



Role of adopting response strategies to manage the Front-End phase of a project.

An exploratory study of the Italian Innovative SMEs.

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Abstract

The present study investigates the role of the Front-End phase within the context of Innovative Small and Medium-sized Enterprises through the project management lens, focusing on what practitioners can do to manage this phase. Taking a cue from the assumption that the Front-End phase of a project is a very critical and important stage, this study begins with a literature review on innovation and on its role among the Small and Medium-sized Enterprises, and moves to the identification of the main challenges that an Innovative Italian Small and Medium Enterprise has to face in the Front-End phase.

Particularly, the research focuses on the strategies that a project manager can implement to deal with the fuzzy nature of the Front-End phase, originated by uncertainty, equivocality and complexity. The study has an inductive approach and a cross-sectional time-horizon. A case study strategy has been employed, together with semi-structured interviews as data collection technique, involving six Italian Innovative Small and Medium-sized Enterprises identified through the framework of legal requirements provided by the European Union. Although literature poses on the same level all three elements, results show that there is a general consensus about the main role played by uncertainty. Practitioners identify several strategies to employ in order to deal with uncertainty, while the number of strategies identified to reduce equivocality and complexity is limited.

Furthermore, this study identifies a correlation between the size of a company and the type of strategies employed to deal with the fuzziness. The more resource a company allocates on a project, the wider is the range of possible strategies project managers can adapt.

Keywords: Project Management, Innovation, Front-End phase, Innovative SMEs, fuzziness, Front-End Strategies

Table of Contents

1. Introduction	1
1.1 Research Objective	2
1.2 Research Question	3
1.3 Unit of Analysis.....	3
1.4 Significance of study	3
1.5 Disposition of the study.....	3
2. Literature Review	5
2.1 Project Management.....	5
2.1.1 Project Lifecycle.....	6
2.1.2 The Phases of the Project Lifecycle	7
2.2 Innovation.....	7
2.3 Small and Medium-Sized Enterprises	9
2.4 Innovative Small and Medium Enterprises	11
2.5 Front-End Phase	11
2.5.1 Uncertainty	13
2.5.2 Equivocality.....	14
2.5.3 Complexity	15
2.6 Response Strategies	16
2.6.1 Uncertainty reduction strategies	16
2.6.2 Equivocality Reduction Strategies	18
2.6.3 Complexity Reduction Strategies	19
3. Research Methodology	20
3.1. Ontology, Epistemology and Axiology	20
3.2 Research Approach.....	21
3.3 Research Strategy	22
3.3.1 Case Study	23
3.3.2 Time Horizon.....	24
3.4 Data Collection – Methodological Choices.....	25
3.5 Sampling.....	26
3.6 Assessing the Research Quality.....	27
3.6.1 Trustworthiness	28
3.6.2 Authenticity	29
3.7 Ethical Considerations.....	29
4. Data Analysis in Practice.....	31

4.1 Participant Selection	31
4.2 Interview design	32
4.3 Interview Transcription	32
5. Findings	34
5.1 Defining the Front-End Phase	34
5.2 The Role of the Front-End Phase	36
5.3 Perception of Innovation	37
5.4 The Common Pitfalls in the Fuzzy Front-End.....	37
5.5 Front-End Strategies and Techniques.....	38
5.5.1 Uncertainty	38
5.5.2 Equivocality.....	41
5.5.3 Complexity	42
6. Discussion of the Findings	44
6.1 Project Managers' Perception of the Front-End Phase.....	44
6.2 Project Managers' Perception of the Innovation	47
6.3 The Role of the Front-End Phase	47
6.4 Front-End Strategies	49
6.4.1 Uncertainty	49
6.4.2 Equivocality.....	52
6.4.3 Complexity	53
7. Conclusions	54
7.1 Answering the Research Questions	54
7.2 Limitations of the Study	55
7.3 Practical Implications	56
7.4. Theoretical implication.....	57
7.5 Validity and Reliability Revisited	57
8. References	59
Appendix	66

LIST OF FIGURES

FIGURE 1. PROJECT LIFE-CYCLE	6
FIGURE 2. RESEARCH ONION	21

LIST OF TABLES

TABLE 1. CHARACTERISTICS COMPARISON BETWEEN LARGE AND SMES	10
TABLE 2. CANDIDATES' BACKGROUND INFORMATION	32
TABLE 3. STRATEGIES USED BY THE RESPONDENTS	39
TABLE 4. STRATEGIES AND TECHNIQUES USED BY THE PARTICIPANTS	42
TABLE 5. MAIN CHARACTERISTICS OF THE FRONT-END PHASE	44
TABLE 6. IMPORTANCE OF THE FRONT-END BASED ON THE RESPONDENTS' EVALUATION	48
TABLE 7. COMMON PITFALLS OF THE FRONT-END	48

1. Introduction

Nowadays, the business environment is going through major changes, becoming very competitive and challenging for all the operating business. As innovation and new product development represent valuable sources for firms' future sustainability and development, it is vital for the firms to introduce effective process at all stages of development. For these reasons, considering both private and public sectors, the need for organizational accountability has grown dramatically. Roberts and Furlonger (2000) in a research about information systems projects illustrate that through the use of detailed project management procedures, a company can improve the effectiveness of its projects by 20 to 30 per cent.

This research is focused on the analysis of project management strategies utilized by innovative Italian Small and Mediums-sized enterprises (hereafter SMEs) in the Front-End phase of a project. Through the use of a case study method the researchers aim to find out how project managers face the challenges arisen in the Front-End phase. In order to clarify key concepts, it is necessary to explain what innovation is, what its role in SMEs is and why this is relevant in managing the Front-End phase.

The Oslo manual (Tanaka et al., 2005, p. 30) includes a definition of innovation that has been accepted by many researchers. Innovation is therefore meant to be “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations” . Furthermore, according to Joseph Schumpeter (1942), innovation should be redirected in value creation and moreover should not be considered only as a new idea or invention, but the improved productivity that stems from its application. Thus, an innovation cannot be separated from the economic value it generates. For this reason, innovation has covered an increasingly important role in modern economies, so that. as testified by the annual report of EUROSTAT agency (2014), innovation can be considered as one of the reasons why the majority of Italian SMEs survived the Euro-zone economic crisis of the 2007 (EUROSTAT, 2014). Moreover, Italy is, among the European countries, where the share of SMEs is more important.

According to the latest data from ISTAT (2014), in fact, about 4.4 million businesses with fewer than 250 employees operate in the country, around the 96% of the whole economy. The added value produced by these companies amounted to over 500 billion Euros, or approximately 70% of the total. In terms of employment the role of SMEs is however even more important: of 17 million people employed in industry and services more than 80% is currently employed in SMEs (ISTAT, 2014).

Previous empirical studies (Joachim et al., 2008; Brown, 2010; Meuris et al., 2014) have shown that innovative SMEs have a particular focus on the initial stages of each project. Therefore, the conceptualisation phase assumes a distinctive role. Accordingly, the Front-End phase covers a vital role (Haji-Kazemia et al., 2012).

What is meant by the Front-End phase? Morgan (1987, p. 46) defines the Front-End phase as that period when time, money and human resources are expended on a project without any guarantee of return. The Front-End is also considered to be the preliminary

emergence phases of the project (Morris, 2011), therefore it refers to the Front-End of the entire project life cycle. In practice, there would seem to be two common usages of the term. Front-End phase may refer to the gathering of user, system, business and other requirements ending in the formal acceptance by the sponsor and the project team of these requirements. However, the previous idea of the Front-End phase might result too simplistic in most projects. (Morris, 2011, p 5). Kim and Wilemon (2002) expand the definition of the Front-End phase considering the nature of this phase defined as 'fuzzy'. Supporting this definition, Stevens (2014) claims that Fuzzy Front-End would be the correct term to refer to this phase. The reason behind this statement is grounded in the identification of three main elements responsible for the fuzzy nature of the Front-End, which are:

- Uncertainty: it is intended as the difference between the amounts of information required to perform a particular task and the amount of information already possessed by the individual (Galbraith, 1973).
- Equivocality: it refers to a situation when managers are unable to interpret or understand events, facts, and data, because the same information might have two or more possible meanings (Meuris et al., 2014, p. 5).
- Complexity: it occurs when a large number of parts interact in a non-simple way (Lucae et al., 2014).

Khurana & Rosenthal, (1997) support the idea provided by Stevens that the fuzzy nature is the first problem decision makers should deal with in the Front-End phase. Subsequently, they argue that, in order to efficiently manage the Front-End phase, it is necessary for decision makers to implement strategies, tool or techniques to reduce the fuzziness. Reduction of uncertainty, equivocality and complexity make the Front-End management easier. Based on these assumptions, the research will focus on describing these three elements of fuzziness and understanding which strategies Italian innovative SMEs implement to deal with uncertainty, equivocality and complexity. There can be very little doubt that many projects fail, or even just fail to reach their full potential, due to inadequate early research or effort in the Front-End phase, while the project is being conceptualized (Morris, 2011). Measuring project success is a difficult task to achieve, since there are too many variables to consider, and it would be out of the scope of this research. However, focusing on good management of the Front-End is an undisputed initial step towards the success of a project (Reid, De Brentani, 2004, pp.. 170–184 Evidence also points to the importance of decision making in this phase. Choices that are made early on in a project have significant effects later, with lower initial strain on resources. Although the importance of this phase has been recognized by many, literature seems to underestimate it (Faniran et al., 2000), resulting in a gap that the authors of this study aim to fulfil.

1.1 Research Objective

The central objective of this research is to explore the project management strategies used by Italian innovative SMEs to deal with the fuzziness of the Front-End phase and the importance given to this phase by practitioners.

A list of sub-objectives have been identified and explicated in the following points.

- 1) Identify and analyse, from the prior literature, the Front-End phase of projects and its role.

- 2) Explore the type of project management strategies used during the Front-End phase by Italian innovative SMEs.

1.2 Research Question

The researchers need to specify the research question, since it is defined as the methodological starting point that will help to address a research problem.

After the objectives of this research have been stated, the research question is defined as follow:

- What are the specific strategies implemented by project managers to reduce the limitations of the Front-End phase?

1.3 Unit of Analysis

The unit of analysis, as many authors state, is one of the core ideas of the research project and is the key entity that researchers analyse in their studies. In order to be more specific, the unit of analysis has been defined as “the analysis you do in your study that determines what the unit is” (Trochim et al., 2015, p. 42).

Although cross-sectional studies often involve surveys, which are closely related to collection of quantitative data, they may also entail the use of qualitative methods, such as interviews conducted over a short period of time (Saunders et al., 2009, p. 155). Since the focus of the authors is more on the collection of qualitative data, semi-structured interviews within cross-sectional design will be employed.

The semi-structured interviews done with project managers will be recorded (if possible) and transcribed in order to get a data set of qualitative information, thus the analysis of sudden data will follow a quantitative analysis technique.

1.4 Significance of study

The authors opted for the selection of this specific topic and context not only due to personal interest but also due the recognition of a gap in modern Front-End phase management literature (Faniran et al., 2000). The decision of analysing Italian SME was made because both the authors are Italian, have successfully completed their previous studies in Italian institutions and, last but not least, they have worked in the past years in Italian organizations. Therefore they have an insight of the Italian situation.

The main reason, anyway, was that conventional Project management has a tendency to understate the Front-End phase, (Morris & Pinto, 2007, p. 8). Moreover, researchers as Winter et al. (2006, p. 641) have established that Project Management has a “need for new thinking in the areas of project complexity, social process, [and] value creation”.

Nevertheless, practitioners are aware that projects are undeniably subject to forces of political, social, behavioural, and even psychological nature (Englund & Graham, 1999, pp. 62-63; Winter & Szczepanek, 2009, p. 58), so that failure of projects can be attributable to the “failure to address people issue” (Thiry, 2002, p. 222).

1.5 Disposition of the study

This chapter is concerned with the introduction of the topic, followed by the research objectives and the research question. Moreover the unit of analysis together with the significance of the study have been explicated.

The second chapter discusses the literature review of the Front-End phase, starting from the relevant Project management literature along with the project lifecycle. The chapter continues with the definition of innovation and its characteristics and then moving to the SME (Small and medium enterprises) analysis. In order to conclude the literature analysis the three elements that cause fuzziness in the Front-End phase are discussed together with the response strategies that can improve the effectiveness of the entire lifecycle of a project.

The following chapter focuses on explaining the methodological stance of the research, underlying the scientific approaches along with the reasons why the authors have taken certain specific choices. Furthermore the trustworthiness and the authenticity of the study are discussed together with the explanation of the ethical considerations.

Chapter 4 addresses the data analysis in practice; therefore it discusses the participants' selection with the interview design and the way in which the authors decided to proceed with the transcription of the interviews. Later on the empirical results from the study are presented.

In chapter 5 the researchers analyse the data obtained from the semi-structured interviews, known as findings, and state some of the quotes that have emerged.

Chapter number 6 will explore the findings in correlation to the existence literature, the final aim is to discuss the results of the study and compare them with what has already been discussed by others authors in prior literature.

