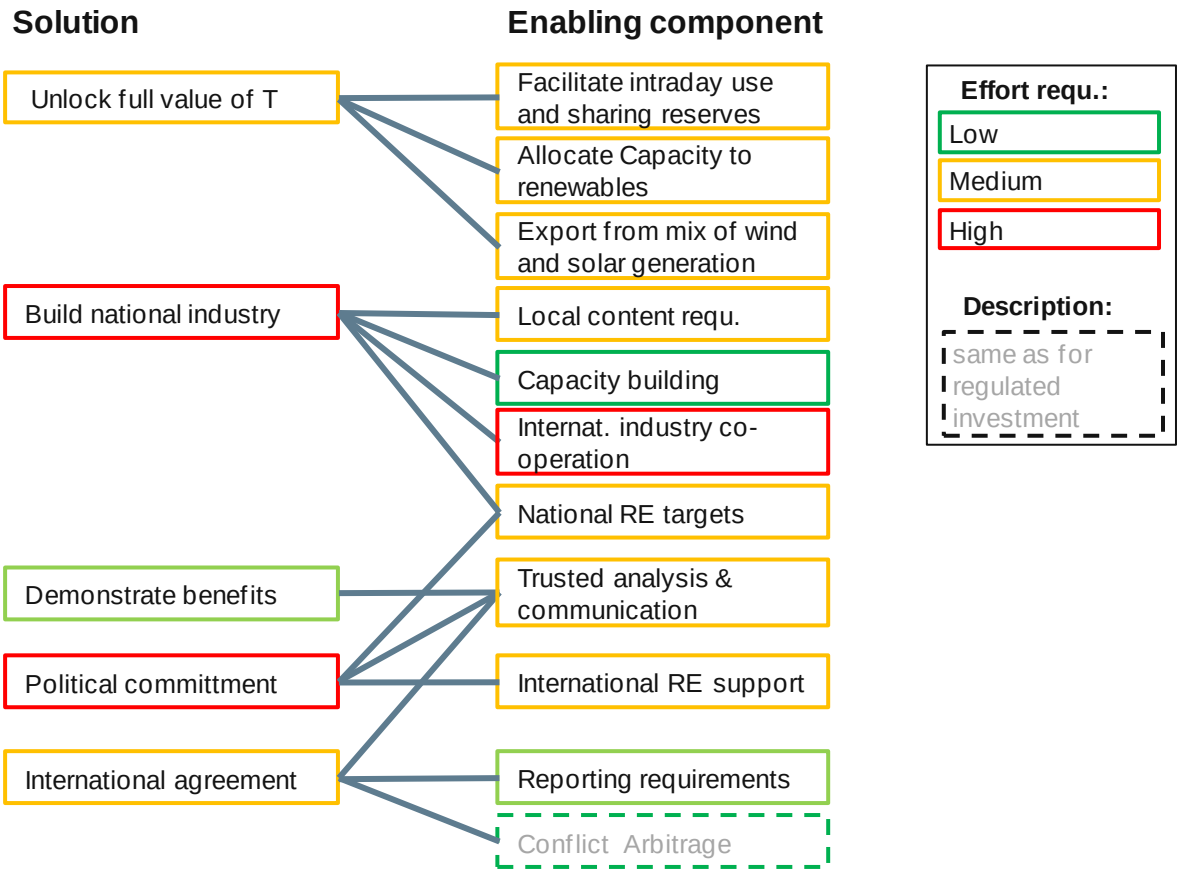
In two interviews mutual dependency was stated as a reason for difficulty to better utilize the interconnector between Algeria and Morocco. Historically, these countries have been close to going to war with one another and the border between them is still closed. As a consequence of these historical tensions in most recent years Maghreb countries have separately sought to develop their exports to their main partner, the EU. The intra-Maghreb trade represents only 3% of foreign trade in the area (CIDOB, 2010).

Solutions for desert power project in general

In address of the issues described in the above, we have developed the following set of solutions (as illustrated in Figure 3.9):

- unlock full value of transmission;
- build national industry;
- demonstrate benefits;
- political commitment;
- international agreement.

Figure 3.9 - Solutions and enabling components for international desert power projects.



I. Unlock full value of transmission

If transmission lines are regulated in a way that allows for a more efficient sharing of balancing energy and reserves across countries, this could reduce the required total generation capacity and thus increase the attractiveness of further interconnections for local governments by increasing the supply security and reducing the cost for their consumers. Benefits from coordinating balancing markets have been observed as quite significant in the literature (Van der Weijde and Hobbs, 2011).

A set of policy options exist to unlock the full value of transmission:

Facilitate intraday use and sharing reserves/responsiveness

The effective use of interconnectors requires frameworks to allow for commercial or administrative cooperation at intraday and balancing stage. This could include alignment of intraday and real time market clearing and dispatch algorithms. In the absence of competitive markets, administrative arrangements could determine the remuneration of services delivered across the interconnector on the basis of transparent international cost benchmarks.

Allocate all long-term capacity to renewables

Long-term transmission contracts can be issued for a line, and can allow investors to sign long-term contracts for power from new generation plants in a MENA country to European consumers or public entities. Thus they could secure stable revenue streams to facilitate lower-cost financing of the investment. To their advantage, such contracts do not have impact on the short-term operation, if capacity is to be returned to the market in short-term auctions. Alternatively, such long-term contracts may be of financial nature and referenced to the result of the short-term transmission auction or, if spot prices are available in both countries, to the difference of the spot prices in the markets adjacent to the interconnector.

Export from a mix of wind and solar generation

The utilisation of the interconnector can be increased if power, from a mix of generation technologies, is exported. In this case the size of the interconnector would be significantly smaller than the total renewable capacity. During a certain percentage of the time, this would mean that not all the renewable energy from all the associated generation assets can be transferred to the EU. As remuneration of the excess production in the MENA markets can be expected to be lower, this will have an impact on the ability to finance renewable investment projects. Technically, however the host country for RES projects would in fact benefit from fuel savings. For example the following two options could be used to reduce the impact on ability to finance new RES generation.

First, renewable technologies could be allocated transmission rights for different time windows. With the provision of firm capacity, the share of generation output that can be exported can be accurately calculated as a basis for financing decisions.

Second, renewable technologies could be allocated transmission rights with different priorities. Thus technologies with higher investment costs (e.g. solar thermal) could obtain rights with higher priority for the share of power not stored, followed by solar PV and wind plants with lowest priority to the share of power that produced from stored solar thermal storage.

In either case, the sale of the power not exported needs to be agreed. In the example of Morocco, local off-take contracts can both be signed with the state owned electricity utility (ONE) or directly with end-consumers (MEM, 2010). In absence of a liberalized market, the price for local off-take of energy needs to be determined prior to construction, as subsequently the generator has very limited power to negotiate an attractive price.

The price can be determined for the individual plant, for example as part of a tender for the plant. Alternatively, the power price in a liberalized market or of a reference power plant could be used as reference point (for example longer-term gas contracts in continental Europe had sometimes been payed at the gas price in the more liquid UK market).

II. Build national industry

A clear strategy to unlock the opportunities for local industry to contribute to and develop with the renewable energy investment as well as a quantification and communication of the resulting benefits could greatly increase the attractiveness of investments in export oriented projects.
This can involve a set of enabling components mentioned below:

Local content requirements

Renewable energy projects could be subject to local content requirements in terms of a minimum local ownership, minimum share of local employment, and minimum share of locally manufactured equipment or other. However, such local content requirements might be challenged under WTO rule. Furthermore, in order to deliver the scale of investments that justify local investment in the supply chain it would be very beneficial to develop a common market across several MENA countries. Local content requirements would need to accommodate this.

Capacity building

Renewable energy projects could be accompanied by local capacity building measures in the form of exchange programs, technical training, apprentice-ships, university courses or the formation of local research centres and others. Capacity building measures may help to prevent a shortage of the skilled labour which is needed to facilitate local provision of inputs.

International industry co-operation

Cooperation between companies in different countries, e.g. in the form of joint ventures or shared research centres can be an effective way to transfer knowledge between them. On the TO level, an industry cooperation has already been set up in the form of the Med-TSO, which is sharing information about best practices and transmission standards in the Mediterranean region. Med-TSO was born in 2011, among France, Spain, Portugal, Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Turkey, Greece, Albany,

Montenegro, Slovenia and Italy, and aims to develop common perspective on the institutional and regulatory frameworks required for a better integration of the systems.

National Renewable energy targets

In addition to the demand for capacity resulting from exports, national renewable energy targets can increase the credibility of signals to the local and the international supply chain.

III. Demonstrate local benefits

Ensuring that initial activities are delivering local benefits and allowing for effective communication of these and future benefits can help to increase interest in co-operation. This can comprise several enabling components:

Producing for local use

Domestic renewable energy projects are firstly beneficial for securing energy supplies locally. Typically, renewable generation is relying on the resource which is cheaper than imported fossil fuels and its development also contributes to economic growth in the country.

Trusted analysis and communication

A trusted analysis about the local benefits and its communication to governments can help to create national interest. In order to be effective, the analysis would have to be perceived as qualified and impartial and needs to illustrate the whole package of cost and benefits for each country not only in terms of the revenues from selling electricity and transmission but also in terms of the impacts along all the other dimensions which matter for policy makers.

IV. Political commitment

The political commitment to renewable energy targets is an important building block that can help to solve a variety of different issues by sending a credible signal of future demand. For potential exporters of desert power, this will also signal national interest in

such a strategy and reduces distrust about future deviations. For the supply chain, an augmented level of confidence increases the case for development of local capacity that would not be warranted for one-off projects. A stronger confidence in growing future demand also increases the case for additional investment in RD&D throughout the supply chain and can thus contribute to lowering the technology costs and foster the national interest.

A credible political commitment to renewable energy targets and trajectories also provides a helpful framing for discussions of individual components of a renewable strategy, to motivate the policies and programs necessary to facilitate grid expansion and project development. The target is thus a reference point for many individual decisions of different government agencies. Binding targets at the national level provides a benchmark against which future governments can be held accountable.

The effectiveness and credibility of such a target can be strengthened with trusted analysis and communication (see previous discussion) and can be enhanced through international renewable remuneration mechanisms.