Last chapter, number 7, is dedicated to the conclusion of the research, where the research question is re-examined taking into consideration the new findings. Moreover, the limitations and the implications are debated along with the creation of a base where to start for further researchers.

2. Literature Review

The present chapter has the objective of examining the relevant literature to form a solid base for identifying the issues that this research is concerned with. After defining project management, in order to correctly identify the role of the Front-End phase, the research will discuss the importance of project life cycle in standard projects. Subsequently, Front-End phase will be analysed to identify the main issues managers should deal with. Finally, a framework of other relevant element to manage in the Front-End will be presented.

2.1 Project Management

A project is defined as a number of temporary tasks executed in a particular period combined with the company resources and capabilities in order to improve a product or a service that already exists or to create a new product, service or result ensuring a great advantage among competitors (Morris & Pinto, 2007, pp.14-17). Successful strategy must be aligned to the company's activities, principles and culture throughout the formation and the implementation of the project (Johnson et al., 2011, p. 16). Its temporary nature indicates that a project has a clearly defined beginning and end.

The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists. A project may also be terminated if the client (customer, sponsor) wishes to terminate the project (Morris & Pinto, 2007, p. 15). Temporary does not necessarily mean the duration of the project is short. It refers to the project's engagement and its longevity.

Project Management, therefore, is the application of skills, tools, techniques and knowledge to project activities in order to meet the project requirements. Effective Project Management practices help organizations carry out project on time, on budget and with the minimal disruption to the rest of the business. It is, moreover, extensively adopted as a complex of techniques and tools for delivering strategic objective and goals (PMI, 2013, p. 25). In the interest of understanding the main actions that have to be carried out in a project, it is relevant to classify Project Management processes into five groups: initiating, planning, executing, monitoring and controlling, and closing. The one that is relevant for this study is the initiating process, due to the fact that this action is been controlled in the Front-End phase. The project management brings a unique focus shaped by the goals, resources and schedule of each project and project managers are the ones that must set the milestones and thus lead the entire process.

Is then important to remember that Project managers are not expected to complete the project work by themselves, even though they are always the ultimately accountable for the project. Project managers have project teams working alongside them who support and help them to achieve all of the objectives of the project (PMI, 2013, p. 14).

Project management has the duty to combine comprehensive upfront planning with detailed downstream planning in order to ensure that strategic and tactical issue are addressed early in the project (Termini, 1999, p. 21). Project managers or organizations, moreover, can divide projects into phases to provide better management control over the project. Collectively, these phases are known as the project life cycle.

2.1.1 Project Lifecycle

To understand the importance of the Front-End phase, it is important to understand where it is located. Often decision-makers do not know how to handle this phase because they are not able to identify it. The Front-End phase is a sub-phase of the project life cycle, and precisely is part of the conception phase. However, although it is not a primary stage, it is vital because any decision taken in this sub-phase of the lifecycle impacts significantly on all the other phases of the project. Furthermore, any modification of the project can be implemented at a lower cost in Front-End phase than in the future states. A project's life cycle refers to the path a project takes from the beginning to its end. A standard project is typically characterized by four (4) main phases, each with their own tasks and issues: conception, planning, implementation and closure. Patel and Morris (1999, pp. 20-22) argued, "The life cycle is the only thing that uniquely distinguishes projects from non-projects". At this point, it would be valuable to examine what role the project life cycle plays in the conduct of project management. According to the same source, the structure of the project is significantly affected by the sequence of phases through which the project evolves. Subsequently, Patel and Morris (1999, p.21) define the generic sequence of phases in the basic life cycle as: Conception, Design, Production, and Hand-over. They note that while the names for these phases may vary according to the industry of organization where the project is being implemented, the concept remains the same whereby the transfer from one phase to another is characterized by evaluation and approval points. They call these 'gates'. The method of division of a project into phases may differ somewhat from industry to industry, and from product to product, but the phases shown in the Figure 1. The project manager and project team have one shared goal: to carry out the work of the project for the purpose of meeting the project's objectives. Every project has a beginning, a middle period during which activities move the project toward completion, and an ending that can be either successful or unsuccessful (Jensen Oellgaard, 2013). As previously stated a standard project typically has the following four major phases (each with its own agenda of tasks and issues): initiation, planning, implementation, and closure. Taken together, these phases represent the path a project takes and are generally referred to as the project "life cycle" (Jensen Oellgaard, 2013).

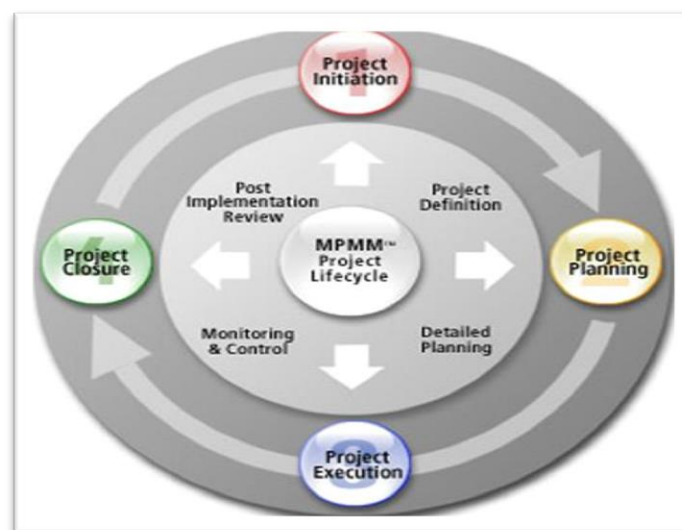


Figure 1. Project Life-cycle

Source: MPMM.com website

2.1.2 The Phases of the Project Lifecycle

Below, each of the phases of the project lifecycle is discussed in detail.

Phase 1: Initiation/Conception

The initiation phase, indicated as “starting point of the project” by the Project Management Institute (hereafter referred as PMI) includes all the activities necessary to begin planning the project. This phase typically begins with the exploration and the elaboration of an idea. Other elements considered in the initial phase are motivations of the project, the feasibility, the resources needed and how to find them (internally or externally), the boundaries of the project and the results to be achieved. One of the critical steps is represented by the Front-End phase, which will be discussed later. Project stakeholders’ alignment must be guaranteed at this stage to ensure that all the people involved in the project have shared goals.

Phase 2: Planning

In this phase, the requirements that are associated with a project result are specified as clearly as possible. The emphasis of the planning phase is to develop an understanding of how the project will be executed and a plan for acquiring the resources needed to execute it.

Phase 3: Execution/Implementation

The project takes shape in this stage, involving the construction of actual project results. These results are evaluated by benchmarking them with the list of requirements created in the previous phase. In this regard, it is necessary to understand that it is hardly possible to achieve a project result that precisely meets all of the requirements that were originally specified in the definition phase (Nauman & Ullah, 2015).

Phase 4: Closeout

The closeout phase - or using PMI’s nomenclature, “closing of the project”—represents the final stage of a project. Project staff is transferred off the project, project documents are archived, and the final few items or punch list is completed. The project client takes control of the product of the project, and the project office is closed down. The purpose of project closeout is to assess the project, ensure completion, and derive any lessons learned and best practices to be applied to future projects.

2.2 Innovation

Innovation is one of the crucial factors of the success of competitive enterprises. Nowadays, for many firm, technological innovation is a strategic imperative to successfully emerge from the competitive dynamics of the market, acquiring or maintaining positions of market leadership. Additionally, the pace of change has increased because of the growing turbulence of the business environment, and it requires companies to have greater flexibility and efficiency in innovation processes.

Innovation can be defined as an iterative process that takes its cue from the perception of a new market opportunity for an invention based on technology: this involves all the activities of development, production and marketing with the aim to achieve commercial success of the invention (Utterback, 1996, p. 14). It relates to the process of translating an idea, or invention, into a good or service that can be valuable for the customers. Thus, the innovation process involves the technological development of an invention combined with its introduction on the market to the final users. Adler (1992,

p. 25) states that the passage of an invention through the steps of production and commercialisation is necessary for obtaining an innovation. A discovery that comes out of a laboratory experiment it is only an invention (Adler, 1992, p. 26). On the contrary, a finding that moves from the laboratory to the production and the commercialisation, and causes an increase of value for a company, even in terms of cost savings, can be labelled as innovation. Moreover, other authors argue that the innovative process is iterative by nature, in the sense that an initial grade innovation is followed by further innovations, which bring improvements to the first attempt (Garcia & Calantone, 2002, p. 122; Howells, 1999).

The nature of innovation and the rate of technological change greatly differ from sector to sector (Puga and Treffer, 2010). Some sectors are characterised by quick change and radical innovations, others by smaller, incremental changes. Innovations are often classified in accordance with several dimensions in order to provide a better understanding of the general phenomenon. Such classification not only helps in considering the different opportunities offered, but also clarifies demands presented by the innovation (Abernathy & Clark, 1985, p. 17). These classifications are often based on the perspective of observer and are not mutually exclusive. A company needs to classify the innovation in order to understand the risk and rewards involved. Depending on the risk appetite of the company, it can focus on certain types of innovation and allocate its resources accordingly (Menzel et al. 2007, p. 732). Some possible classifications are listed below.

Process vs. Product Innovations

Process innovation refers to novelty in an organization's way of doing business. Novelty could consist in a shift in organisational activities, such as marketing, production or sales, or it could be in the linkages between the activities. Process innovation may refer to the implementation of a new or significantly improved production or delivery method, including significant changes in techniques, equipment and/or software. Minor changes or improvements, an increase in production simple capital replacement, changes resulting purely from changes in factor prices, customisation, and regular seasonal or other cyclical changes are not considered innovations (Garcia & Calantone, 2002, p. 118).

On the contrary, product innovation refers to the development and the sequent market introduction of a new, redesigned or substantially improved good or service. Reasons to enable a product innovation may lie in a change in customer requirements, or in the opportunity to tap new markets or market segments, or to increase the product life cycle.

Incremental vs. Radical Innovations

Increment innovation involves a minor change to existing practices, whereas a radical innovation is a larger leap in the practices. Incremental innovation concerns an existing product, service, process, organization or method whose performance has been considerably improved or upgraded. A simple product, for example, may be improved in performance or cost reduction through use of better components or materials, or a complex product comprising a number of integrated technical subsystems may be improved by partial changes to one of the subsystems (Von Tunzelmann & Acha, 2005).

A radical or disruptive innovation is an innovation that has a substantial impact on a market and on the economic activities of firms in that market. The innovation could, for

example, change the structure of the market, create new markets or revitalise obsolete products. However, it might not be apparent that an innovation is disruptive until long after it has been introduced, and the cut-off point between incremental and radical innovation might be set at different levels (Abernathy & Clark, 1985, p. 22). In Schumpeter's view radical innovations create major disruptive changes, whereas incremental innovations constantly advance the course of change (Schumpeter, 1942).

Competence enhancing vs. Competence Destroying Innovations

This perspective of looking at innovation is very useful for companies. Competence enhancing innovation implies an improvement in abilities the company already has, building the innovation on the existing knowledge base. Competence destroying innovation, instead, requires a new set of skills, abilities, and knowledge in the development and production of a product relative to those held by existing firms in an industry (Tushman and Anderson 1986, p. 442). A competence destroying innovation is often faced with resistance amongst firms. Innovations involving new competence acquisition take longer to implement and are positively associated with organizational change (Garcia & Calantone, 2002, p. 39).

2.3 Small and Medium-Sized Enterprises

Small to medium-sized enterprises (hereafter SMEs) play a significant part in economic activity through employment, innovation and growth (Floyd and McManus, 2005).

Several different definitions of SMEs have been proposed based on their nature and characteristics (McAdam and Reid, 2005, p. 235). For the purpose of this research, the European Commission's definition will be taken into consideration. The European Commission (2005, 2008) defines small and medium enterprises as follows:

- Medium - up to 250 employees and, and turnover of less than €50 million
- Small - less than 50 employees, and turnover of less than €10 million
- Micro - less than ten employees, and turnover of less than €2 million

Another classification of SMEs has been provided by Ghobadian and Gallear (1997, p. 95), in which the authors focus their attention on the differences between SMEs and larger organizations. The main differences can be expressed in term of:

- Processes: SMEs require simple planning and control systems, and informal reporting.
- Procedures: SMEs have a low degree of standardization, with idealistic decision-making.
- Structure: SMEs have a low degree of specialization, with multi-tasking, but a high degree of innovativeness.

Rothwell and Dodgson (2007, p. 228) identify several advantages of SMEs if compared to large companies in terms of innovation. The authors analyse SMEs' advantages in term of (i) Management, - SMEs benefit from "Entrepreneurial Management", characterised by short bureaucratic procedures and rapid decision-making processes, whereas large firms suffer from high degrees of bureaucracy and lack of dynamism; (ii) Communication - SMEs have a more informal and effective internal communication network, while long decision chains that would result in slow reaction times could hamper large firms communication; (iii) Marketing – SMEs can react faster to changing market, dominating narrow market niches. Larger firms, instead, might ignore emerging market niches with grow potential; (iv) Finance – Innovation can be less costly in SMEs

that gain market advantages from R&D (Research and Development) efficiency, while large firms operate under the pressure of stakeholders on focusing on short-term profits. SMEs are also more likely to be capable of “fast learning” processes and adapting new routines and strategies, while large firms are slow-to-learn (Turner, 2009, p. 930) and locked into well-established practices; (v) Government and Regulation – especially in the past years, governments assist and support innovation in SMEs, not only by offering tax credits for innovation to SMEs that focus on R&D, but also by encouraging patent to secure innovations.

Table 1. Characteristics comparison between Large and SMEs

	SMEs	Large
Management	Little bureaucracy – fast decision making	Managers as bureaucrats and lack of dynamism
Communication	Effective internal communication	Internal communication can be cumbersome
Marketing	Fast reaction to change in market requirements	Lack of awareness of market niches with growth potential
Finance	R&D efficiency	R&D risky and costly
Government and Regulation	Assist and promote	Focus is on SMEs

Source: Created by the authors

Turner et al. (2009, p. 932) stressed the importance of project management in SMEs. The authors argue that on average SMEs spend a third of their turnover on projects. However, this percentage might vary a bit according to the size of the project. In micro-sized companies, the size of a project lasts up to three months, in small companies it goes from three to six month long and in medium-sized companies it lasts from six to nine months (Turner et al., 2009, 935-937). Moreover, while in all three sized companies more than half the projects have team sizes of one to ten people, larger companies are more likely to have larger team sizes.

SMEs undertake a variety of types of project, including the delivery of tailor-made and personalized products to customers and innovation and internal development. These projects represent a significant percentage of the work of SMEs, with at least a third of the turnover on average being spent on projects (Turner et al., 2009, p. 945). Related to use of project management in SMEs Turner et al. (2009) also investigated the extent to which SMEs employ professional project managers. The authors found that larger companies were more likely to employ professional project managers and use formal project management practices. On the other hand, SMEs are less likely to employ dedicated project managers, and less likely to adopt identifiable project management practices. Turner et al. (2009, 2010) focused on the nature of the project management practices adopted by SMEs, identifying that SMEs use some tools such as project plans, but are less likely to use the more systems oriented planning and control tools such as Critical Path Method (CPM) and Earned Value Method (EVM).

Andersen et al. (2009) claim that SMEs demand a less bureaucratic form project management than those traditionally available, with a greater emphasis on people-focused, behavioural competencies (International Project Management Association, 2006; Alam et al., 2010, p. 234).

2.4 Innovative Small and Medium Enterprises

Not all SMEs in all sectors innovate (Storey, 1994). However, across industrial sectors, SMEs carry the major contribution in terms of innovation if compared to large firms (Oakey, 1993, p. 12). In order to clearly define the role of the innovation in SMEs, a framework of legal requirements from The European Commission (2013) will be considered. To claim the title of Innovative SME, a company should meet all of these requirements:

- Production plants must be located in one of the countries member of the European Union;
- Shares must not be listed on a regulated market;
- Company must fill an audited financial statements at the Company Register;
- Annual turnover must not exceed €50 million or the annual balance sheet total must not exceed €43 million;
- The company employs less than 250 people;
- Costs of research, development, innovation and greater than or equal to the value of production;
- Personnel holding an Academic Degree must represent 1/3 of the total workforce.

Turner et al. (2009) argue that SMEs have different degree of innovativeness in dependence of the industry they are in, but they tend to exhibit broadly similar characteristics: (i) SMEs are more likely to involve product innovation, based on R&D efforts, than process innovation, which nevertheless has a significant role in the process; (ii) incremental innovations are preferred to radical innovations, improving performance step by step; (iii) SMEs significantly focus on products for niche markets rather than mass markets, in order to achieve competitive advantages related to specialisation and customer orientation; (iv) SMEs are less frequently oriented to a rigid and formal organisation, tending instead to be more project-driven; (v) are likely to be associated with growth in output, turnover and employment.

Lastly, Wong (2005, p. 263) claims that Innovative SMEs have not had the attention they deserve in the European economic scene. Lee et al. (1995) argue that existing studies have applied the considerations valid for large companies to SMEs context, without finding a real recognition in practice. However, as witnessed by the European Union (2014), Innovative SMEs were the only firms that have weathered the most the economic crisis of 2007.

For these reasons, the authors considered appropriate to investigate the role of Front-End in Innovative SMEs, focusing on the Italian context.

2.5 Front-End Phase

The Front-End phase of a project begins when the project idea is conceived, and it ends once the final decision to finance the projects is made (Artto et al., 2001, p. 257). In the project life cycle, Front-End phase precedes the detailed planning phase or the engineering phase, since it focuses on concept definition of needs and possible

solutions, on concept development of ideas to strategic choice and on concept evaluation of cost, profitability and time. The Front-End phase of projects is a stage that tends to be largely underestimated by mainstream project management literature and yet it is critical to project success.

The initial phase of a project is also defined fuzzy Front-End, since it identifies a stage where the level of relevant information and data is very low; however, the decisions made during this period widely influence the outcomes of the overall project (Koen et al., 2001). Many firms often underrate the importance of the Front-End because managers do not perceive the value of up-front planning as an investment that helps to reduce the amount of rework, but rather see planning efforts as an additional cost, or because during the planning phase the clarification of reducible uncertainty is postponed to a later point in time due to resources and time constraints (Kurkkio, 2011).

In an attempt to lessen the fuzziness, Nobelius and Trygg (2002) discuss the use of model in Front-End management in their paper titled “Stop chasing the Front End process — management of the early phases in product development projects”. They provide a list of Front-End activities that are normally used in the initial phase of a project. These include six distinct categories/activities; Mission statement, concept generation, concept screening, concept definition, business analysis and project planning. All these activities have different priority, sequence and are weighed by importance depending on the project itself (Nobelius and Trygg, 2002, p.48). Yet, they also recognize that the use of any single model could be disadvantageous for an organization. Projects are by definition unique and therefore the approaches taken towards them require flexibility (Nobelius and Trygg, 2002, p. 51). They suggest that it is more beneficial to consider multiple co-existing Front-End routes thereby ensuring flexibility. This is in line with conclusions drawn by Cooper (1994) who claimed that focusing on only one of the activities might lead to risks. He stressed the importance of proficiency in predevelopment activities and emphasized the danger of avoiding any vital activity. Khurana and Rosenthal (1998, pp. 256-259) similarly claimed that the Front-End activities are to be seen as interrelated, and avoiding one of them contributes to project failure.

In line with the need for flexibility, the idea is that sticking to a single model may deter project managers from considering other vital factors in the Front-End phase such as mapping other interfacing projects or strategies that potentially might affect the planning and execution of the pre-projects (Nobelius and Trygg, 2002, pp. 52-55). Thus, there is clearly a need for adapting the Front-End model according to the type of project and overall company situation rather than to a rigid framework. In other words, it is not necessary to map out a Front-End process in terms of providing a universal set of procedures, but rather a need to develop a flexible Front-End process applicable to any pre-project phase (Nobelius and Trygg, 2002, pp. 54). This, however, brings into question what precisely constitutes as Front-End management and how it differs from other phases of the project, namely the implementation and post-project phases.

It's vital for managers and firms to fully understand the importance of the Front-End, because the foundations for failure often seem to be established at the very beginning of projects lifecycle (Reid & de Brentani, 2004, p. 35). Front-End decision making for projects is very important since it allows having a broad perspective on the project and its features, which are relevant for various stakeholders (Samset, 2010, p. 78).

Scholars focused on the nature of the fuzziness to elaborate effective response strategies. Stevens (2014) identifies the following three (3) main elements that cause

fuzziness in the initial phase of a project: uncertainty, equivocality and complexity. These three elements will be analysed individually, and then valid response strategies will be presented.

2.5.1 Uncertainty

Uncertainty is a key concept of the organization theory and is intended as the difference between the amounts of information required to perform a particular task and the amount of information already possessed by the individual (Galbraith, 1973). Organisations always suffer in defining future scenarios as consequence of present actions, especially in the Front-End phase of innovation projects that are essentially non-routine, dynamic and uncertain (Kim & Wilemon, 2002, pp. 180-183). Consequently, managers are unable to be sure about outcomes that might follow any of their possible lines of action when engaged in initial phases' activities since all decisions are made in relation to a future situation that is difficult to predict. Uncertainty mainly is concerned with the environmental interpretations or perception in an individual related to an organisational attempt.

In the stage of conceptualisation activities, uncertainty typically relates to a firm's target market or technological environment (Khurana & Rosenthal, 1997, p. 75). If management or project participants face initial high levels of such uncertainties (i.e. fail to close important information gaps on time) when engaged with Front-End, the general proposition is that they are likely to face severe consequences in future and even project failures (Herstatt & Verworn 2004, pp. 25-27). The main consequence of uncertainty which is not sufficiently reduced is that it might force project participants to take larger risks, which, if they occur, will have severe consequences on project objectives and could even cause the failure (Weick, 1995, p. 97).

Previous researches have shown that successful projects are characterized by low uncertainty during the earlier phases of projects (Moenaert, et al., 1995, p. 18). The reason behind this statement is that at lower levels of uncertainty, it is easier for managers to detect early warning signals of potential problems that may arise during the project. The earlier the warning signals are identified, the more time will be available for taking appropriate and efficient corrective actions before the negative consequences of a problem show up (Haji-Kazemi et al., 2012). Early warnings identification should be an integral part of the management process in the Front-End stage because it can help managers in having better insights towards the future of the projects. Managers are aware that threats and opportunities will undoubtedly arise during the project life cycle, and early warnings identification might be a useful tool to identify on time their nature and the sources (Ansoff, 1984).

For Ansoff (1975, 1984), the author who first introduced the term, early warning signals, also referred to as weak signals, consist of advanced and imprecise symptoms of impending future problems. The author suggested the usefulness of the concept of weak signal for building more sensitive strategies stressing the importance of weak signals for triggering well-timed managerial responses. Ansoff's focus was on the importance of a correct management of information, reason why he developed a three (3) stages model about the various filters that a weak signal has to go through upon arriving to decision makers. The "surveillance filter", also labelled as "analytical", is the firm's ability to select the necessary information, and it represents the first stage. If the firm was attempting to detect weak signals, this surveillance system would have gaps, and, therefore, some signals would not be detected. Another level of failure is related to the incapacity to understand a given signal if it does not conform to the frames of

reference and culture shared in the organisation. This is called “mentality filter”, due to its sociological and psychological characteristics. The “power filter”, or “political filter”, represents the last level. Warning signals might not be analysed because they do not match decision-makers’ best interests.

Aside from Ansoff’s contributes, very little literature explicitly deals with early warnings in projects and project management (Nikander, 2002). However, if it is possible to identify general rules to define early warning sources that can be directly derived from literature, the choice of the right approach will be very much dependent on the project itself, the project organisation and the project context.

According to Nikander (2002, p. 45) the process to identify early warning signs is characterised by two different phases. First the attention should be focused on the severity, the likelihood of materialisation and the time available to take a corrective action. Secondly, managers should evaluate the impact that planned responses might have on the project, and on the project participants.

Moreover, Nikander (2002, p. 60-63) has suggested a six (6) stages model to support decision-makers in taking into account potential early warning signals. The model will be briefly described here, to have an overview on the general methodology. The first step is the actual identification of early warning signs. In the second stage, an interpretation of the signs takes place, in order to analyse their significance. In the third stage, decision-makers consider the information they have about the early warning signs and hypotheses on the impact of response actions are made. The fourth stage is characterised by attempts to identify the real problem, or risk, anticipated by the early warning signs. The fifth stage includes an assessment on the time available for taking the right actions, considering the level of urgency of the problem. Lastly, in the sixth stage, decision-makers have to choose the response strategy that best fits the context. Nikander (2002) suggests that the utilisation of this model in Front-End stage of projects can provide a clear insight towards many possible problems that may arise in the future. Although this model has obvious characteristics of risk management, it differs from a simple risk analysis because it can give in advance notice of arising risks, but it does not provide information about the probability of occurrence of these risks on the project. Furthermore, it is not possible to detect every risk that might arise from early warning signs, but for the ones that can be identified the model provides a strong basis for decision-making initiatives (Haji-Kazemi et al., 2012), due to the sufficient available time prior the occurrence of the real problem and thus providing a high possibility for assessing the responses that can be taken in order to see if the projects will achieve success or not.

2.5.2 Equivocality

Uncertainty requires additional sources of data in order to close an information or knowledge gap, which if it is not closed on time, will expose participants in an innovation project with high levels of risks concerning of to further develop (Iluz & Shtub, 2015). Equivocality refers to a situation when managers are unable to interpret or understand events, facts, and data, because the same information might have two or more possible meanings (Meuris et al., 2014, p. 5).