V. International Agreement

An international agreement can provide a basis for effective cooperation between participating countries, as well as provide a platform for the coordination of policies and investment projects between the participating countries. Again there is an important role for trusted analysis and communication of the underlying benefits for the participating countries.

In order to be effective, an international agreement requires some form of moderation process or an independent mediator for conflict arbitrage. Some options have been discussed.

Indeed, it is in every partner's interest to avoid legal confrontation, and as such, one of the key risk mitigating measures is to foster more dialogue and participation among stakeholders.

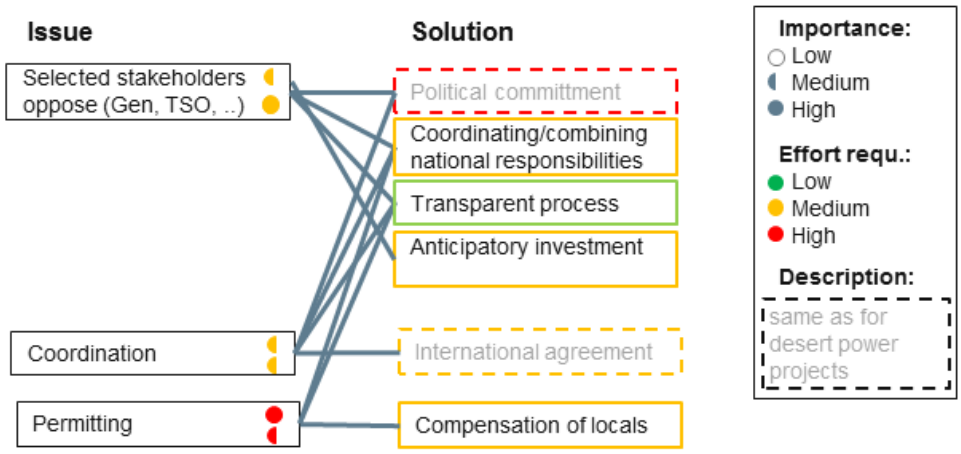
Legal enforcement of international agreements is challenging, therefore reporting requirements can play an important part in its success. Timely reporting on the process,

output and outcome of such an agreement allows stakeholders and the public to track the progress, and can enhance the public commitment to such an agreement.

3.2.2 Interconnection specific aspects

Transmission projects are faced by a number of problems that arise independently of the business model and are also relevant for projects outside EU-MENA. An overview of these transmission specific problems as well as potential solutions and their enabling components is given in Figure 3.10 and explained below.

Figure 3.10 - Generic Issues and solutions for transmission projects.



Issues specific to interconnections

Selected stakeholders opposition

In the case of liberalised neighbouring markets, the reinforcement of interconnections between them leads to a price convergence for consumers and increases the competition between the generators as well as the need for coordination between TSOs. This is less of the case in the MENA region as its markets are not fully liberalised, however we will expect gradual price convergence as a result of connecting MENA electricity sectors with European markets. Convergence typically goes along with price increases in some countries, not welcome by respective consumers, and price reductions in other

countries, not welcome by respective generators. If overall efficiency gains and cost reductions are not sufficient or not well enough communicated, selected consumers or producers may therefore oppose the expansion of transmission grids in order to protect their specific interests.

Coordination

The simultaneous expansion of generation and transmission assets requires some form of coordination in order to ensure a timely delivery of the appropriate scale of transmission capacity. In the past this coordination could often be achieved through an approach often described as “transmission follows generation”. As traditional, large scale, generation projects took several years to develop, it was possible to initiate the necessary transmission investment once generation investment plans had firmed up. Provision of early and credible information to guide the transmission investment was further facilitated through vertical integration between generation and transmission.

For renewable generation projects this approach is less suitable, because they tend to be characterized by shorter project cycles, e.g. can be executed within one to two years, and would then have to wait several years until also the transmission is in place. Due to such temporal dependencies, transmission planning needs to precede respective renewable generation being built.

In the case of larger scale transmission corridors and in particular international interconnectors, the planning and permitting period for transmission is particular lengthy, and therefore it seems particular relevant to revisit the paradigm of transmission follows generation.

In addition to the coordination between transmission and generation capacity, future transmission expansion also needs to be coordinated with the supply chain. For example the market for under-sea HVDC cables is still relatively small. Bottlenecks in the supply chain, e.g. because ships for installing the cables are booked out, may lead to significant delays that can risk the success of the project. For some of the MENA countries bottlenecks in the supply chain may create a significant risk, as most of the components that are needed for the construction will either require the prior development of local production facilities or will need to be imported. MENA countries will need to be as

attractive marketplaces for the technology suppliers as their primary focus markets therefore.

Permitting

The difficulty of obtaining permits for the construction of transmission lines, which is often referred to as the "nimby" (not in my back yard) problem, is one of the major obstacles for grid expansion. Within the EU, this problem has already been studied in detail and a number of suitable solutions have been suggested, e.g. involvement of a consultation with local communities and/or making local public a financial partner in projects (Ragwitz et al., 2007; Roland Berger, 2011b). The EU energy infrastructure guidelines (EC, 2011) provide suggestions for the permitting process and its timelines where applied by EU member states to projects of common interest.

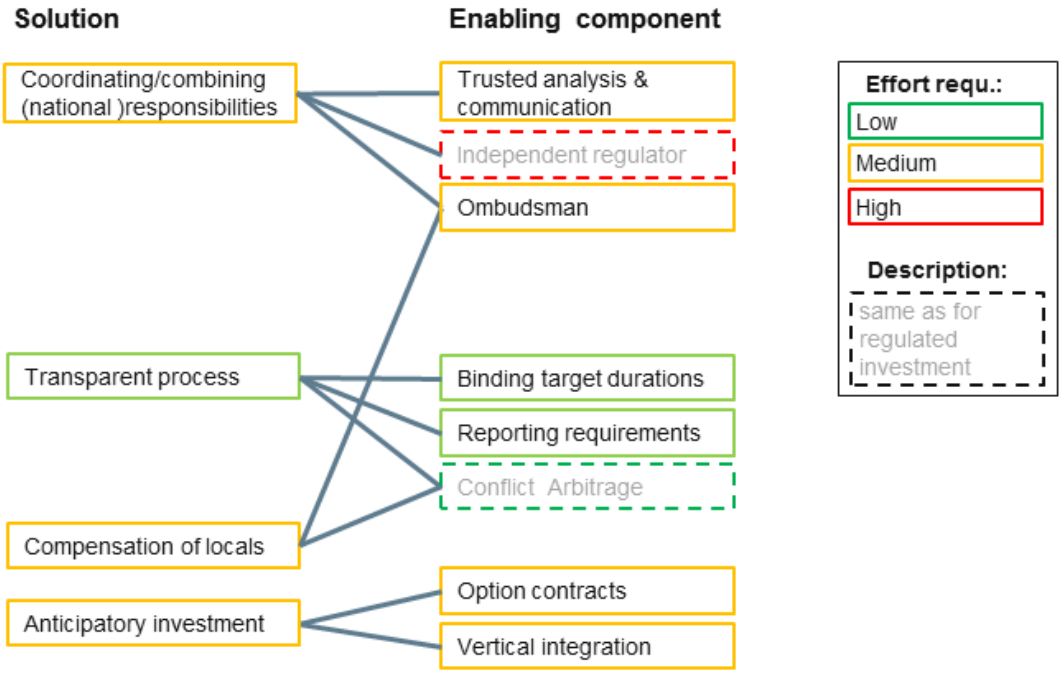
Several transmission projects in our case study were significantly affected by delays in the permitting process due to local opposition. In the most positive case, a recent interconnection between Spain and Portugal, was delayed for three years. In other instances the opposition of local communities or limited interests of neighbouring TSOs in advancing cross-border transmission links significantly delayed investments, e.g. the expansion of interconnection capacity between France and Spain took thirty years to build.

Solutions for interconnection specific issues

The following solutions have been identified to address these issues (see Figure 3.11):

- coordinating/combining (national) responsibilities;
- transparent process;
- compensation of local communities;
- anticipatory investment.

Figure 3.11 - Solutions and enabling components for generic issues of transmission.



I. Coordinating/combining national responsibilities

The designation of one competent authority which "shall be responsible for facilitating and coordinating the permit granting process for projects of common interest" is required by the EU Infrastructure package (Art. 9EC, 2011). Furthermore, where projects are at risk of delay, there is a possibility to "designate a European coordinator for a period of up to one year renewable twice" so as to facilitate also the international coordination (Art. 6 EC, 2011).

Such a designated authority might be more effective in addressing the problems of stakeholder opposition and permitting by providing a platform for the coordinated integration of individual stakeholder concerns into the planning process. It can also help to solve coordination problems by providing a single point of contact for the regulators and project developers in neighbouring countries.

The Mediterranean Energy Regulators Group MEDREG aims to contribute to such a process by facilitating a transparent dialogue among the regulators from the

participating countries[5]. The history of regulatory cooperation among EU countries illustrates that it may be challenging to build on a bottom up approach of regulators if there is insufficient political support (e.g. Germany was very late to implement an independent regulatory authority and thus was less engaged in the regulatory cooperation under e.g. the Florence Forum). In Federal states the creation of a single agency faces the additional challenge to integrate responsibilities from subnational bodies (e.g. Belgium, Germany). In the light that currently several MENA countries have no regulatory authorities or have formed regulatory bodies only with limited powers, future cooperation between MENA regulators will be lengthy in its establishment.

Within individual countries, such a one-stop shop for regulation and permitting has been established in England and Wales, where the Infrastructure Planning Commission is responsible for the whole permitting process, or in the Netherlands, where the Ministry of Economic Affairs, Agriculture and Innovation is a single contact point responsible for the coordination of all the other authorities that are involved in the process (Roland Berger, 2011c).

Within the EU, a coordination between individual member states is achieved through the EIP and the Ten Year Network Development Plan by ENTSO-E, which is compiled from the grid expansion plans by individual national transmission owners and is non-binding in its nature. Following the principles outlined in, EIP, an ad hoc working group composed of the Commission, member states, TSOs and project promoters, regulators, ENTSO-E, ACER and, on ad hoc basis, third countries or external experts (Nabi Siefken, 2012) will select a number of Projects of Common Interest (PCI) which will receive addition funding from the Connecting Europe Facility (CEF). One condition for these projects is that they have to obtain construction permits by national agencies in no longer than 3.5 years (EC, 2011).

Trusted analysis and communication

A set of initiatives can help to improve coordination. Trusted analysis and communication can contribute to a shared vision that can become a reference for all parties. An independent regulator can help to balance individual stakeholder concerns

[5] http://www.medreg-regulators.org/portal/page/portal/MEDREG_HOME/ABOUT

and defend the interest of consumers. While these two points had already been introduced before, additional opportunities created by an ombudsman and transparent processes are now discussed.

Ombudsman

An ombudsman is an authorised central contact point that can help to streamline the decision process by channelling stakeholder requests. This can improve coordination between different stakeholders, both in the phase of designing regulation and during the planning and permitting processes for individual projects.

In the case of the Connecting Europe Facility, the ad-hoc group is offering such a centralized contact point for the concerns and suggestions of independent project developers or other stakeholders. A similar procedure has also been used with some success in the case of the North Sea grids initiative. In the past, the centralized contact point has been successful in facilitating the dialogue and focusing discussions on a technical level.

II. Transparent process

A transparent process can be built on a set of enabling components that will be discussed in detail, including reporting requirements and stakeholder involvement, and requires clear timelines for credibility to all parties. Again clear provisions for mediation or conflict arbitrage that has been previously discussed can strengthen the credibility of a transparent process.

Reporting Requirements

In order to ensure the adherence to target durations for the permitting process, national authorities need to report the duration of permitting decisions which effectively enables early indication of problems. For example in case of the Connecting Europe Facility, developers of all projects of common interest need to submit an annual report regardless of the project status. As another example, in the UK, the chair of the Infrastructure Planning Commission needs to report to Parliament if the permitting procedure for nationally significant infrastructure projects exceeds target duration.

Binding target durations

In order to ensure the uncertainty for project developers and increase the incentives for regulatory authorities to speed up procedures, clear target durations for each of the planning stages can be defined. (Roland Berger, 2011b).

While the agreement of target durations for projects involving many steps and unknowns is difficult, where this is possible, a process which only requires reporting in case of deviations from the schedule could be more efficient because it is saving the need for regular project updates while increasing the disincentive to fall behind the schedule.

III. Compensation of local communities

In some cases, the compensation of communities can help to gain the approval of local authorities. Compensations often involve the construction of public infrastructure such as schools, sport centres or others but could also consist of environmental benefits such as natural reserves. In the case of the interconnection between Morocco and Spain, local authorities agreed to the construction of the interconnector after a total of 3.000 EUR per inhabitant of Tarifa were invested in compensation projects.

Additionally, the MENA region has an experience of formal environmental and social framework assessments by World Bank (World Bank, 2011), which further formalises the process of land acquisition and use with respect to the local communities (e.g. Moroccan Agency for Solar Energy (MASEN) had commissioned such an assessment for the Quarzazate I CSP project). The assessment showed that in this case although land acquisition was a voluntary process, it triggered the "Involuntary Resettlement Policy" which led to a preparation of the Land Acquisition Plan describing the acquisition process and to monitoring of the proceeds to the benefit of the local population.

Apart from compensation through public infrastructure, compensation can be provided through environmental actions, such as reforestation measures or the establishment of a natural reserve in the respective community. In the case of the France-Spain interconnection, for example, the permit was granted in return for the guarantee that

other than for supply local consumption in the Eastern Pyrenees, no further interconnectors would pass through that department (Zapatero and Sarkozy, 2008).

The issue with the compensation however is related to the underlying process for its determination, e.g. is it a "closed doors" decision by government and TSO(s) or an open forum or a voting process among stakeholders for different ways of allocating the funds. The effectiveness of such compensation can be increased, if it is seen to be fair, e.g. negotiated according to the rules of a transparent process, perhaps by a credible independent party (ombudsman), and linked to accepted conflict arbitrage mechanisms.

The Energy Community has been established in 2005 and entered into force in 2006 following two memorandums of understanding: in 2002 and in 2004. It currently comprises the EU and the states of Albania, Bosnia and Herzegovina, Croatia, Macedonia, Moldavia, Montenegro, Serbia, Ukraine and Kosovo as contracting parties, and Armenia, Georgia, Norway and Turkey as observers.

The original purpose of the energy community has been to implement EU regulation in the areas of electricity, gas, environment, competition, renewables, energy efficiency, oil and statistics.

Its organisation is divided into the following five organs: [6]

1. The Ministerial Council, which is the key decision making organ that meets once per year to decide about the rules and regulations for the Energy Community.
2. The Permanent High Level Group, composed of senior officials from contracting parties and two representatives of the EU community which is following up on work from the Ministerial council.
3. The Regulatory Board composed of regulators and EU officials advising the ministerial council in case of technical questions and cross-border disputes.
4. The Fora, where stakeholders from all relevant sectors come together to discuss current questions which will feed into the analysis of the Permanent High Level Group.
5. The secretariat, which is coordinating the day-to-day activities of the Energy Community and monitoring whether contracting parties fulfil their obligations.

Particular factors for the success which have been highlighted by respondents was the permanence and independence of institutions, the enforcement of rules through an arbitration process, the interest of the governments in member countries, the public backing by the EU commission and multi-lateral nature of the treaties.

Since its foundation, the Energy Community has evolved and increasingly started to adapt regulations or develop its own rules in order to accommodate specific circumstances of member countries.

Text Box 4 - Energy Community as an example of an institutional umbrella.

[6] http://www.energy-community.org

IV. Anticipatory investments

To avoid delays or failure of renewable projects due to lack of timely transmission access, regulators or governments can approve and back transmission investment prior to a firm investment decision for a specific generation asset. (Van der Weijde and Hobbs, 2012).

In cases of on-shore wind farms, where the lines are not dedicated to individual projects, national regulators are increasingly approving anticipatory grid expansion to ensure the network expansion can advance in anticipation of future generation projects (see Ofgem, 2012 and German Network Development Plan).

Anticipatory planning could be seen as a 'light' version of anticipatory investment. In the case of the connections for the first two rounds of UK offshore wind projects, the coordination was achieved by initiating planning prior to the tender, and by then allowing developers that were successful in the tender to build the lines which connected their wind-farms to the grid.

In absence of a coordination by the regulatory framework, approaches which are used by private actors in order to solve coordination problems include option contracts and vertical integration.

Option type contracts were used in the in the case of UK offshore wind-farms: the licences for land use needed for connecting the farms to the onshore grid provide an opportunity, but not the obligation, for the developers to build an onshore connection to the offshore wind-park during the time required for its in-depth feasibility studies. Thus if feasibility of the project or financing cannot be secured, the developer is not left with expensive land lease contracts. Such optionality in the land license contracts enables developers to minimize their financial risks of failed or delayed project construction.

Vertical integration can offer another mechanism to allow for anticipatory grid investment, as a vertical integrated entity might initiate the grid investment prior to the generation investment based on internal information about the full project status and internal commitment to the overall delivery. Thus coordination between the construction of wind-turbines and off-shore transmission in the UK has been achieved as both assets were developed within the same consortium. In order to comply with unbundling requirements stemming from the EU Third Energy Market Directive, such

consortium has to divest the line to independent transmission owners after commissioning of line and generation project.

3.2.3 Summary of issues related to transmission

Table 3.2 summarizes the most prominent issues with regard to desert power in general and interconnection specific.

Table 3.2 - Summary of most frequently mentioned concerns by interviewees and in literature.

Frequency of concerns mentioned	Regulated investment	Concession-based invest.	Merchant investment
Desert power related concerns			
Lack of national interest	High		
Building trust between countries	High		
Interconnection specific concerns			
Selected stakeholders oppose	High (MENA) / Medium (EU)		
Co-ordination	Medium		
Permitting	Medium (MENA) / High (EU)		

It is interesting to observe that a set of concerns that need to be addressed that are independent of the business model that is used and in particular also apply to merchant based investments. Thus, the advantage that merchant investment models might offer, avoiding potential obstruction of projects by allowing independent commercial parties to initiate and advance a project, is constrained by a set of concerns that need to be addressed by transmission owners in neighboring jurisdictions and regulators or governments. After all, an interconnector needs be to be integrated with the existing network at both ends of the line. Even where project proponents find initial grid impact studies, the ultimate configuration of the network will remain responsibility of the TSOs. This might explain why merchant based transmission investments, while very prominently represented in the literature and studies, in practice remain very rare.

The summary also shows the importance of a public commitment to a desert power strategy and to network expansion for the export-oriented share has repeatedly emerged in this analysis. This requires that all participating countries need to see benefits of such projects matching their priority objectives like jobs, energy security, or emission mitigation. This can provide confidence that the multiple issues will be addressed by public and private actors.

3.3 Options to match approach to renewable energy remuneration and transmission regulation

In the previous chapters, we have identified a large number of issues and regulatory solutions. However, the importance of these issues is strongly dependent on the design of the renewable energy remuneration mechanisms. In order to unlock the potential of desert power projects, renewable energy remuneration schemes and the rules for transmission investment thus need to be coherently designed to create a clear-cut business case for investors.

In this section, we will provide an in-depth description of three comprehensive packages of renewable energy remuneration and transmission regulation that can be used for this purpose.

In principle, we can classify the policy packages according to the following criteria:

Coverage of RE remuneration: renewable energy or premium

Renewable remuneration schemes can be the only revenue stream for power produced from a renewable plant, in the form of a Feed-in-Tariff (FIT) or a contract awarded in a tender. Alternatively, renewable remuneration mechanisms can provide a complementary revenue stream in addition to the revenues which renewable projects obtain from selling their output in electricity markets. Renewable certificate schemes and feed-in premium provide such additional revenue streams.

Delivery point: landing point in EU, EU country, or EU consumer

Renewable remuneration schemes typically only pay the generators for the energy that is physically delivered to the importing region. The delivery point for the renewable energy remuneration mechanism can either be a specified EU border country, any EU country, or European electricity consumers[7]. This will also impact the responsibility for contracting for (potentially new) transmission capacity within Europe.

Additional policy instruments exist and are further developed to support renewable power projects for local use in the MENA region. (NAMA cooperation, financing remuneration through public banks).