Wiio et al. (1989) identified other alternatives sources of equivocality in communication barriers, loss, distortion and noise. Communication barriers refer to mistakes in addressing the information, or the lack of participants to communicate. Communication loss indicates both disappearance of communication, in which the information

disappears from our internal processing system, and rejection. Rejection is strongly linked to aforementioned. Ansoff's filtering model and can be broken down into three (3) sub-categories: individual rejection factors, social rejection factors, and technical communication problem. Distortion in information might be caused by misunderstanding or misinterpretation, related to other disturbances in communication. Often the information in this stage suffers from the different experiences and interpretation of the situation of both the "sender" and the "receiver". The result is that the information gets altered during the process. Lastly, communication noises occur in presence of potential interruption of the flow of information.

Equivocality has been neglected by literature, because uncertainty has always been considered to be the most important variable (Brun & Saetre, 2009, p. 582; Cleden, 2009, p. 14). As for uncertainty, decision-makers should focus on reducing equivocality. Reduction of equivocality cannot be achieved by gathering more information on a specific topic but rather by using organisational tools as a leverage to collectively align meanings through the adoption of combined behaviours. The main difference between uncertainty and equivocality is that additional information might not resolve the misunderstanding. While uncertainty necessitates the acquisition of additional information, equivocality necessitates the exchange of subjective views among organizational members to define a problem and resolve disagreements (Daft, et al., 1987, pp. 140-146). Literature suggests that managers should avoid meeting an equivocal situation by searching for accuracy; instead they should search for plausibility (Weick, 1995). Nevertheless, managers should not focus on reducing simultaneously equivocality and uncertainty, because if equivocality is mistaken for uncertainty, managers and project participants might take actions to reduce uncertainty, which are more likely to increase equivocality.

Stevens (2014) suggests that changing the interpretation frames by trial and error or by involving experts and mean making might be considered efficient tools to reduce the level of equivocality. This step is vital because equivocality can cause more severe problems than uncertainty in terms of consequences, even though the degree of perceived equivocality may actually be lower than that for uncertainty (Stevens, 2014). Even moderate degrees of equivocality can paralyze Front-End phase of a project, thus making it difficult for firms to proceed. Uncertainty can also be addressed with more practical tools and systematic work procedures, while equivocality reduction seems to require skills not sufficiently possessed.

According to Frishammar et al., (2011) signs of equivocality can be the lack of precise definitions within the organisation, lack of clarity, high complexity, or paradoxes. If these signs appear, the development team needs to engage in highly complex communication processes to handle the issue they are facing in an adequate way.

2.5.3 Complexity

Complexity often occurs when a large number of parts interact in a non-simple way. The link between decision and effect is difficult to forecast because of the unpredictable course of the interactions between subparts. This is the case of large engineering programs, which consist of various projects and sub-projects that contribute to the overall program benefit (Lucae et al., 2014). These programs often include many interrelated components, subsystems and technologies. Challenges within a complex system that is too large may affect the rational decision making process. Usually, during the pre-development phase, when a decision on one aspect of the project affects the other components, their respective adjustments induce changes in the entire system. To

deal with complexity, Boukis & Kaminakis (2014) identified two main learning strategies. First, companies should focus on increasing their capacity to process complex cause-effect link. Second, firms should reduce complexity by separating the project into smaller components to facilitate management.

Baccarini (1996) defined project complexity as a mosaic of interrelated parts that can be operationalized in terms of differentiation and interdependency. Differentiation refers to the number of hierarchical levels, number of specialisation or diversity of inputs and tasks (William, 1999). Interdependency indicates the operational relationships between organizational elements and/or tasks, teams and technologies.

Williams (2002, pp.17, 18) splits project complexity in two (2) elements: structural complexity and uncertainty. The latter refers to uncertainty in goals and in methods, deriving from the project environment. The former is related to projects size, and the number of sub-elements, the interdependence of elements and complexity of interactions between people and organizations.

Another classification of the complexity is proposed by Xia & Lee (2004) highlighting the multidimensional nature of complexity. Three (3) dimensions are identified: organizational, technical/structural and social dynamics. Organizational complexity is related to organization structure, project team and other actors involved in the process. Technical complexity refers to technological uncertainty, dynamics and the uniqueness of the project (de Brujin et al., 1996). Lastly, social complexity indicates interests of involved actors, risk and consequences of the project in relation to its environment. Projects' complexity directly depends on two (2) more variables: stakeholders' identification and engagement (Ulrich, 1987). The first element refers to the process of identification of internal and external stakeholders and what are their needs that have to be satisfied by the project. By considering these needs in the Front-End, is it possible to assess them in a correct way without missing or underestimating any of them. Hillson & Simon (2007) recommend to assess three (3) dimensions for each stakeholder: attitude (supportive or resistant), power and level of interest. These characteristics actively contribute to the project and are expected to have a relevant impact on project's complexity and how to adapt the Front-End phase to the particular complexities.

Ultimately, Gidado (1996) focused the attention on complexity originating from the innovation industry. The author attempts to measure the complexity of the production process developing a tool to assess the complexity of innovative projects and its influence on time, cost and schedule. However, one limitation of his studies is that his approach only focuses on time and cost planning, dominantly including aspects of only technical complexity.

2.6 Response Strategies

After analysing the elements forming the Front-End, it is helpful to look at what are the strategies undertaken by management to achieve reductions of uncertainty, ambiguity and complexity.

2.6.1 Uncertainty reduction strategies

The greatest contribution in this field is ascribable to Cleden (2009). Associated with the project lifecycle the author identifies the uncertainty life cycle, suggesting that every stage has an appropriate strategy that should be enabled. Moreover, Cleden (2009, p. 16) expands the definition of uncertainty introducing the concept of "latent uncertainty", namely the part of uncertainty that is not susceptible to any form of

analysis and inevitably accompanies the project during its entire duration. Latent uncertainty, once triggered, has the potential to develop into unexpected outcomes, causing major problems and/or creating a more severe crisis.

Knowledge Centric Strategies

As stated before, information gathering is a central activity in reducing uncertainty. Increases in knowledge enable decision makers in modeling how events will unfold. Knowledge-centric strategies include two different methods: forecasting model and knowledge map. Forecasting model is used to make predictions about future scenarios based on the identification of project drivers (or variables) and the relationship of these drivers within the firm. The more knowledge a project manager has on these two elements, the more accurate the forecasts can be. Knowledge map is a practical way to address uncertainty that cannot be measured (Cleden, 2009, p. 60) and it's based on the identification of key areas of knowledge within the firm and the quantification of how much is known about each area. For each area, a level of available knowledge is established in order to visibly identify which areas need more information gathering.

Anticipation Strategies

No forecasting model can be totally reliable since it is not always possible to identify all project drivers and their relationships, as well as all the areas involved in the process. If one of these parameters is omitted, the model loses in accuracy and reliability.

When is not possible to gather enough information to improve the level of knowledge, anticipation strategies come into play. As the name suggests, these strategies focus on anticipating vulnerabilities in order to deal more effectively with the problems. Cleden (2009, pp. 72-78) identifies two (2) main anticipations strategies: scenario building and multiple explorations. Scenario building implies a visualization of future project states. Thus, by making an intuitive leap to a future scenario, decision makers could think backwards to detect the key factors that they would need to combine to achieve success. Myddelton (2010, pp. 13-16) argues that good project managers should consider both positive and negative outcomes adopting a balanced stance between a positive and negative attitude.

Multiple explorations strategies are based on the idea that the project is heading in roughly the right direction. From a starting point different parallel experiments are made, each of them with different key drivers. The main assumption is that each experiment has a chance to adjust one key variable, identifying in this way possible path, which may head in the same direction of project's goals (Cleden, 2009, pp. 80). The primary purpose of multiple explorations is to obtain a better understanding of what leads the project towards its goals and where there might be threats. Successful and failed explorations are useful in equal way, because each of them gives deeper information on how to face problems before they arise. Conducting multiple explorations needs a lot of planning and organization and requires high investments both in time and resources, but it contributes in an accurate way to reduce uncertainty in the initial phases of a project.

Resilience Strategies

Anticipation strategies aim to reduce the threat of uncertainty, while resilience strategies focus on minimizing its impact. Turner (2008, p. 52) defined resilience as the capacity to recover quickly from a bad consequence. Clearly, resilience strategies can be enabled

only in presence of trigger points, or early warning signals, as a rapid response to unexpected events.

Agility is the first resilience strategy proposed by Cleden (2009, p. 89). It is considered to be a significant alternative to investments in uncertainty preventions measures and contingency planning. Agility is recommended because it is useful when a project has to adapt and cope with the unexpected and when reorientation is needed or new objectives have to be identified. A Project can gain agility by improving several factors: reduced length of project phases to quickly feedback lesson learned; working iteratively; improving the early warning mechanisms to frequently scan from problems; willingness to change what is not working.

A second valuable strategy to deal with uncertainty reduction is the Fast Learning Loops approach. Key activities are planned to be iterative in way that the closure is achieved only after more cycles of work, and each cycle includes the lesson learned from the previous ones, promoting flexibility and adaptability to uncertainty. Cleden (2009, pp. 107-110) specifies that the main elements of an iterative working process should be represented by the creation of a framework to analyse and evaluate project objectives, prioritizing short-term goals, and by the idea that each iteration is reversible and does not have a critical impact on the project. The iterative nature of the process combines more frequent checkpoints to review opportunities with the possibility to feedback the experience gained to successive phases seeking continuous improvements.

Problem-Solving Strategies

Problem solving strategies can be divided into two different processes: problem framing and solution finding (Cleden, 2009, p. 42). Problem framing consists in decomposing uncertainty in various areas and reflecting on its causes in each segment. Subsequently, solution-finding techniques provide a way to efficiently resolve the uncertainty. The sum of all the solution found for each area should give enough information to reduce uncertainty at an aggregate level. However, in more complex projects, solving all of the constituent parts leaves behind an unresolved root problem, that should be analysed using other techniques.

2.6.2 Equivocality Reduction Strategies

Equivocality arises when information have diverging interpretations. Since the study of the equivocality has been neglected by previous literature, due to the major importance assigned by scholars to the uncertainty, researchers tried to apply techniques and methodologies from related fields of study. Føllesdal (1994, p. 580) suggested implementing hermeneutics theories as a tool for searching for meanings. Brun and Saetre (2009, pp. 581-586) broaden this idea by introducing the Hypothetical-Deductive Method (hereafter HDM) where an interpretation is considered as a hypothesis that has to be tested. The model reduces equivocality in two different but related approaches.

The first approach focuses on interpretations, and on the presence of multiple interpretations as a cause of ambiguity. Interpretations are treated as hypothesis in the HDM that can be tested, resulting in confirmation or rejection. In the second approach, each assumption underlying an interpretation is managed as a sub-hypothesis that can be tested, resulting in confirmation or rejection. If the assumption is confirmed, also the interpretation is accepted. Otherwise, if the assumption is rejected, the interpretation resulting from that assumption has to be rejected.

In conclusion, equivocality is reduced by the HDM not only by testing alternative interpretations, but also by testing underlying assumptions, giving a specific meaning to each piece of information.

2.6.3 Complexity Reduction Strategies

From the literature review it was not possible to identify actual strategies that aim to complexity reduction. Adler (1992, p. 25) claims that the absence of strategies is due to the perception of complexity as perceived as an exclusive feature of large enterprises' projects.

The only strategies to reduce the complexity in projects that can be found in the literature are based on the aforementioned division of complexity proposed by Williams (2002, pp.17, 18) in structural complexity and uncertainty. For the uncertainty the strategies previously discussed can be applied. Structural complexity has to be managed proactively by using typical project management techniques to map and analyse. Time scheduling, activity plan, risk analysis, quality plan and budgeting are relevant tools to effectively manage structural complexity. Macheridis and Nilsson (2004, p. 15) identify four elements that a good strategy should have in order to achieve complexity reduction: integration, coordination, communication and control. Decision makers to efficiently predetermine the order between events and activities should use these elements.

Finally, Simon (1977, pp. 25-28) explains that a good organizational solution to deal with structural complexity is to clearly define hierarchies. Hierarchies are easy to manage because they require less information transmission among their parts and provide stability to the whole system.

Starting from these theoretical bases, derived from the analysis of the literature, and due to the proved scarcity of researches in this field, the authors believe they have identified a gap in the literature of the Front-End phase management implemented by Innovative SMEs. With this study the authors aim to fulfil this gap, being therefore able to provide new insights.

3. Research Methodology

In this chapter, the research methodology governing this thesis will be explored. This implies the explanation and justification of the so called “Research Onion” in order to clarify the research philosophy, the approach, the research strategy, the research choice, the time horizon of the study, along with the techniques and procedures regarding the data collection and data analysis. The chapter concludes by addressing the reliability and validity of the research, as well as the ethical considerations that need to be taken into account.

3.1. Ontology, Epistemology and Axiology

The first step in a business research is to clearly state which are the philosophical positions undertaken by the researchers. In this section, a quick overview of researchers’ choices in terms of ontology, epistemology and axiology is provided; subsequently, these choices will be further discussed.