Qualifying location: one specific or several potential MENA countries

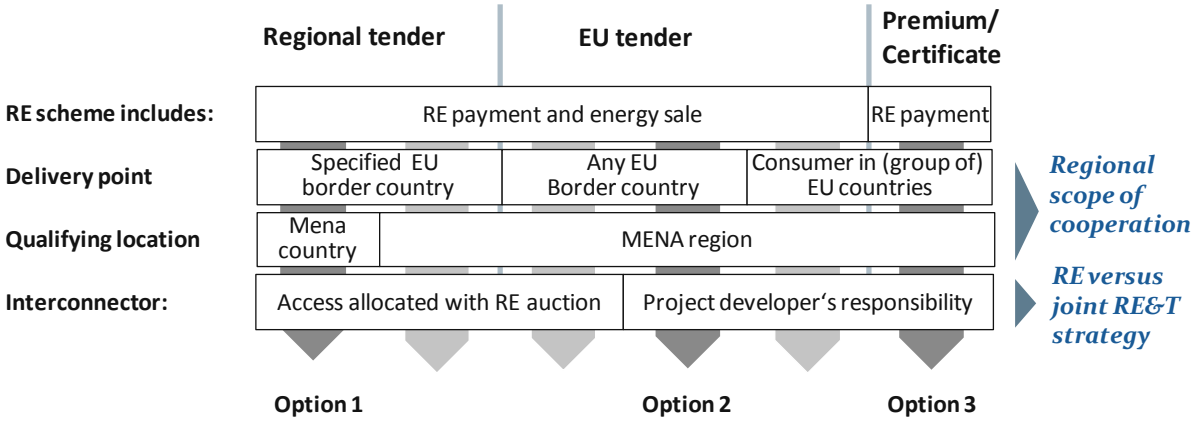
Renewable remuneration mechanisms in Europe can be open to projects in only one specific MENA export country or can allow for competition between projects exporting from different MENA countries.

Development of interconnector – responsibility of project developer?

European renewable remuneration mechanisms had traditionally relieved the project developer from the responsibility for securing grid access, and there is some move to a system of expanding grid capacity in expectation of future RE projects. In this spirit, governments could take the initiative of developing interconnecting capacity to be provided to RE project developers. In contrast, the UK off-shore wind regime allocated the responsibility for the construction of the (relatively short) cable from off-shore turbines to the landing point to the project developer. Equally one could envisage that a developer for an export oriented RE project in the MENA region also has to take responsibility for development or contracting of the necessary MENA-EU interconnector.

[7] In principle one could also envisage renewable remuneration premiums granted to generation that is not exporting power to EU consumers. However, this would be incompatible with the EU RE directive, which requires physical imports to ensure that generation that is supported contributes to an increased renewables share in the EU power mix.

Figure 3.12 - Arrangements for combining renewable remuneration mechanisms and transmission rights.



From the various combinations possible, we select three for a detailed discussion. They are selected as they represent different dimensions of the scope of the cooperation, as well as the RE only versus joint RE, and Transmission strategy:

Option 1: Regional tender - interconnector constructed by EU and MENA countries

An EU country or a group of EU countries run a tender for imports of RE from a specific MENA country to a Mediterranean EU country, which is in alignment with the Art. 9 (EC, 2009). Winning bidders commit to deliver RE from a new project e.g. by a specified technology (wind, solar, concentrated solar) in the MENA region and will obtain a specified price per MWh delivered. In parallel, the participating EU and MENA countries coordinate on the construction of an interconnector typically in either a regulated TSO or concession-based approach. Long-term transmission rights for the interconnector are allocated to the winning bidders of the RE tender on a cost basis.

Option 2: EU tender – project developer responsibility for constructing or contracting interconnector

A group of, or all EU countries, run a tender for imports of RE from the MENA region. The winning bidders commit to deliver RE from a specified technology to one of the participating Mediterranean EU countries and will receive a price that has been determined in the tender for every MWh delivered. It is in the responsibility of winning bidders to secure or develop transmission to deliver the energy to the EU shore. Without

a priory government commitment to such an interconnector this would likely involve a merchant based approach.

Option 3: EU premium – project developer responsibility for constructing or contracting interconnector

We assume that EU countries jointly implement a system that grants a premium payment for all renewable energy. Such a premium would also require delivery of the renewable energy to the shore of an EU country and thus allocate responsibility for securing transmission to project developers. In contrast to the EU tender, the premium system allocates responsibility of selling the produced power to the project developer. This will likely require that the project developer finds a counter party that signs a long-term power purchasing agreement of sufficient duration to facilitate financing of the RE project. If the counter-party is not located next to the landing point, it will also require that the RE project developer acquires corresponding transmission contracts. Without a prior government commitment to such an interconnector this would likely involve a merchant based approach.

For each of the packages there are a number of critical points that need to be addressed by transmission regulation which will be described in the following sections.

3.3.1 Cross-cutting topics for all options

All of the three options which we discuss will need to address the role of long-term contracts to back the transmission and generation investment, the framework for an efficient use of the interconnector beyond the flows anticipated for exports from contracted plants and the issues relating to concerns on carbon leakage.

Long-term contracts

Merchant generation investments outside liberalized markets (and frequently RE generation investments in liberalised markets) are usually backed by long-term energy off-take contracts, so called power purchasing agreements. Similarly, interview partners

in the MENA region also reported that they anticipate new RE plant investments expect RE plant investment to take place with such contracts.

Long-term contracts for the interconnection provide RE project developers with the confidence that they can access the interconnector to deliver to the EU and capture both energy and renewable remuneration payments. Similarly, the stability of revenue is attractive for investors in the interconnector. Thus, in the case of regulated or concession based investment, the costs for consumers of regulated TSO in neighbouring countries are avoided. In the case of merchant interconnections the investor benefits from more stable revenue streams.

Arguably, if a RE plant in the MENA region could secure firm transmission access to the EU market, it could sell power on shorter term arrangements. However, given uncertain developments on fuel and carbon prices as well as deployment volumes both within Europe and from imports, power price projections are very uncertain. Project investors therefore have to anticipate low energy prices for the calculations of revenue streams they need to secure debt financing. As a result, investors can use only a small share of debt and need to primarily rely on equity to finance their investment. In the presence of technology, regulatory and sovereign risks, the return requirements and therefore cost of equity is very high. Thus, financing costs would be extremely high, increasing the level of necessary renewable support to ensure break even. Both the high returns observed and the high costs put the sustainability of political support at risk and thus further increasing their risk profile.

Hence we assume, as base case across all options presented in this chapter, that RE projects are backed by long-term energy off-take contracts. For options 1 and 2, the contracts are of similar nature to the provisions offered for RE energy projects under tender or feed-in approaches across most European countries. In option 3, the long-term contract is assumed to be signed directly with power consumers, similar to the contractual provisions between large industrial users and the investor group into the Finnish nuclear plant. In the Finnish case the counter party risk inherent in such a long-term contract is reduced as the industrial consumers that anticipate acquiring power from the nuclear power station also own shares in the project.

We equally assume that for all the options presented in this chapter, there will need to be some form of arrangement to provide long-term guarantees to transmission access

matching the energy off-take contracts. However, the design of these guarantees will deviate across different options and is therefore discussed in the corresponding sections.
If all generation assets require individually firm access to the interconnector, then the diversification effect of the portfolio is not captured. The time profile of wind production various across locations and differs significantly with the production profile of solar energy. Thus investors might consider the development of a portfolio of wind and solar plants exceeding the capacity for which they can secure access to the interconnector with the perspective of also selling to the national market.
The central role of long-term contracts did raise some concerns in discussions with stakeholders. After all, prevailing long-term contracts were one of the main obstacles for the introduction of competition in Europe. In particular long-term contracts of small generators with incumbent utilities strengthened the dominant position of incumbent utilities and long-term physical access rights to international interconnectors restricted the interconnector capacity available to increase competition between countries.
Hence, the use of long-term contracts requires a case by case approval of the EU commission. The prevailing case law offers some comfort that such exemption will be granted. Additional support for such an exemption can be linked to the energy strategy nature of the project. In a resolution from 12 June 2012, the European Parliament "considers the conclusion with our strategic trade partners of long-term energy and raw materials supply contracts at fair prices to be one of the top priorities; calls, therefore, for the EU to adopt a coherent strategy with regard to energy supply contracts with these partners" (European Parliament, 2012).

Efficient use of interconnector

The contribution of interconnectors to total welfare increases with the efficiency of their use. Therefore, within the EU, merchant TOs are subject to regulated third party access to enhance competition (Cuomo and Glachant, 2012). However, merchant transmission projects will only be pursued, if the merchant investor can capture a sufficient share of the value created by the interconnector. Thus, in certain circumstances the EU commission can grant merchant investors an exemption from third party access in order to increase the possibility of rent extraction. Such exemptions from the duty to provide access to third parties have been granted to EstLink (FI/EST), BritNed (UK/NL), East-

West Cable (UK-IE) and Arnoldstein/Tarvisio (AT/IT) (http://ec.europa.eu/energy/infrastructure/exemptions/doc/exemption_decisions.pdf).

The exemptions may also apply to the situation with the EU-MENA interconnectors. RE project developers, acquiring the long-term transmission contracts, have the primary interest to deliver power to the EU markets and to secure the ability to do so. Hence it is not against their interest to implement effective "use-it-or-lose it" provisions for the transmission capacity.

On an efficiently operated interconnector the flow pattern can vary from the long-term contractual position. For example, if current generation capacity shortages prevail, MENA countries might use the additional interconnection capacity to import power from EU countries. In this case, flows might be scheduled to export RE energy to the EU, while simultaneously flows are scheduled to import EU power into the MENA country. Thus, the physical net flow would be zero. If the RE energy exporters can make a firm commitment to their export flows, then this would allow to double the imports into the MENA country (once backed by the RE export, once by the physical capacity on the line).

This example illustrates a feature of energy markets: the physical flows implied by commercial transactions can cancel each other, such that the volume of commercial transactions can exceed the volume of physical flows. This is desirable in the specific case of an EU-MENA interconnector for at least two reasons:

1. The commercial transaction (the long-term energy export contract) facilitates financing of the RE plant. Furthermore the physical delivery of the energy to the EU has been required in the current EU RE Directive (Art. 9) to ensure the development of the overall system.

2. The effective use of the interconnector can address short-term energy availability concerns in the MENA region. This might reduce the need to implement quick fixes with low-cost and inefficient fossil plants, and can thus provide time to implement longer-term solutions, preferably based on RE technologies at further reduced costs in the future.

Thus, the deviation of commercial and physical flows is in the interest of the EU, of MENA countries and of the environmental strategy and increases the value of the interconnector and the interest of all partiers for cooperation. This also creates the basis for increasing the scale of cooperation in the longer-term.

The energy system scenarios developed by DII show that in the longer-term also physical flows will deliver energy from the MENA region to Europe (DII, 2012). The generation capacity invested in the MENA region with the expectation of exporting will however exceed a cost efficient choice of interconnection capacity.

Assuming a generation mix of wind, solar PV, and solar CSP, in the MENA region, every 1GW of additional export oriented generation capacity would be matched with 0.6GW of interconnection capacity. As a result, during 40% of the time some of the renewable production cannot be transferred to the EU because production exceeds the interconnection capacity. This will have to be reflected in the design of new transmission contracts (see section 0).

Carbon leakage

The construction of interconnectors between MENA and EU raises concerns of carbon leakage: assuming an increasing carbon price and thus increasing cost of fossil power generation within the EU, production from fossil power plants in the MENA region could be increased or even expanded for exports to the EU. We currently lack a detailed assessment to quantify the materiality of the concerns. Several options to address the concern could be explored in more detail:

1. Approval for long-term contracts for transmission on the interconnector can be conditioned on their use to finance RE projects. Without access to such long-term contracts, it is difficult to finance the construction of new fossil plants in the MENA region;
2. All importers of power into the EU could be requested to submit CO2 allowances for the carbon emissions associated with power production. Such an approach has been implemented in California for power imports from neighbouring states. If importers do not demonstrate evidence for the carbon intensity of the power

plant where the power has been sourced, then a default emission rate of a coal power station is assumed (http://arb.ca.gov/cc/capandtrade/capandtrade.htm);

3. It is suggested that renewable energy producers could obtain priority access to the interconnector. However, if renewable projects that were initially constructed to meet local demand, and potentially even obtained international support through CDM or finance from public banks, are encouraged to export their power based on preferential priority access conditions on the interconnector, then the local demand they would have otherwise served can be captured by fossil producers. Thus priority access provision for exports from a market might me less suitable to address carbon leakage concerns.

Obviously any such intervention has to be carefully designed and possibly agreed upon in international process, so as to ensure they avoid any undue discrimination and concerns about protectionism.

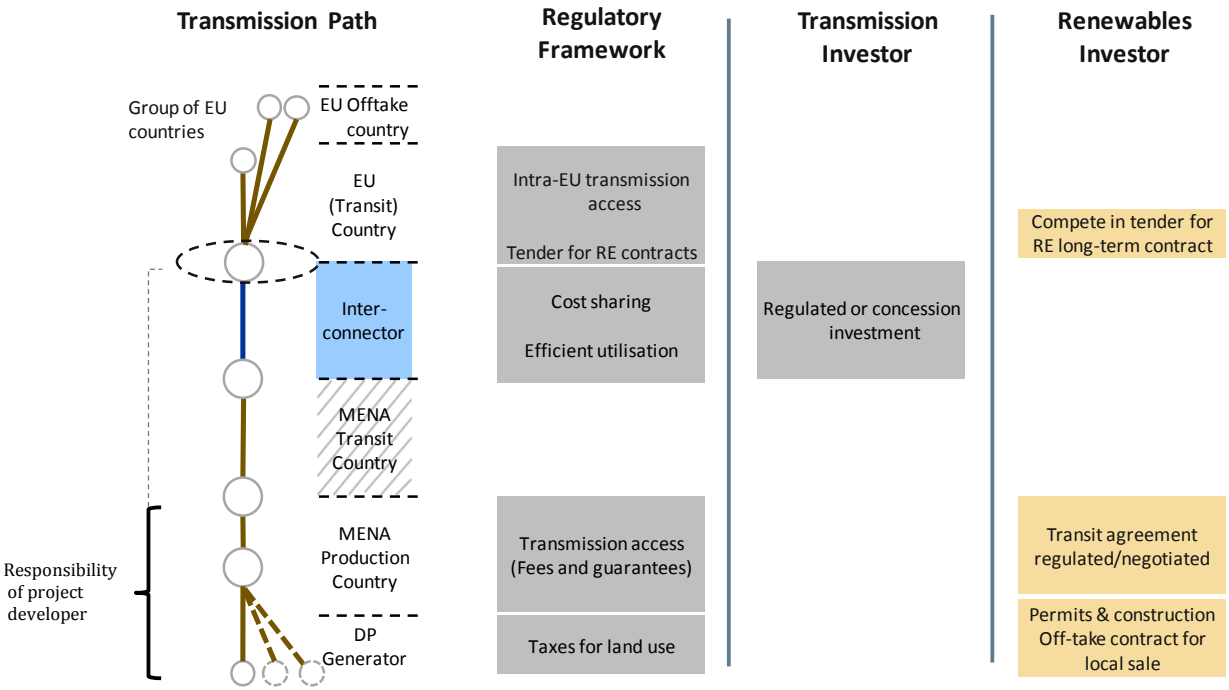
A recent example from Egypt cement production illustrates that a carefully designed intervention that addresses risks of leakage created by unilateral carbon prices can be of interest not only for the countries with the carbon price. With increasing European willingness to pay for cement, also linked to carbon prices, an increasing share of the Egyptian cement production had been exported prior to 2007. This in turn increased costs of cement for local construction with negative impact for Egyptian consumers. In response the Egyptian government implemented in early 2007 an export tax of 11 $ per ton of cement which corresponds thus increasing the price of exported cement by about a third and thus scaled back the exports (Hourcade et al., 2007).

Option 1: Regional tender

In this section, we will provide a detailed description of the regulatory framework for transmission investment for the option of a regional tender for renewable energy.

An overview of the critical points along the transmission path that need to be addressed by the regulatory framework (grey boxes) or by private renewable investors (yellow boxes) is shown in figure 3.13.

Figure 3.13 - Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of a regional tender.



Renewable Investors

Project developers are competing for projects in one MENA country. Prior to the regional tender they need to secure options for sites, technology and financing, and need to agree on transmission within the MENA country. The project developers that can offer the lowest price/MWh for energy delivered in the tender will obtain a twenty year energy off-take contract and transmission rights for the interconnector to deliver the power to EU shore. To ensure timely delivery, the project developers have to post collateral at the time of the tender and winning bidders are liable for penalties in case of project delays.

Where projects envisage delivering power both for local use and export, the project developers need to secure off-take contracts for local sale prior to the tender for international sales. If local and international sales are linked, the project developer might otherwise be in a weak negotiation position for the discussion of the local off-take contract.

Regulatory framework – Local taxes and transmission access MENA

All RE projects competing in the tender require grid access and are subject to the taxes and grid tariffs in a single MENA country. As all tender participants are subject to these provisions, they implied costs will be added by all tender participants to the bid and the respective MENA country faces no incentives to reduce the implied costs. Therefore they need to be agreed prior to the tender between EU countries and the MENA country that will host the projects to balance the interests of EU and MENA consumers and citizens.

MEDREG has planned an initiative to promote and develop the regional tender approach (which is also referred to as "corridor approach" by MEDREG) which among other aspects will focus on harmonisation of national regulations for the access to the networks and power exchanges, including the possibility to develop merchant lines. It will also aim to develop a common approach and decision tools to assess profitability of transmission infrastructures.

With regard to the transmission tariff level within the MENA country, if they are set below long-run costs of transmission investment within the MENA country, then MENA consumers would subsidise power exports. This seems unfair, and could trigger future changes to the tariff level and thus create regulatory uncertainty complicating financing. If tariffs are set above long-run costs of transmission investments, then EU importers subsidise the MENA power system reducing attractiveness of such cooperation and public acceptance. It is therefore advisable that transmission tariff levels are linked to long-run marginal costs for transmission investment and fixed (for e.g. 20 years). In the UK a methodology was developed to calculate transmission tariffs according to this principle (DC loadflow (DCLF) ICRP Transport Model, www.nationalgrid.com/uk/Electricity/Charges/transportmodel/).

With regard to national taxes and regulation, again a balance needs to be found and agreed between the MENA country and the EU countries organizing the tender prior to the tender process and grid construction. This will include a specification of the expectations on local input enabled with technology assistance or local labour or content requirements and taxes charged for the projects. This cooperation can be reinforced with clear transparency guidelines and with the regional or global transparency institution development (as e.g. in http://www.publishwhatyoupay.org/).

Thus, project developers can develop robust proposals and MENA countries are confident about the local benefit and will advance the cooperation.

Regulatory framework for interconnector

The EU framework for such an interconnector is a project of common interest (PCI). A proposal is submitted to the Ten Year Network Development Plan (TYNDP) and evaluated by ENTSO-e and ultimately by the European Commission. The plans, and thus also the list of PCIs are updated every two years. In 2012 three EU-MENA interconnectors have been proposed as PCI, but at least one was not short-listed by the European Commission, arguably because the state of the project development had not been sufficiently advanced. However, without regulatory backing, it might be difficult to further advance such a project proposal, pointing to the importance of public backing already at such an early stage.

As the PCI process builds on the EU infrastructure package and the 3rd Energy Package initiating the TYNDP, it focuses on EU member states. Therefore, additional mechanisms need to be developed to ensure coordination with third countries. In principle they can be listed as project proponents. This raises the question of whether MENA countries would also accept that ACER, the agency of coordination of European Energy Regulators, acts as arbitrage body as envisaged in the infrastructure package, to resolve for example issues of cost allocation if they cannot be adequately addressed among the project proponents.

Once a project has been agreed, in principle the easiest approach for its implementation would be through the TSOs in neighbouring countries as a regulated investment. With the backing of national regulators and governments, national TSOs in the Mediterranean EU country and MENA country can plan and finance the interconnector. Typically the ownership is split according to the financing contributions. This can be modelled on existing examples, e.g. Spain-Morocco or the envisaged interconnector Italy-Montenegro. The revenue from transmission use (e.g. sale of long-term contracts) would also be allocated in proportion to the financing contribution.