Ontology is concerned with the nature of the reality and of the social entities (Bryman & Bell, 2011, pp. 32-34). Two different perspectives can express ontology: objectivism and constructionism. On one side, objectivism is an ontological position that considers the existence of social phenomena and their meanings as independent from social actors. It implies that social phenomena and the categories used in everyday life have an existence that is independent or separate from actors (Bryman & Bell, 2011, p. 33). On the other side, constructionism is an alternative ontological position that argues that social phenomena and categories are produced through social interactions and are in a constant state of revision. Constructionism is also referred to as subjectivism since it is necessary to explore the subjective meanings, which motivate the actions of social actors in order for the researcher to understand these actions (Saunders et al., 2009, p.111). Constructionism is the ontological stance adopted for this research, therefore the researchers have to understand the differences of the employees as individual and as a part of the organization, and the related implications. Supporting this choice, the authors believe that, even though project managers are involved in similar projects, their perceptions about similar issues might be different. For example, while conducting interviews, special attention is devoted to gathering information about how the participant value work as part as his or her life as well as the interaction of work life and non/work life, in term of motivation.

Contextually, it is required for the researcher to express its own view regarding the epistemological stance to embrace. Epistemology is the study of the nature and the scope of knowledge through the analysis of what is considered to be acceptable knowledge in a field of study (Saunders et al., 2009, p. 112). Positivism, realism, interpretivism and pragmatism are the four alternative paradigms a researcher can embrace while conducting a research. Positivism implies that only observable phenomena lead to the production of credible data; the authors therefore consider this stance as inappropriate for this study, since the subject of the Front-End phase is too complex to be traced back to natural science methods, promoted by this approach. Similarly, realism assumes that the scientific approach is the most appropriate way to develop knowledge; however, the authors believe that the reality cannot be considered as merely external to social actors and, thus, there is a need of understanding every meaning individual assign to the reality. Furthermore, pragmatism relies on both observable phenomena and subjective meanings as tools to create acceptable knowledge

in accordance with different research questions. Pragmatism might be an acceptable stance for this research, but, since the aim of this research is to find new interpretation of a social phenomenon, interpretivism is the epistemological stance that best fits the purpose. Interpretivism is an appropriate view to study complex human behaviour and social phenomena, as the Front-End phase, integrating human interest into a study (Dudovskiy, 2010, p. 45), thus leading to subjective findings that may differ between researchers (De Villiers, 2005, p. 112). The interpretivist epistemological perspective mirrors the ontological considerations previously discussed. Therefore, researchers have to understand the subjective meaning of social action (Bryman & Bell, 2011, p. 10).

Lastly, axiology should be considered. Axiology is related to the researchers' perspective of the role of values in the research (Saunders et al., 2009, p.118). This research is considered to be value bound since the authors play a significant throughout the research process that cannot be separated from the research.

3.2 Research Approach

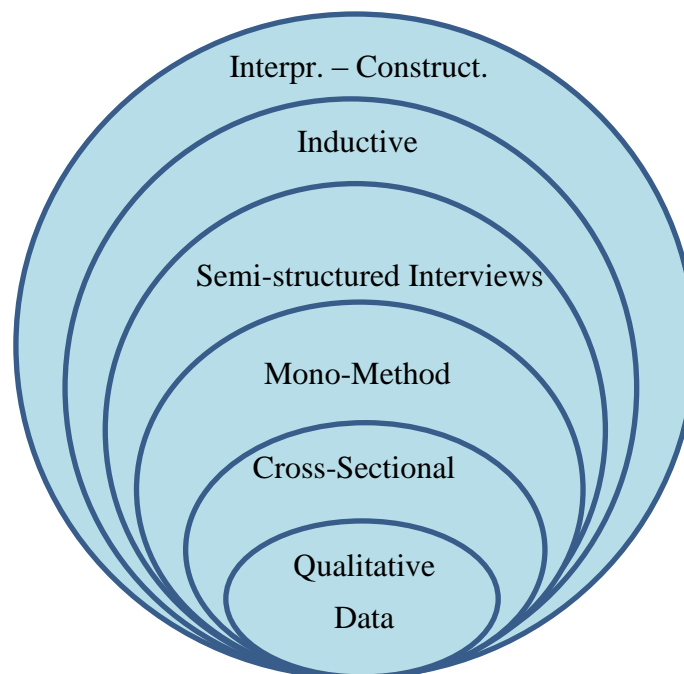


Figure 2. Research Onion

Source: Created by the authors

Having defined the philosophical stances underpinning this research, it is important to define the research approach that will be adopted. Literature presents two different approaches that can be followed: deductive and inductive (Bryman & Bell, 2011, p. 11; Saunders et al., 2009, pp. 124-126). Deductive approach is also defined as “top-down” approach (Williams et al., 2006, p. 12) since an initial formulation of a general view of the system is gradually defined through continuous additions of particulars, reaching the level of detail required. This approach involves the test of various hypotheses elaborated from the theory through the analysis of observations collected to address the hypotheses. The output of this process will impact on the theory leading to its confirmation or rejection. Deduction is a significantly structured approach that is usually based on the collection of quantitative data, and that needs a sample of a sufficient size to support generalisation. Since this approach derives from natural

science, the researcher is independent of what is being researched and, thus, the research is value free.

Bryman and Bell (2011, p. 13) argue that inductive approach produces theory as an outcome of research. The main purpose suggested by scholars is to gain a deeper understanding of the meanings that humans attach to events. Inductive approach starts with the observation and measures of a social phenomenon and the identification of patterns, and then it produces theories based on the collected and analysed data (Saunders et al., 2009, p. 124). Walliman (2005, p. 191) claims that inductive approach is relevant when researchers' main concern is the context in which social phenomena take place, and for this reason the analysis of a smaller sample is more convenient. Moreover, the inductive approach offers a more flexible structure to allow changes of research emphasis while the research is in progress, and it is commonly based on the collection of qualitative data (Long et al., 2000, p. 7). Induction is the approach adopted for the purpose of this research; it is perfectly in line with the ontological, epistemological and axiological stances previously discussed and embraced, because it enables the authors to address the subjective nature of decisions taken into the Front-End phase by different project managers. In addition to that, the aim of the authors is not to create a new theory, but to bridge the gap between literature and practice, providing new insights. As Saunders et al. (2009) stated, interpretivism shows how to develop a truth based on social interaction and induction is the proper approach that moves from observation to theory.

3.3 Research Strategy

The formulation of a clear research strategy is usually preceded by the definition of the purpose of the research. Saunders et al (2009, p. 139) classify research purposes in three (3) different ways: descriptive, explanatory and exploratory. A research might have more than one purpose depending on the nature of the research question. Furthermore, Robson (2002) suggests that the purpose of the research might change over time, to adapt to new findings.

A descriptive study aims to have a clear picture of a phenomenon. It addresses only the "what" question to understand the characteristics of the object of the research. It describes a phenomenon without any attempt to explain why the behaviour occurs or the underlying causes (Robson, 2002, pp. 58,59). Descriptive studies are oftentimes used as precursor research for explanatory studies, which focus on studying a situation or a problem aiming to explain relations between variables. The objective of a descriptive study is to determine which variable causes certain behaviour or if there is a causal-effect relationship between variables. Last categorisation offered by the literature, and the one chosen for this research is the exploratory study. It is used to clarify the general understanding of a problem, often as an initial attempt to lay the foundations that will lead to future studies, or to determine if what is being observed might be explained by a currently existing theory (Bryman & Bell, 2011, p. 21).

An exploratory study can be conducted in three (3) principal ways: search for literature, interviews with experts in the subject and through focus-groups interviews. Exploratory studies usually have an initial broaden focus that becomes progressively narrower as the research progresses, conferring to the research a good degree of flexibility. Adams and Schvaneveldt (1991, cited in Saunders et al. 2009, p. 140) argue that flexibility is one of the strength of this research purpose because it allows changing the direction the research is heading to in presence of new results, and it improves the adaptability of the

study to change. This research is based on an exploratory study because it aims to clarify the understanding of the Front-End phase Managements in projects. Considering the studies already conducted by Siddiqui (2014), Brown (2010) and O'Connor and De Martino (2006) related to the field of innovation and innovative projects, the choice of researchers fell on this type that appeared to be the most suitable. Therefore, search for literature and experts' interviews will be applied.

Having clarified that, literature discusses several different research strategies that can be used for each study regardless of the purpose of the study. Bryman and Bell (2011, p. 39), describes the research design activity as the framework for the collection and analysis of the data. The authors identify five noticeable typologies: experimental design, cross-sectional design, longitudinal design, case-study design and comparative design. Nevertheless, Saunders et al. (2009, p.141) describe a different categorisation of research strategies, which are experiment, survey, case study, action research, grounded theory, ethnography and archival research. Each of them is a different way of collecting and analysing empirical evidence, following a different logic (Yin, 2009, p. 24). Furthermore, there is no hierarchy among these different strategies, since all of them could be used to conduct descriptive, exploratory and explanatory studies. A research strategy should be chosen in accordance with the research question(s) posed, with the degree of control on behavioural events and with the level of focus on contemporary events (Yin, 2009, p. 27). Saunders et al. line of thought is taken into consideration in this research.

3.3.1 Case Study

The aim of this research is to explore and investigate how project managers deal with the Front-End phase of projects. To fully comprehend the importance of this phenomenon it is important for the researchers to observe it in its real life context, because it may lead to the generation of an intensive and detailed evaluation of the phenomenon or the settings. Moreover, the context is an integral part of the phenomenon and cannot be separated from it. Having said that, case study is considered being the best strategy to achieve the purpose of the research. Stake (2004, p. 341) argues that case study strategy is particularly significant when the purpose of the research is exploratory. Yin (2003, p. 14) confirms that case study strategy should be pursued when the objective is to learn if a theoretical idea works in its actual context. Moreover, the same author argues that the strength of case study research lies in the ability for in-depth study of complex social phenomenon in its surrounding environment, providing a chance to gather first-hand experience using a multiplicity of data collection method.

Additionally, case study is the only plausible strategy for this research. The nature of this research limits the use of action research considering that this strategy does not involve generalisation of results (Saunders et al., 2012, p. 147). Alternatively, grounded theory could have been a significant strategy to adopt, because it would have derived from data, systematically gathered and analysed through the research process. Furthermore, as Strauss and Corbin (1998) discussed, the data collection, the analysis and the eventual theory stand in close relationship to one another; however, due to the insufficient amount of time available to complete this research, this strategy has been ruled out (Saunders et al., 2012, p. 148). Experimental research design was a priori excluded since it requires a high degree of control on all the variables involved in the study, and does not consider the context that, instead, is vital in this research (Bryman & Bell, 2011, p. 45; Saunders et al., 2012, p. 142).

Stake (1995, 2003) provides a first classification of case studies, distinguishing between intrinsic case study and instrumental case study. Intrinsic case study includes the investigation of one particular case for its own sake, where there is no expectation that results have implications for other case studies. On the contrary, instrumental case study involves a case study to gain insights into particular phenomenon with an explicit expectation that the results could be used to generalise or to create a theory. Moreover, Yin (2009) identified four (4) basic types of designs for case study based on two different dimensions: single case vs. multiple cases, and holistic vs. embedded. Single-case study approach is usually used in presence of a critical case in order to confirm or reject a theory, or to find some alternative propositions. Other rationales for single-case study design (Sanders et al., 2009, p. 147) are represented by the extreme or unique case, the representative or typical case, the revelatory case and the longitudinal case. The rationale for using multiple cases focuses upon the need to determine whether the findings of the first case occur in other cases, and, thus, if they are generalizable. These results can be used for “literal replication” (Yin, 2009, p. 72), the prediction of similar results that might be applied in other fields, or “theoretical replication”, the prediction of contrasting results but for anticipatable reasons (Sanders et al., 2009, p.145). In this last case, the initial proposition should be adjusted and examined again with another set multiple cases. Holistic and embedded refers to the unit of analysis. Holistic design analyses the phenomenon as a whole entity; embedded design examines each logical sub units of the phenomenon.

In conclusion, this research will be based on a multiple case studies approach for the following reasons. Firstly, multiple case studies are more appealing since their results are considered more robust (Blumberg et al., p. 255). Secondly, scholars have neglected the topic of the Front-End phase management and, this leads to the necessity of considering multiple perspectives in order to fully understand the phenomenon. Finally, the results of this study should be as more generalizable as possible: a multiple-case study is the right strategy because it provides the ground for more accurate and generalizable results (Eisenhard & Graebner, 2007, p. 30).

3.3.2 Time Horizon

The choice of time horizon does not depend from the selected research strategy or the methods employed. It is the time framework within which the study is intended for completion (Saunders et al., 2009, p.155). The research can have the features of a cross-sectional study or a longitudinal study. In cross-sectional studies, the focus is on a particular phenomenon at a specific time, as snapshot of a single moment in time with no consideration of what happen before or after. In a longitudinal study, instead, the researcher conducts several observations of the same subjects over a period of time, detecting developments or changes in the characteristics of the target population. The researcher can then establish a sequence of events, identifying cause-effect relationships (Bryman & Bell, 2011, p. 58).