If the national TSOs do not attribute sufficiently high priority to the project, given other demands on their project execution and financing capacity, then the project can instead be pursued in a concession based approach. There are several options that may be

applicable that range from capital investments provided by the third parties to the construction, ownership and operatorship by the third party.

The regulators or administration of the countries adjacent to the interconnector would tender for the construction of the line in exchange of a long-term revenue guarantee. As the neighbouring TSOs have initially declined an interest in pursuing the line as a regulated investment, they and their affiliates could be excluded from the tender for the concession. This would reduce information asymmetry between the TSO and other participating bidders that might otherwise preclude participation or aggressive bidding by other project developers. It also reduces the potential disincentive for a TSO to pursue a line as regulated investment so as to take it forward under other contractual arrangements. The project of developing on-shore wind parks in Ireland for power export to the UK (http://www.greenwire.ie) envisages the development of transmission in such a concession based approach. If in the longer-term an independent ISO is evolving, then it could facilitate the coordination of planning and operation of network assets owned by multiple entities and the differences between regulated and concession based approach might be further reduced.

The inherently international nature of interconnectors could pose additional regulatory challenges, sometimes referred to as regulatory gap. It has been argued that some national regulatory frameworks do not allow TSOs to pursue regulated investment in transmission lines outside of their own and international territory. This applies according to ECRB (2010) e.g. to some EU countries and according to an interview comment to at least one MENA country. In this case the national TSO would have to pursue the transmission investment. If the investment is however only beneficial for third countries, then there seems to be little rational why a national regulator should approve such an investment. However, if instead projects are to be pursued by third parties, they would require access to information and decide on grid aspects, a prospect likely to be opposed by local utilities. Various options to address these potential problems seem in principle suitable, but would have to be explored for any specific instance, including (i) directly refining the relevant regulatory provision that limits such investment (ii) development of a joint project thus ensuring that joint ownership avoids concerns about territorial issues and cost sharing ensures the beneficiaries will also pay

for the line (iii) use of alternative business models like concession based or merchant approaches.

Regulatory framework – Design of the regional tender

One, or a few EU countries, jointly tender for RE imports to Europe. Prior to the tender they specify the amount of energy, the technology mix and the contract duration for energy imports to be tendered.

The design needs to carefully consider the constraints imposed by EU state aid rules (see state aid discussion in Johnston et al., 2008). Possibly the international energy security nature of the relationship, or the specific innovation policy dimension of CSP could provide additional justifications and thus design flexibility.

The energy tendered for at EU shore then needs to be delivered to final consumers in EU countries. To the extent that power has been tendered in Northern European countries, it will likely require that the corresponding energy is delivered to consumers in the respective Northern European countries. This increases the value for these consumers with regard to energy price stability and energy security. At the same time it reduces concern in a country like Spain, that providing transit capacity reduces the ability to use available export on the Spanish-French interconnector to export power from Spanish renewable energy projects and thus reduces the ability to advance Spanish investment projects to create local jobs. In the longer-term, this requires linking larger scale import projects with corresponding transmission expansions within the EU, for example within the 10 year network development plan of ENTSO-e.

The situation in Italy has been historically different. For the last decades significant power imports result in persistent transmission flows from the North to the South. Thus any power that is inserted into the system for export to the North, will initially help to balance this flow pattern and would thus not induce additional congestion or cost.

It is however currently difficult to secure access to intra-EU transmission for periods exceeding one year. If this continues to be the case, two options remain:

1. governments could obtain the transmission rights at an uncertain price in annual auctions or shorter-term markets and socialize the risk and benefits through transmission tariffs.

2. governments could negotiate with the TSOs of the transit country that they would receive part of the congestion revenues resulting from the renewable energy imports in exchange for a contribution to network costs.

Lastly, for international export, transmission access and fees are also negotiated by project developers but supported with a Letter of Understanding (LOU) or framework agreement between the MENA country and the EU countries tendering for RE imports. Public actors in EU-MENA take responsibility for both the interconnection investment and a tender for RE imports into the EU.

Summary (option 1)

The approach does require a significant level of coordination to be delivered by public actors including the implementation of a regional tender, grid expansion, and some level of framework agreement between the importing EU countries and the MENA country hosting the RE projects. The coordination could in principle be embedded within the process of National Renewable Energy Action plans that are submitted by EU member states to the EU commission and comprise plans on RE deployment trajectories and the provision of enabling environments including grid and planning. Alternatively, a dedicated person or institution could be tasked with facilitating the coordination. As part of the North Seas Grid Initiative the EU Commission appointed an EU Coordinator to identify and address concerns for the successful development.

Thus the approach will likely depend on the initial success of semi-public initiatives to advance the project idea and framework with subsequent sign up at the political level in both EU and MENA countries. It has the benefit that requirements on the further development of coordination and local regulatory functions are comparatively limited and that the resulting regulatory framework can support investments based on established business models with limited complexity.

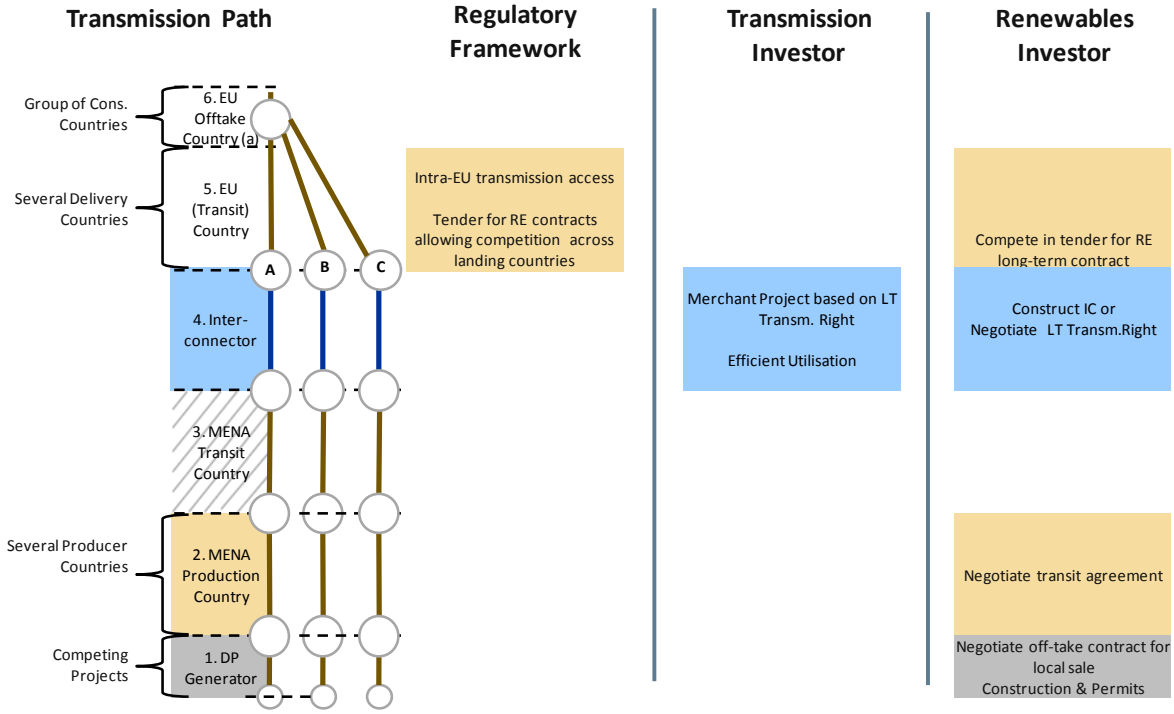
Option 2: EU Tender

The case of an EU tender for RE energy imports differs from the regional tender described in option 1, as projects in multiple MENA can participate in the tender, and the power can be delivered to several EU landing points. This also implies that the

responsibility of securing of the interconnection is shifted from the public to the RE investors and thus may be more adequately pursued according to the merchant based approach.

Figure 3.14 illustrates that, as a result, responsibility shifts from the regulatory framework towards the renewable investor. The following discussion in this section focuses on differences to the previously described regional tender.

Figure 3.14 - Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of an EU tender.



In contrast to a regional tender, in the case of an EU tender a number of different export countries are eligible and might in principle be competing with each other on transmission tariffs and provisions for land-use they can offer RE project investors. If there is suitable regulation in place and sufficient experience with renewable export projects, the negotiation of off-take contracts for local sale, taxes for land-use and transit agreements could thus be left to RE developers. Gobney (2012) points to the value of aligning regulatory and policy frameworks across the MENA regions through

harmonisation of the arrangements for system operation and tariff methodologies and deepening energy sector reforms and establishing internal power markets.

In contrast to the regional tender, in case of an EU tender, the winning bidders need to secure access to interconnector. They either have to develop such an interconnector on their own, or secure capacity on a merchant interconnector developed by a third party. Approaches that had previously been used to facilitate the development of merchant interconnectors have been earlier described.

A high level of coordination effort has to be shouldered by the RE project developer. Prior to the EU tender, the developer has to sign option contracts for RE technology, options on land use and transmission access in the MENA region and options for access to an interconnector. Therefore, a merchant transmission developer also needs to put in place contracts for grid access in the neighbouring countries, secure planning consent, secure options for the DC converters and line, and secure options for the financing of the project. The synchronicity that is required seems challenging, given the nature of the various public institutions that need to provide credible assurance for their approval, and given the scarcity in production capacity for DC cables and CSP plants.

The design of the EU tender varies in two aspects from the regional tender. Firstly, no transmission rights are allocated to the winning bidder. Secondly, project developers with offers to deliver power to different landing points are competing. And thirdly, the countries in the MENA region are also seen as competing for hosting projects that are participating. The clearing algorithm for the tender needs to correct for the different value of electricity delivered to different landing points. For example, if power is delivered to Southern Spain, then additional on-shore transmission expansion costs for delivery to Northern Europe are significantly higher than if the power is delivered to a landing point in Southern France and thus requires less transmission expansion within continental Europe. This suggests that the bids in the tender should be adjusted by an estimate of long-run marginal costs for grid expansion that would be required at each connection point (see http://www.nationalgrid.com/uk/Electricity/Charges/transportmodel for an example of the possible methodology).