Cross-sectional studies are oftentimes related to the use of quantitative or quantifiable data. However, it is possible to use also quantitative methods, as many researches are time-constrained (Saunders et al., 2009, p. 155). This research is based on semi-structured interviews conducted over a short period of time; therefore it adopts a cross-sectional design since it aims to collect qualitative data in a specific set of time from different organisations.

3.4 Data Collection – Methodological Choices

Data collection activity, or data generation as suggested by Mason (1996, p. 35), is a fundamental process through which the researcher gathers the information needed to answer the research problem. It is a critical step because inaccurate data collection can influence the results of a study and ultimately lead to invalid outcomes. The methodological research choice refers to the way in which the researcher chose to combine qualitative and quantitative techniques and procedures.

Qualitative collection method is primary used in an exploratory research. It is used to gain an understanding of underlying reason, opinion and motivation. It then provides insight into the problem and helps to develop ideas or hypothesis for potential future quantitative studies. Qualitative research is a subjective process of inquiry done in natural settings in order to construct a complex and holistic pictures described in words (Saunders et al., 2009, p. 168).

On the other hand, the quantitative collection data method is mostly used to quantify a problem by generating numerical data or data that can be transferred into usable statistics (Bryman & Bell, 2011). It is used to quantify attitudes, opinion, behaviour and other defined variable, and to generalize results from a larger sample population. The quantitative research employ measurable data to formulate fact and uncover pattern in research and it has a more complex structure than the qualitative ones.

According to Long et al. (2000) the qualitative methods are more suitable for building theories, whereas the quantitative approach is more useful for testing theories. Morgan and Smircich (1980) point out that quantitative methods are also more appropriate for investigating a reality that is perceived as a concrete structure.

For the purpose of this research, which is to explore the management of Front-End phase of innovative Italian SMEs, a qualitative method will be adopted, since the research addresses its objectives through techniques that allow the researchers to offer elaborate interpretations of the phenomenon without depending on numerical dimension, focusing instead on uncovering true inner meanings and new insights (Zikmund, 2010).

After having defined the qualitative nature of the study, researchers can choose to employ either one or multiple data collection procedures. Saunders et al. (2009, p. 151) identify mono-method or multiple-methods choices. Choosing a mono-method implies that only one between qualitative or quantitative method will be adopted for the data collection. Furthermore, within multiple-methods framework the authors distinguish between mixed-methods, where both quantitative and qualitative data are simultaneously collected, from multi-methods, which it refers to those combinations where more than one collection technique, and corresponding analysis techniques, is used but is restricted within a quantitative or qualitative worldview. Due to the reduced amount of time, this research focuses only on collecting, or generating, qualitative data by conducting semi-structured interviews. For this reason, a mono method will be employed.

Interviews were chosen as the most suitable tool since they allow researchers to gather valid and reliable data that are significant to answer the research questions and objectives. The classification provided by Saunders et al. (2009, p. 320) distinguishes between three classes of interview: structured, unstructured and semi-structured interviews. Structured interviews are based on standardised and predetermined set of questions and always operate within a formal written instrument indicated as interview

schedule. Unstructured interviews have a more informal tone and are widely used in exploratory studies because of their flexibility to the topic that is under the analysis. However, a deep knowledge of all the aspects of the topic is requested to perform unstructured interviews. Lastly, semi-structured interviews propose a list of themes to cover, but they may vary from interview to interview (Saunders et al., 2009, p. 320). Moreover, the order and the logic of the questions is not fixed, since it might vary according to the flow of the conversation, and it is possible to ask other questions beside the ones that were determined prior to the interview. It is actually possible that the majority of questions generate within the interview itself (Bryman & Bell, 2011, p. 467). For this reason, semi-structured interviews are widely used in qualitative researches, as they are referred to as “qualitative research interviews” (King, 2004, p. 142). They encourage a two-way communication between the interviewees and the interviewer, providing not only answers but also the reasons behind them.

Semi-structured interviews represent the most suitable technique to achieve the purpose of this research. Cooper and Schindler (2008, cited in Saunders et al. 2009, pp. 323-324) support the use of semi-structured interviews in an exploratory study since they allow interviewees to explain meanings that they attribute to events and actions. Furthermore, semi-structured interviews allow interviewees to freely choose their words in order to best communicate their meanings, mirroring the choice of the aforementioned interpretivist approach.

3.5 Sampling

Sampling involves selecting a number of individuals from a population for a study in a way that the individuals represent the larger group from which they were selected. It is a necessary process when data collection of the entire population is impossible or impractical due to budget or time constraints (Saunders et al., 2009, p.213). Literature provides two main typologies of sampling: probability, or representative sampling, and non-probability, or judgmental sampling (Saunders et al., 2009, p. 213; Bryman & Bell, 2011, p. 91). In a probability sampling case, the chance of each case being selected from the population is known and it is equal for all cases. Thus, this typology of sampling is widely used in survey and experimental research strategies. Probability sampling can be subdivided in four (4) different techniques: simple random, systematic, stratified random and cluster sampling.

On the contrary, non-probability sampling implies that probability of each case being selected is unknown, and that the researchers' subjective judgment is used in order to select the sample. Generalisation of the results is still possible (Saunders et al., 2009, p.214) but it is not possible to make statistical inferences about the characteristics of the population (Bryman & Bell, 2011, p. 92).

Non-probability sampling offers a range of alternative techniques to select samples based on subjective judgement: quota, snowball, self-selection, convenience and purposive (Saunders et al., 2011, p. 233).

Quota sampling is entirely non-random and it is usually used in researches based on a survey strategy. Barnet (1991) argues that quota sampling divides the population into specific groups, and then calculates a quota for each group based on the available data, to combine them and provide the full sample.

Snowball sampling is typically used when it is difficult to identify members of the population subject of a research. Researchers should identify a first contact within the

population, and then ask him to provide other contacts or further cases to focus on. When no other contact can be identified, or the sample is large enough, the process stops. Lee (1993) suggests using this methodology only if it represents the only possibility, since respondents are most likely to identify other potential participants who are similar to them, resulting in an excess of homogeneousness of the sample.

In self-selection sampling, the researcher publicises the need for cases and collects data from those who respond. Publicity for suitable samples can occur through media or personal invitations.

Convenience sampling involves an arbitrary selection of cases based on their accessibility until the required size of the sample is reached. This technique is widely used in research. However, it is biased by the researcher's influence since the cases are selected only because it is easy to obtain them. (Saunders et al., 2011, p. 241)

Purposive sampling allows researchers to use their own judgements to select cases that can contribute in the best way to reach the objectives and answer the research question (Saunders et al., 2011, p.237). Neuman (2005, p. 56) argues that purposive sampling is often used in researches based on a case study strategy, which best secures validity in small samples (Miles and Huberman, 1994, p. 35). The same authors argue that qualitative research should be based on purposive sampling instead of probability sampling. Therefore, purposive sampling is the chosen methodology for this research since it is based on a case study strategy and the interviews will be conducted over a small number of participants. Nevertheless, for an exploratory study, Saunders et al. (2009, p. 238) suggest purposive sampling technique since it allows the researcher to use his/her own judgment in selecting the most appropriate respondents that can help in satisfying the research questions. This is in line with Mason's (1996, p. 93) theoretical sampling that explains it as the sampling technique that helps to answer the theory in question.

3.6 Assessing the Research Quality

For the purpose of assessing business research, the following three criteria have to be considered: reliability, replication and validity (Bryman & Bell, 2011, p. 41; Saunders et al., 2012, p. 156). Golafshani (2003, p. 598) describes reliability as the degree to which the findings of a study are consistent throughout time. It can be seen as a benchmarking factor in defining whether or not the results can be replicated under similar methodology at a different point in time. Analogously Saunders et al. (2012, p. 156) describe reliability as the extent to which data collection techniques yield to consistent results. Replication is denoted as to what extent a research study can be replicated by other researchers (Bryman & Bell, 2011, p. 41). Nevertheless, validity is seen as the most important criteria among the three. It determines whether the research accurately measures what has planned to measure and how true the results are (Saunders et al., 2012, p. 157). Bryman and Bell (2011, pp. 42-43) assert that validity consists of: measurement validity, which questions whether the findings of the study reflect the concept that it is supposed to be expressing; internal validity, which measures the cause-effect relationship among variables; external validity, that is concerned with the factor of generalizability of the findings. However, the concepts of reliability, replicability and validity are strongly criticized and viewed as inadequate by the practitioners of qualitative research (Golafshani, 2003, p. 599). Lincoln and Guba (1985, p. 219) coined two alternative criteria for evaluating qualitative research: trustworthiness and

authenticity. For the purpose of this study, the approach presented by Lincoln and Guba (1985) will be assessed in terms of trustworthiness and authenticity.

3.6.1 Trustworthiness

Trustworthiness can be divided in several sub-categories: credibility, transferability, dependability and conformability (Lincoln & Guba, 1988, p. 2).

Credibility evaluates the trustworthiness of the research by determining the feasibility of the findings. It deals with the question on how compatible are the findings with the reality (Lincoln & Guba, 1985, p. 293). It observes the compliance of the empirical observations and theoretical philosophies presented on the study (Bryman & Bell, 2007, p. 410). When comparisons are drawn with quantitative research, credibility is proportionate with internal validity that is a measure for causality (Bryman & Bell, 2007, p. 411). In order to promote confidence and increase credibility throughout the study the researcher has to ensure an early familiarity with the culture of the individuals and environment being studied (Shenton, 2004, p. 65). While focusing on the role of the Front-End phase, this research aims to increase credibility by ensuring that the study is conducted in accordance with the rules and procedures defined by Bryman and Bell (2007, p. 411).

The second criterion introduced by Lincoln and Guba (1985, p. 295) is concerned with the transferability of the results, also referred to as the possibility of generalizing the information gained from the conducted study. It recalls the concept of external validity when observed from the quantitative perspective (Bryman & Bell, 2011, p. 43). The generalizability factor can be of a particular interest if the researchers are employing case study research in one organization or a small number of organizations (Saunders et al., 2009, p. 158). Lukka and Kasanen (1995, p. 86) observe that generalizability of the findings derived from qualitative research is higher, considering that at such situations the researcher tries to understand the context of the setting being studied but also accumulates knowledge from prior studies.

In this particular study, the authors decided to interview a particular group of companies from the innovation industry, which are considered an appropriate sample to be used for empirical evidence. Although one may argue that the sample size of the study limits the generalizability of the results, in overall term the findings provide robust information, which can be categorized under analytic generalization (Yin, 2009, pp. 38-39). Analytic generalization requires the identification of the existing data in the literature; ergo, it focuses on providing a solid theoretical framework (Saunders et al., 2009, pp. 333 – 336).

Dependability is strongly related to the criterion of reliability, observing whether the findings of a study are repeatable (Bryman & Bell, 2011, p. 398). In searching for dependability, the researcher has to study if the work could be repeated and could give the same results, considering the same settings used in the original work (Shenton, 2004, p. 71). However, in reality this is difficult to achieve, since the social settings are continuously changing and it is not possible to isolate, as a researcher would do in a study based on an experiments strategy (Bryman & Bell, 2011, p. 399).

Last but not least, conformability requires that the researcher has carried the study in good faith (Bryman & Bell, 2011, p. 398). The criterion stresses the importance of ensuring that the findings are an objective result of experiences and opinions of the participants, rather than the preferences and stances of the researcher/s (Shenton, 2004, p. 72). As from the beginning of this study, the researchers acknowledged the fact that

complete objectivity cannot be achieved, however, throughout the authors have attempted not to let personal values and theoretical implications affect the process so that conformability of the findings is achieved.

3.6.2 Authenticity

Lincoln and Guba (1985, pp. 219, 220) stressed the importance of the authenticity, which plays a significant role in a research. Authenticity criteria are commonly referred to as intrinsic criteria, and they include: fairness, ontological authenticity, educative authenticity, catalytic authenticity, and tactical authenticity (Morrow, 2005, p. 252). On one hand, fairness is reached by guaranteed by simultaneously considering a set of various theories elaborated in the project management literature and the point of views expressed by individuals who were subject of research (Bryman & Bell, 2011, p. 398). On the other hand, tactical authenticity is achieved by conducting open-ended questions, which give the respondents sufficient control over the interview and topics they want to cover.

In essence, as demonstrated this study fulfils the criteria of trustworthiness and authenticity. One should always bear in mind that when employing qualitative research, objectivity and replicability is hardly maintained due to the constant changing environment that surrounds the social setting being studied. Nonetheless, detailed attention has been placed at all stages of the research; therefore, aiming at providing a theoretical and practical contribution within the field of Front-End Management.

3.7 Ethical Considerations

In the context of a business research, ethics refer to the appropriateness of researchers' behaviour in relation to the rights of those involved or affected by the study (Saunders et al., 2009, p. 183).

Ethical considerations, also defined as moral philosophies, focus on the methods by which information is collected and the way the information is conveyed to the target audience. Ethical rules encourage the roles of research, such as the acquisition of knowledge, the pursuit of truth and the avoidance of errors.

That being the case, scholars agree about the existence of two opposite philosophical stances within the business and management research: deontology and teleology (Bryman & Bell, 2011, p. 140; Saunders et al., 2009, p. 184; Diener & Crandall 1978). Deontology argues that a research has always to follow ethical behaviours in every phase of its research process, and that unethical behaviours are never justified. It is defined also as "duty-based" ethic since it identifies a set of guidelines or rules that a researcher should not break (Truman, 2003, p. 9). By contrast, teleology claims that acting unethically can be a path to follow if it would justify the results. Unethical behaviours should be weighed against the benefits of the research (Saunders et al., 2009, p. 184). It is also labelled as "consequence-based" ethic since the results or the outcomes of decisions establish what is ethical (Truman, 2003, p. 11). The present research embraces the deontological stance since it is guided by the Umeå University's code of ethics. It provides the list of principles and procedures for the conduct to distinguish what is and what is not considered to be ethical.

Ethics apply at every phase of the research, and researcher must ensure that the rights of all the individuals involved are not violated in any way (Gall, 1996, p. 22). Bryman and Bell (2011, p. 75) argue that every business research should have deep basis in goodwill, trust and professionalism. Moreover, the same authors identify several main

ethical considerations that should drive a research: informed consent, privacy and confidentiality, deception and risk of harm of participants.

Informed consent refers to the permission researchers should have from people they are collecting data from. This means explicating to hypothetical participants the purpose and the nature of the research so they can spontaneously decide whether or not to be involved. Relatively to this research, every participant has been fully informed about his/her rights and the use of data. Additionally, interviewees had the opportunity of declining given consent or terminating their involvement in the research at any point. Furthermore, during the aforementioned semi-structured interviews, participants and researchers have signed consents in the form of written agreements.

To ensure the respect of the privacy, the identities of interviewees remain anonymous throughout the whole research, together with the organizations to which they belong. Their data is not traceable back to either them or their organization. This is ensured through the removal of any personal information before the analysis of the data is performed in order to protect the data and improve anonymity. All gathered data would be used only for the purpose of this research. Confidentiality is also guaranteed through the signing of a confidentiality agreement: respondents are more willing to express their views and opinions if they know that the information is going to be used in a confidential manner (Cooper et al., 2006, p. 95).

Deception happens when the researcher provides misleading information from participants about the study or omits information about the real purpose of the research. Deception should be minimized (Bryman & Bell, 2011, p. 80) or, if necessary, its degree and effects should be mitigated as much as possible. Needless to say, any form of deception while accessing to data or gathering information is strictly forbidden by the Umeå University code of ethics since it clearly states, “the researcher may not act deceptively in data collection and data reporting”.

Lastly, it has to be clarified that no participant has been harmed in any phase of this research. By signing the Informed Content, the Confidentiality Agreement and Non-Disclosure Agreement participants’ rights have been guaranteed and protected.

4. Data Analysis in Practice

The aim of this chapter is to analyse the empirical data collected by the researchers. In order to analyse the findings of the research the following activities must be described and explained: the participant selection process, the participant description but also the interview process. Moreover, in order to show the core findings of the research, the application of the template analysis will be demonstrated. The authors will focus on presenting the main findings in the order that it has been showed in the research question. Therefore, the final purpose of this chapter is to establish the structure of the succeeding chapters, facilitating the reader's comprehension and the flow of the findings discussion.

4.1 Participant Selection

With the intention to explore the Project Management strategies used in the Italian innovative SMEs during the Front-End phase of a project life cycle, the researchers have concentrated on setting interviews with Project managers only. A scan of databases of innovative SMEs has been performed in order to identify possible candidates to interview. During the selection the focus of the authors was on those companies that operate only in Italy. Over 30 innovative SMEs were contacted in order to arrange an interview, but only 6 companies provided us a name of a Project manager available of taking part of this research. This number, turned into statistical percentage reveals a response rate of 20%. However, considering the case study strategy adopted in this research, the number of respondents is sufficient to conduct a research and have reliable and generalizable results, as Yin (2009, p.44) indicated the minimum number of participants to be 5 in a case study based research, and Creswell (2007, p.6) has indicated 3 as minimum number of participants.

The method adopted by the authors was to contact the possible candidates through e-mail in order to arrange the most suitable time for conducting the interview. Attached to this e-mail there was an initial document created appositely by the authors, which contained the aim of the research and the request to participate to it.

The researchers have decided to focus on SME (Small and Medium Enterprises), with a number of employees up to 250 and with project that are going on also in foreign countries. Concerning the educational background of the people interviewed there are four (4) areas represented. From the two enterprises in the IT sector, one candidate is an industrial engineering while the other has only graduated from high school, therefore no university degree. Both the two candidates operating in the construction sector have an Economics university degree, and least but not last the remaining two candidates operative in the manufacturing sector possess a University degree or more. In order to show this type of information in a more visual way, the researchers have included a table.

Furthermore, in order to be able to evaluate the reliability of their responses we established that was important to consider the sudden interviewees study background and in particular if they had any Project Management degree or certification.

Table 2. Candidates' Background Information

Interviewee	Company's size	Educational Background	Industry typology
Candidate 1	25	Bachelor' degree in Business Administration	IT Projects
Candidate 2	140	MBA	Manufacturing
Candidate 3	210	Master of science in Project Management	Construction
Candidate 4	40	Bachelor degree in Economics	Manufacturing
Candidate 5	70	Industrial engineering degree	IT Projects
Candidate 6	60	IPMA Certificate	Construction

Source: Created by the authors

4.2 Interview design

In order to clarify the type of question asked during the interviews by the researchers, a list has been included in the appendix. The interviews constructed by the authors were separated into three distinct phases.

The first stage was used by the interviewers to present themselves and create the atmosphere, to make both researchers and the interviewees feel comfortable, but also to introduce the topic that would be discussed during the interview. Once both parties were on the same page, the privacy matter was discussed, where researchers explained that all the answers obtained from the interviews would be used only for educational purposes and no names would be published in the thesis, which ensure the confidentiality of the data.

The second stage was focus on questioning about the importance and the role of the Front-End phase for the interviewees as a person and as member the company in which they are employed. A list of seven questions was initially created for this stage, but depending on the answers received, other following questions were articulated. These questions have been built on the basis of research done previously by researchers, thus on the basis of the theoretical framework developed on Chapter 2.

The third stage of the interview consisted of questions on the strategies adopted in order to improve effectiveness of the Front-End phase. A total of 19 question were asked, starting from a wider context (i.e. the Front-End process in general) to a more detailed one, narrowing down to the importance of the initial part of a project, also called conceptualize phase, and the effectiveness of the available strategies on the market. The list of questions used by the researchers is illustrated in the appendix.

Since the decisions and actions made in this stage have the power to affect the whole performance of the project, the researchers have stressed on getting more detailed information by the interviewees in the second and the third stages of the interviews.

4.3 Interview Transcription

By common consent, the researchers decided to do the transcription process on the same day that the interviews were conducted. The transcription was time consuming, but it was important to do it right after the for the sake of avoid piling up and to not mislay

any important citation or information. The interviews have been scheduled in order to allow both the authors to assist them and to take notes to gain more reflecting opinions and insight on the responses received by the respondents.

The authors opted for this method also because initial findings from interview encode could lead to different shape of the subsequent interviews questions. Once all the interviews have been transcribed, including the personal insight, the data analysis process was initiated.

The transcription of the interviews is not included in the appendix, but is available upon request for any applicant.

5. Findings

In the current section, the results of the empirical study of the research are presented. Following the logic of the semi-structured interviews, the first topic addressed regards the definition of the Front-End phase, followed by the observation of its role within the context of every interviewed organisation. Lastly, the focus is moved to the strategies adopted by practitioners in order to deal with to the three core elements of the Front-End phase identified by literature review: uncertainty, equivocality and complexity.

5.1 Defining the Front-End Phase

The introductory part of the semi-structured interviews focuses on setting the basis for a common understanding of what the Front-End phase is. The reason behind this is that “Front-End phase” is not the only term used; thus, the first aim of the semi-structured interviews is to define a clear terminology to employ. Respondents suggested different definitions, even though all participants came from similar industries. Different terms were used to identify and define the Front-End phase, including: Initiation phase, Diagnostic/ Diagnosis phase, Pre-study, Predevelopment. Regardless the term preferred it was possible to find commonalities on some specific features of the Front-End phase. These common elements are presented below.

- (1) It is a preliminary phase in which significant decisions about the efficient allocation of resources are made

According to respondents, the Front-End phase is a prerequisite for the decisions on the continuation of the project, in order to find the most efficient allocation of resources. In the majority of cases, the decisions are not necessarily implemented at the end of this phase, thus they have a preliminary nature. Commonly, Front-End phase is perceived as preparatory to a subsequent feasibility study, in which a final decision about the project is taken. Furthermore, respondents agree that the decisions taken in the Front-End phase are reversible, because the cost of change is still at an acceptable level.

Respondent 2: “The end of the Front-End phase is very critical, because the decisions need to be focused on committing a significant investment of resources (time, resources, staff) on a single project.”

Respondent 4: “...decisions are not irreversible and there is still time to go back, analyse alternatives at a low cost, and take another route more effective”.

Respondent 5: “The fuzzy Front-End is the time between when you accept the job and when you actually start, and it’s magic time. Very very important time.”

- (2) Decisions are taken in a context of uncertainty and ambiguity

Respondents agree on the uncertain and ambiguous environment of the Front-End phase, since there is not enough clearness on what effectively has to be done. The term “*fuzziness*” occurs in one respondent (n° 1) and refers to the predominant nature of the Front-End phase. Uncertainty is the main responsible for this messy nature since, in many cases, project teams are not aware of what should be done and which direction should be undertaken. Ambiguity corresponds to what in this research is labelled as equivocality. Although the difference in terminology, equivocality is an important factor firms should deal with, because it causes dissonance in understanding what the

project is going to achieve. Nevertheless, complexity is perceived as an integral part of a project based on innovation.

Respondent 1: “Our first objective is to effectively understand the possibilities of the situation. But in many cases the situation is fuzzy, we don’t even know all the variables. Uncertainty is the main cause of all the issues we face in this stage.”

Respondent 4: “Ambiguity is often easy to identify, because it causes problems even in the basic communication with teammates. But not always you know how to deal with it.”

(3) It is an iterative phase that precedes the operative phase of the project

From the perspective of project managers interviewed, the Front-End phase is a step that generally precedes the operational stage of the project. It is the starting point where opportunities are recognized and concepts are developed before entering in the actual product development process. Front-End phase also has an iterative nature: according to the respondents, project managers can go backwards and revisit the project definition phase in order (i) to reflect on the actions undertaken and control their consequences on the other stages of the project; (ii) to modify and adapt the scope of the project as response to new findings; (iii) to ensure that all the participants have the same understanding of the project

Respondent 3: “It comes before the phase when you actually do the work, when you get your hands dirty!”

Respondent 5: “Usually in this phase we have many iterations: it means we go backwards to check our conclusions, and to make some improvements. So we can focus on the next decision that has to be taken.”

(4) Project managers and Project Teams can implement strategies to reduce the fuzziness and manage the Front-End effectively.

Interviewees agreed that, in order for projects to be aligned with organizational strategy—and stay aligned—it is important to recognize the turbulence of the environment, and build in the competency to cope with this turbulence at the Front-End phase of the project. The theoretical background of this research highlighted a set of strategies that project managers can implement to deal efficiently with the Front-End phase. However, it is not possible to adopt a systematic approach for every project since there might be differences in projects’ context and the environment might change rapidly. It can be observed that project managers agreed on stating that there is not a single magic tool or unique strategy that can be applied to every situation. Nevertheless, it is possible to state that strategies can to be adjusted and modified in accordance to the project specifications, the context, the projects environment and the people involved in it.

Respondent 4: “[in the Front-End phase] we often have quite confused, poorly structured situations where objectives are not clear, where different participants have conflicting aims.”

Respondent 6: “It’s a bit of a black box for a lot of Project managers, but this doesn’t mean that the fuzzy Front-End is managed with chaos.”

Respondent 2: “Normally this phase does not involves much money, in terms of what you are spending, but clearly since we are talking about new idea or process it does require a structure. That’s why the implementation of strategies is important for us.”

- (5) Decisions undertaken in the Front-End phase have consequences throughout the whole project life cycle

Respondents stated that project success is to a great extent depending on decisions made in the Front-End phase. The impact decisions can have on the overall project result decreases along with the project evolution: whereas Front-End decisions can impact the outcome of the project as a whole. For this reason, some of the interviewees believed that the Front-End phase has a strategic nature. In order to succeed in strategic terms, planners need to have an open and long-term perspective. Although firms should be proficient in each phase of a project, the most significant benefits could be achieved through improvements in the performance of the Front-End activities. Some of the respondents identified benefits of a well-managed Front-End phase, which can be summarized in (i) increase of future revenues; (ii) increase of profitability; (iii) increase of the overall performance of the project; (iv) increase in efficiency. Lastly, respondents underlined the importance of Top Management involvement, since it can support the alignment of individual activities because it provides strategic thinking to the Front-End phase and often cuts across functional boundaries.