Summary (option 2)

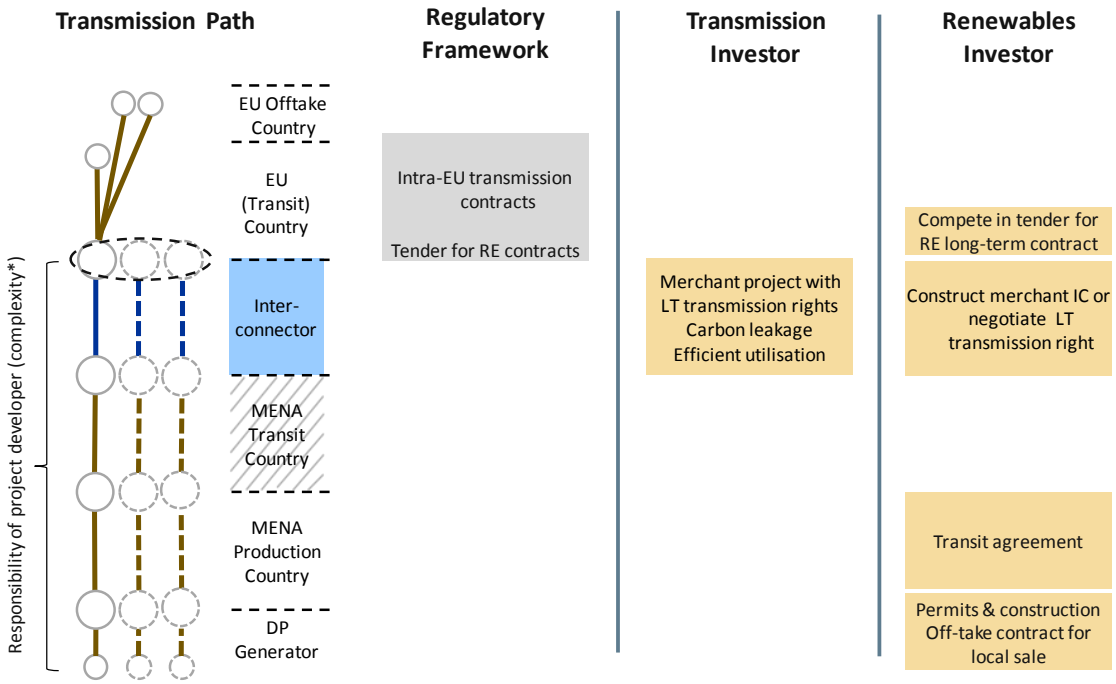
The approach requires strong coordination across several EU and MENA countries to implement a regulatory framework that can support the broader tender and merchant based investment. This might be more suitable in a mid-term perspective as scale and frequency of investments increases and the governments want to limit their involvement in decisions in transmission and generation strategies.

Option 3: EU premium or quota system

Option 3 involving a European premium or quota system to remunerate RE differs in two main aspects from an EU tender approach. First, the RE project developers do need to secure off-take contracts for the energy they will produce including transmission contracts if the counter party is in a different pricing area from the landing point of the interconnector. Second, the requirement to put in place all commercial and administrative arrangements prior to the EU tender is relaxed as qualification for the quota or premium is not linked to auction deadlines but to continued availability of the remuneration mechanism.

Figure 3.15 illustrates that by comparison to the other packages, an EU premium or quota system allocates most responsibility to renewable and transmission investors.

Figure 3.15 - Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of an EU premium.



In the same way as for an EU-wide tender, in the case of an EU premium or certificate system, a number of different export countries are eligible and competing with each other on transmission tariffs and taxes for land use. If there is an advanced regulatory framework and sufficient experience with renewable export projects, the negotiation of off-take contracts for local sale, taxes for land use and transit agreements could thus be left to generators without further support by the regulatory framework.

Again, in the same way as for EU tenders, project developers could construct a merchant interconnector. Although the financial closure does not have to be aligned with an auction, the timing for the construction of interconnectors and power plant still needs to be aligned.

Different from a regional tender or the EU tender, an EU premium or certificate scheme would only pay for a top-up to energy market revenues. Project developers would thus till have to sign off-take contracts for their energy in the EU and obtain intra-EU transmission contracts from the landing point until the target destination. This would depend on significant further development of EU congestion management approaches. In absence of long-term transmission rights, RE project developers will have to find

counter parties for the imported energy in the price zone of the landing point of the interconnector.

Summary (option 3)

The approach requires the development of EU and MENA market framework and the development of trust in quality and continuity of decisions of the regulatory structures in participating countries that will determine the future revenue streams to remunerate the necessary investment. This suggests that option 3 is more suitable after experience and trust have been gathered with other, less ambitious, regulatory and market structures.

3.3.2 Criteria to compare options

In order to compare the policy packages, we will use the following criteria:

Criteria A: Coordination and timing

In option 1, public actors have to coordinate the cooperation between selected EU countries and a MENA country to advance and time both transmission investment and the RE tender. The allocation of costs for the interconnector can be particularly challenging but should be viable if linked to long-term contracts acquired by RE importers.

In option 2 and 3, private project developers have to coordinate planning, permitting for RE project and transmission line, and transmission access in addition to the investment in new generation and transmission technology across multiple jurisdictions. In option 2, the project development has to furthermore match the timing of the EU tender, while in option 3 additional coordination is required to ensure access to EU transmission rights and secure energy buyers.

The high level of coordination with multiple public agencies required in options 2 and 3 can be a challenge for project developers. If clear standards and procedures are established for the planning, permitting, transmission, access etc., then options 2 and 3 offer to project developers the advantage of more control over the dimensions relevant for overall project success.

Conclusion: Coordination requirements for private investors are reduced if governments or regulators take responsibility for energy transmission and off-take in the EU (option 1 and 2) and responsibility for the development of the interconnector (option 1). This can help project developers to gather experience in the still challenging commercial and technological environment. As experience and scale of activity increases, the additional coordination requirements of option 2 and 3 will be easier to tackle.

Criteria B: Initiative

Multiple challenges have been identified in this study for international exchange and local use of renewable energy in EU-MENA. This raises the question which of the discussed options is most likely to encourage actors to take the necessary initiative to address the issues.

Often, public actors are argued to be less active than private actors that might be driven by social, environmental or profit motives. However, the social and environmental objectives can initiate action in each option. As the investment in RE generation is pursued by private, profit oriented, investors in all three options, this motive is also present in all three options.

Project developers responsible for most of the activities in option 3 might however respond stronger to the profit motive than a regulator, and thus might be more successful in advancing a transmission line. However, also a project developer with the ambition to advance a merchant line for the power transmission will have to engage with the same public actors to obtain support for planning, permitting and grid access.

Conclusion: Public and private initiatives are essential and not a strong differentiating factor between the options.

Criteria C: Competition

All options provide for competition between RE projects for the market. In option 1, projects in one MENA country compete in a RE tender, in option 2 projects from several MENA countries compete in one regional tender, and in option 3 renewable projects in MENA countries can compete with renewable projects in the EU.

All options also allow for competition in transmission investment. In option 1, the interconnector is either constructed based on a competitive tender for a concession, or if constructed by a regulated TSO typically the components are acquired in competitive procurement processes. In option 2 and 3, the interconnector is constructed by a merchant transmission investor.

As coordination requirements and risk exposure in option 1 are smaller, more project developers have the capacity to participate. The lower entry requirements are likely to translate into a higher level of competition.

As the number of RE export projects increases, the emphasis shifts from successfully delivering a project in the presence of challenging technology, financing, and regulatory environment to enhancing the efficiency of system design. Also, with increasing number and scale of projects, generation and interconnection projects might become increasingly decoupled.

In option 2 and 3, the number of eligible export countries increases, which is likely to increase the competition between them, resulting in a pressure on transit fees and land use charges.

Conclusion: option 1 might offer the highest level of competition for RE project while the overall number of projects is still low. In the longer-term, if the scale of EU-MENA energy cooperation and number of RE and transmission projects increases, the matching between generation and transmission projects is less challenging, and therefore also options 2 and 3 may provide for a competitive environment.

Criteria D: Access to capital and financing costs

The dominant cost share of wind and solar projects are up-front investment costs. Therefore access to capital to finance the investments, and cost to access are central for execution and competitiveness of RE projects. They are primarily influenced by the investment risk.

Renewable Energy project development and operation risk remain under all three options with the project developer. Interruption of transmission access in the MENA region or unexpected tariff increases constitute a key risk in all three scenarios.

The risk profiles of the options differ at the EU end. In option 1 and 2 publicly secured off-take contract at the landing point should in principle eliminate all risks. In option 3 additional risks are embedded in the long-term sales contract to European consumers (counter party risk) and the additional complexity created by the need to contract for transmission on EU network.

There might be additional differences with respect to the risk embedded in the long-term transmission contract for the interconnector that is assumed for all three cases. The recent discussion on German off-shore wind parks has demonstrated the importance of provisions for the case of interconnector failures. As the technology and delivery risks are still difficult to assess, risk sharing agreements for the case of long-term downtimes had been considered essential. Such guarantees could also be necessary where interconnection projects are an essential component of RE financing schemes and could be more easily integrated with option 1.

Conclusion: in the current market environment, options 1 and 2 provide long-term stable revenue streams and thus facilitate access to lower cost finance which translates to lower costs for consumers. The differences will reduce as energy technology mix stabilizes and thus the value of energy delivered can be better projected.

The analysis suggests, that for the initial RE projects with EU export component, a transmission and renewable remuneration framework as outlined in option 1 is most effective in addressing coordination requirements, ensuring competition, and facilitating access to low cost finance.

In the longer-term, this choice can be re-evaluated. In principle, option 1 can remain a viable option. If the number and scale of export oriented RE project increases in the MENA region and continues to be closely linked to interconnection projects, option 2 could also become a viable option. If the state of energy markets in EU and MENA increase predictability of future power prices, option 3 can also become viable. In all cases, the efficient utilisation of interconnection assets is possible. Currently, this requires appropriate administrative procedures but if markets on both sides are liberalized, the line needs to be integrated in the market arrangements. This needs to be

anticipated in regulatory approval process for merchant lines and contracts with concession projects.

CONCLUDING REMARKS

According to the European Union guidelines aimed at overcoming the present global economic crisis, the purpose of this work is to investigate and highlight some policy suggestions to support the entrepreneurial level of the European countries, with a special focus on the electric market.

Recalling Horizon 2020, this contribution deepens the debate on the following three objectives:

- ✓ rise the entrepreneurial level through innovative opportunities exploited by new SMEs;
- ✓ foster clean energy production and transmission;
- ✓ encourage the cooperation among countries, mainly with developing ones, to reach at the same time their economic growth and the increasing EU competitiveness through the reduction of production costs.

This framework allows us to identify key aspects concerning opportunity recognition process in general and to give some specific insights on electricity, particularly about the interconnection issues.

First of all, regardless the origin of the entrepreneurial career, would it be internally or externally stimulated, the process who leads to the detection of a profitable opportunity is generally pushed by a deliberate search. Fortuitous discoveries happen but, in any case, the individual needs to be equipped to catch them. This process of recognition is fostered by education, work experience, experiences abroad and by some crucial behavioral features that should be already stimulated during the school period. Moreover, such preparation needs to be incremented and tested together with other people in networks and teams.

In detail:

- a high degree of education (master degree or more) is important, not just for the knowledge corridor acquired, but mostly for the ability to manage complex situations and to dialogue with technology;

- some personal traits play a relevant role in the opportunity recognition process, such as awareness, need for achievement, creativity, self-confidence, ambiguity tolerance and risk perception;
- many and diverse work experiences (prior knowledge) indicate that information gathered through a rich and varied life experience can be a major "plus" for entrepreneurs in terms of recognizing potentially profitable opportunities;
- networks are very relevant, the more they are the better it is and, as a consequence, working in teams is desirable;
- many entrepreneurs are organizing and not innovating individuals. It is important to share the idea that absolute innovation is not the only source of entrepreneurship, but also small changes or new combinations in production factors are enough to start a new business.

The competitiveness of an economic system heavily depends upon the qualities of its human capital, and one of the most relevant among them is certainly the enterprising attitude of people. Our respondents are surely enterprising people and we have tried to highlight their main traits and the impact of some environmental aspects on their decision to start a new venture. In general, it is important to underline that there is a concern about how people consider the entrepreneurial career. The risk associated with entrepreneurship is perceived by many as too high; as to this perception, a better knowledge of entrepreneurial process and functions can induce individuals to start this fascinating career and not to choose a different path. The opinion shared by the majority of the entrepreneurs in the sample is that the main objective of enterprise education programmes is not the training of entrepreneurs, which is tightly linked with the specific enterprise creation, but they should consider the attempt to make people more autonomous and conscious about their future and to show the various opportunities open to them as independent workers.

Creativity, together with the ability to find original solutions to change normality into something new, should be educated, not only by families, but also by schools and other educational organisms. This does not underestimate the importance of specialized education and work experiences, better if abroad. Another target to reach should be the

creation and the improvement of institutional networks to make possible the melting-pot among people and ideas.

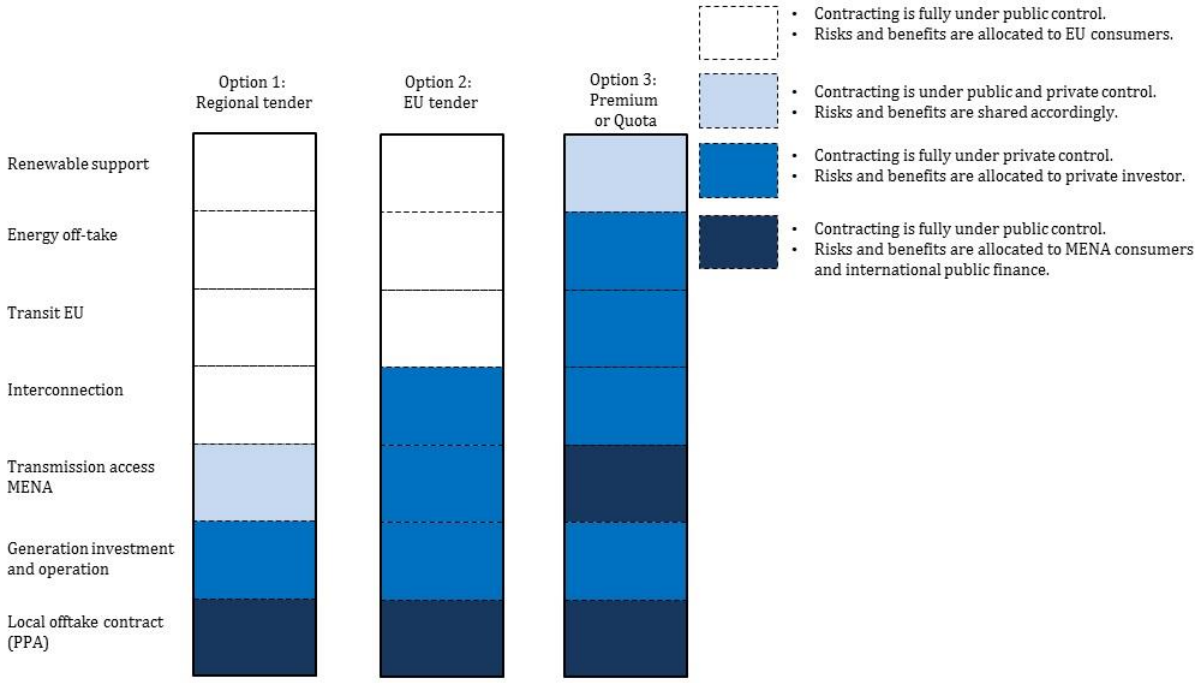
In our sample, often the decision to exploit an opportunity has been supported by a network and the venture creation by a team. Networks take different forms and serve different purposes, some are structured and formal, others are informal, some aim at general information sharing, while others address more specific objectives. Moreover they can allow an accelerated learning and, in particular, peer-based learning, permitted by networks, is the preferred learning medium for many small entrepreneurs.

From all this, it emerges a type of entrepreneur acting very differently from the one the literature and the diffused perception have defined as prominent in the Italian context. Is this unexpected result a consequence of a gradual change in individual mentality and in the value given to entrepreneurship contribution to social welfare, or high technology, that characterizes our sample, creates a bias in our interpretation?

For an in depth analysis of one specific industry that needs a higher level of entrepreneurship to allow the overcoming of the actual crisis, we have identified multiple issues that are linked to entrepreneurial investments in energy production and transportation and that need to be addressed to enable transmission investment for international exchange and local use of renewable energy in EU-MENA countries. Such issues can be classified into general (e.g. lack of national interest, trust building between countries), specific to the interconnection in question (e.g. opposition of selected stakeholders, coordination between generation and transmission investments) and in relation to relevant business models (regulated, concession-based and merchant approaches). However, the importance of the issues and the suitability of different solutions depend on the design of the renewable energy remuneration mechanism. Three policy packages are presented that could be used to address the problems faced by renewable energy projects in a consistent manner.

Figure **16** compares these three options, focusing on the respective role of private and public actors in coordinating the project delivery and the sharing of risks and opportunities between private and public actors.

Figure 16 - Contractual responsibilities, risks and benefits for different aspects of international export arrangements under the three options: Regional tender, EU tender and Premium/Quota.



In option 1 – a regional tender - project developers can focus on the planning, permitting, financing, implementation and operation of the RE project in the MENA region. International export, transmission access and fees are also negotiated by project developers under either a Letter of Understanding or a framework agreement arrangement between the two regions.

In option 2 – an EU tender – project developers can develop projects in several MENA regions and potentially deliver the energy to different Mediterranean EU countries. This, however, also imposes the additional requirement on the project developers to negotiate transmission access in the MENA country of their choice and secure interconnection capacity from the MENA country to an EU Mediterranean country, by either developing own interconnectors or contracting with third party transmission investors.

In option 3 – a European premium or quota system – project developers do not need to develop the entire project to the level of financial closure to an exogenously determined time frame of a tender auction, but can advance at the pace matching their needs and requirements for negotiation with third parties. However, this comes at the additional

requirement to secure a counter party for their power sales and transmission contracts within Europe to deliver to this counter party. This requires new ways of recruiting buyers of such long-term contracts and addressing the counter party risk, and further development of EU regulation to enable and back transmission contracts of durations exceeding their maximum current length of one year.

In all three options it is assumed that national governments in the MENA region tender for power purchasing agreements (PPAs) to secure access to energy from RE plants for local use. Often, winning projects also obtain international support through preferential loans from public banks like World Bank, European Investment Bank, or KfW.

Figure 16 illustrates the differences in the allocation of responsibility between public and private actors regarding the options.

It is important to decide on one clear strategy, so that project developers can make a clear business case for their investors and the tasks to be executed by public entities are clearly defined.

For the initial RE projects with EU export component, a transmission and renewable remuneration framework as outlined in option 1 is most effective in addressing coordination requirements, ensuring competition and facilitating access to low cost finance.

In the longer-term, this choice will have to be re-evaluated. In principle, option 1 can remain a viable and dominant option of choice. If the number and scale of export oriented RE project increases in the MENA region and continues to be closely linked to interconnection projects, option 2 could also become a viable option. If the state of energy markets in EU and MENA increase predictability of future power prices, option 3 can also become viable. In all cases, the efficient utilisation of interconnection assets is possible. Currently, this requires appropriate administrative procedures but if markets on both sides are liberalized, the line needs to be integrated in the market arrangements. This needs to be anticipated in regulatory approval process for merchant lines and contracts with concession projects.

We want to end on a theme that was emphasized across our interviews and stakeholder workshops: the importance of the overarching policy framework. Common issues across all business models can only be addressed if participating countries are committed to the

desert power strategy and to interlinking electricity networks. To this extent the analysis, design and communication of specific policy choices to enable the EU-MENA transmission and RE projects needs to be embedded in the energy and economic policy strategies of the participating countries. Both in the analysis of the entrepreneurial context and the application to the electric market, the key importance of developing an entrepreneurial culture emerges as a crucial enabling component to allow each country to overcome the challenges of the actual crisis through innovation, sustainable investment and, essentially, real growth.

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