Respondent 2: “We are always looking for a balance the fuzzy Front-End, in every single project. We are doing so because our aim is to minimize the problems that can arise in the other phase of a project”.

Respondent 3: “All the decision taken in this phase can affect the whole project life cycle, and we are conscious about this. This can be explained in terms of costs saving, because reducing some expenses in this phase is cheaper than reducing them in a later stage, and also because investing money in modification or improvements of the project is more economical in the FE than in the future. Front-End team performs better what its members fully understand and accept the purpose and goals of the organization.”.

Respondent 5: “Our Company considers the Front-End phase very important, because improving “now” is easier, faster and more efficient that improving “later””.

5.2 The Role of the Front-End Phase

The core part of the semi-structured interviews is concerned with the investigation of Front-End phase and its importance as perceived by project managers. The Front-End phase benefits from a general consensus among the participants in terms of importance. However, depending on the variables project managers were focusing on while being interviewed, it is possible to identify different stances. Some considered the resources used in this stage, and argued that the Front-End phase is less important than other project phases, since the actual usage of resources is limited if compared to other phases, such as project implementation. Others stated that the Front-End plays a paramount role and it is vital for a firm to go through this phase properly in order to achieve project’s objectives. Lastly, a third option was that every project phase is important, because very stage has its own opportunities and challenges.

The majority of the respondent state that the role of this phase is not easy to explain, it is a very complex process in which companies need to know and understand about the unmet needs that can help to feed a new product development process. Project managers remark the importance of this phase associated with the complexity of it, due to the multiple variables existing.

Respondent 4: "...it's a significant phase, but I wouldn't say it's the most important. Think about executing a project. It's a really complex mission, because you have to coordinate a wide range of activities, teams, manage the budget, ensure transparency with regards to finance, sustainability etc."

Respondent 3: "The most typical example we use: it's not possible to build a house starting from the roof, or from the walls. Foundations come first, like Front-End and planning in every project thus is the most important phase."

Respondent 2: "It's the phase in which expectations are set, but it's not more important than the others. All phases are equally important, for the sake of the project."

Respondent 6: "It's a chaotic and complex phase, it's not a structure process like the development one. We need to consider a lot of variables, such the impact of the business strategies, the customers' demands and understanding the technology in order to understand the future possible issues."

5.3 Perception of Innovation

The aim of this section is to get an understanding of what is the project managers' perception of innovation, the same question have been asked to every respondents and the answers were pretty similar. Many organizations, especially SMEs, in the past have been able to obtain good results using very limited amount of innovation. They were concentrated on delivery good quality products and from time to time update them to a level high enough to let them maintain their competitiveness in the market. Nowadays, the need to improve efficiency and effectiveness in the organization, along with the globalization and thus the enormous competition that surrounds the market pushed companies to include innovation in the process.

Most of the respondents when asked about innovation started to discuss the concept of creativity and how those two are tied together. The project managers that have been interviewed think that is possible to have creativity without innovation, nevertheless they were very clear on stating the fact that you cannot have innovation without creativity. For them it must be considered as a requisite. Moreover, some of respondents have recognised multiple factor that can prevent innovation from happening. Since this research is focus on SMEs time and resources are the main barriers, but the reluctance of the leaders towards new ideas is also an important factor that need to be considered.

Respondent 1: "I don't think you can have innovation without creativity."

Respondent 2: "It's a complex process of implementation of a product already existent on the market or the creation of a new one."

Respondent 4: "Innovation is strictly related to the technological advance. It's nowadays vital because it can drive down cost and more important improve the productivity"

Respondent 6: "Innovation is not always easy! There are several barriers to it, the common ones are time, resources and a leader that is not open to new ideas"

5.4 The Common Pitfalls in the Fuzzy Front-End

Analysing the interviews it can be seen that there are some common pitfalls in this phase no matter the sector of the SMEs. First of all, it is noticeable a lack of understanding about how communications works in the organizations' structure, there is a need of proper knowledge sharing. Many times Project managers decided to start a

project without consulting enough with others co-workers, having a weak understanding of the consumers and of the environment. Second of all, is a lack of understanding of what is the customers demand, therefore it may happen that the team is suffering in the process of figure out what the needs really are. Beyond that, even if the team is conscious of what these needs are, a good organization should find out those unarticulated needs that could help the team in the design of the product. Last but not least, a pitfall that can arise in the conceptualization phase is the miscalculation of the rate of return (ROR) base on the estimation cost and a very risky price scenario. This is a common problem especially in enterprises that develop new products or ideas.

Respondent 3: “Project managers should put more focus on how people think, how the situation works, and especially how you can work together with your team, but most of the time this does not happen. We should focus more on knowledge sharing, I guess that is the key.”

Respondent 4: “It happens quite frequently that miscalculation of the ROR leads to influence and affect the good performance of the project.”

Respondent 5: “Most of the times organizations have a lack of understanding toward customers’ needs, and this can turn into a bad management of the Front-End phase.”

5.5 Front-End Strategies and Techniques

The last part of the semi-structured interviews is focused on understanding how Italian SMEs that manage innovation projects deal with the Front-End phase. The main focus is to comprehend if the three fuzziness factors identified by the literature and indicated in the theoretical background have correspondence in practice. While there is a unanimous consensus about the primary role played by uncertainty and equivocality, complexity is considered to be a secondary element.

5.5.1 Uncertainty

Respondents agreed on considering uncertainty the first and most important challenge that project managers commonly have to face in the Front-End phase of their project. Moreover, some of them preferred to operate a clear distinction between risk and uncertainty, describing them as cause and consequences. This is relevant because it improves the definition of uncertainty, as the situation in which is not possible to calculate any risk. Consequently, in order to define risks associated with the project, managers should focus first on how to efficiently define and manage uncertainty.

Respondent 1: “Uncertainty and risk are often perceived as synonym, but in reality one is the cause of the other”.

Respondent 4: “... separating them [risk and uncertainty] is the first step to understand their effects on project performance”.

Respondent 3: “Consider when you have to play a new game, but you don’t know the rules. That’s a situation of uncertainty. If you don’t know the rules, you cannot calculate any outcome and any risk associated with it. Defining the rules, makes the situation certain”.

Once clarified that, it was possible to address the topic of the identification of the major issues caused by failures in uncertainty management. In this section, respondents were asked to indicate the major challenges encountered in managing the Front-End phase. The challenges that arise in this specific phase are summarised in the figure below.

Table 3. Strategies Used by the Respondents

Strategy	Implemented to:	Respondents Using It
Forecasting Model	Reduce uncertainty	6
Knowledge Map		6
Scenario Building	Anticipate uncertainty	5
Multiple Explorations		1
Agility	Minimize the impact of uncertainty	5
Fast Learning Loops		3
Problem framing and solution finding	Solve uncertainty	5

Source: Created by the authors

Knowledge centric strategies in practice

Knowledge centric strategies are the first to be considered in the semi-structured interviews. Respondents were asked to indicate which strategies they implemented in order to reduce uncertainty. They agreed in considering the Front-End phase as an initial recognition of an opportunity and a firm that wants to succeed in exploiting opportunities needs a constant flow of high quality information, as well as procedures for assessing this information. Information gathering and screening play the most important role in the definition of these strategies. Lack of knowledge refinement and screening often result in increases of costs of later stages of the process. After refining information, a firm should focus on the screening process. It is considered a critical step in Front-End phase management, because initial screening has the highest correlation with Front-End success. Accordingly, terminating inferior projects based on poor quality information in the initial phases often results in large costs savings. Information gathering and screening are related to the two knowledge strategies discussed in the theoretical background of this research: Forecasting model and Knowledge map. What the interviews have highlighted is that these two strategies are not alternatives, but complementary: one is usually applied to support the other.

Respondent 3: “what I am looking for is a right balance in screening the information: I want to get rid of losing project ideas as soon as possible, but at the same time I should consider that I might kill winning ideas as well. So, yes, adequate degree of balance is what I seek.”

Respondent 2: “We are used to divide and analyse the areas in which we have a significant lack of knowledge. Those areas are the ones we need to focus on more, in order to bridge this information gap. A Knowledge map visibly shows this.”

Respondent 6: “Forecasting is the prelude to the real planning phase. Before making plans, it is useful to have estimation on the conditions that will exist in a future scenario.”

Lastly, some respondents stated that they are used to integrate forecasting model and knowledge map with two other Project Management techniques: business analysis and feasibility analysis. Business analysis is used to ensure a future financial profitability of the product, while feasibility analysis determines if a firm can support a new project with sufficient resources.

Respondent 4: "... assessing the resources we can use on different projects is always a necessary step. It's what is commonly labelled as feasibility."

Respondent 2: " if the projects' products don't have market, we might think of not developing them yet. A business analysis helps in defining it."

Anticipation strategies in practice

The next step of the discussion is focused on anticipation strategies. The literature review has previously identified two major anticipation strategies; however, practice shows that only the use Scenario building is widespread, while Multiple Explorations play a secondary role.

Respondent 2: "When we don't have enough knowledge, and it's not easy to gather more information, we try to visualize what could happen in a future scenario. After that, we think backwards trying to identify every variable that comes into play."

Respondent 6: "personally I recommend using simulations as an exploratory method for decision-making, mainly to highlight the discontinuities from the present and to reveal the alternatives available and their potential consequences."

When asked about the Multiple Explorations, respondents have provided different opinions. Two respondents were not aware of the existence of this strategy, while the remaining four knew about its use in practice. However, while three respondents stated that they did not adopt this strategy because of the amount of work, time and investment required, only one interviewee (respondent 3) confirmed the use of this strategy in his company.

Respondent 5: "Our projects often involve several variables. Conducting an experiment for each variable would be too expensive."

Respondent 3: "...when a project is really important, you can make an effort in economic terms and implement this strategy. Moreover, the investment is not lost, since the results of this strategy are used to increase the efficiency of the stage, and the overall performance of the project."

Resilience Strategies in Practice

Resilience strategies are implemented when a fast response to unexpected events is required. Interviewees claimed that resilience strategies can be preferred to anticipation strategies when (i) investing in anticipation is more expensive than investing in resilience, and (ii) because the scenario building technique previously discusses is not always completely reliable. Thus, the majority of respondents indicated the Agility strategy as the best solution for this situation, while half of them rely on Fast Learning Loops.

Respondent 2: "How do we enhance agility? First of all, we reduce the duration of each project phase, so the lesson learned travel faster through every stage. Secondly, we work iteratively, where each iteration is focused on a specific task."

Respondent 3: “Agility is necessary because it is the ability to adapt, especially in a volatile environment in which there is uncertainty about project requirements.”

Respondent 5: “The Learning Loop strategies help you to make sense of what you have done in the past and what you intend to do, it can help you in planning your next step by breaking down the project in stages for continuous improvements.”

Problem Framing and Solution Finding Strategies in Practice

Last two strategies analysed are Problem Framing and Solution Finding. However, while from the literature review these two strategies emerged as separate but sequential, semi-structured interviews showed that in practice those are treated as two different phases of the same strategy.

Respondent 5: “Reframing a problem helps you consider it as an opportunity”

Respondent 6: “rethink the questions and challenges assumption, that’s what we labelled as frame-storming.”

Respondent 3: “Problem framing is the first step, because you want to go beyond the problem and consider also the context. After that, finding a solution should be easier.”

5.5.2 Equivocality

Before starting the discussion about the role of equivocality, it has to be noted that it is not the actual term used by practitioners. Even though the literature explicitly refers to that concept as equivocality, project managers interviewed prefer to use the term “ambiguity”. However, it is just a difference in terminology, as the concept remains unchanged. For this reason, in this section equivocality and ambiguity will be used as synonym. Having clarified that, the focus was moved to the issues caused by the presence of equivocality and the strategies on how to reduce equivocality in the Front-End phase. Initially, the respondents were asked if they were aware of the role played by the equivocality within the Front-End phase. Responses were discordant, because some respondents acknowledged only the role of uncertainty, while the majority considered equivocality on the same level of uncertainty.

Respondent 1: “...we prefer to focus our efforts on uncertainty, since ambiguity can be reduced through explanation.”

Respondent 4: “In the past we were not used to consider ambiguity as a primary issue, but once we experienced so many problems of communication and interpretation, that it was mandatory to clarify any meaning before starting.”

Respondent 3: “Clarity is one of our strength point. So it means that uncertainty and ambiguity have to be at the lowest possible level.”

Mirroring the previous ideas, the choice of how to intervene to reduce ambiguity is not unanimous. One company (due to its small size) does not adopt specific equivocality reduction strategies or techniques, because it can take prompt action to stop any problems arose from ambiguity, given the number of staff employed in the process. Three other companies often implement strategies focused on process formalisation. Formalisation in the Front-End makes the whole phase explicit, widely known, with clear decision- making responsibilities. By balancing the level of formalization it is possible to detect and evaluate critical issues without adding unnecessary complexity, costs and delays to the Front-End phase. Last two companies had experience in implementing the Hypothetical-Deductive Method that has been explained in the

theoretical background of this research. However, while one of them is still in the initial phases of the implementation of this strategy, the other has been adopting it for years.

Respondent 1: “if I understand that a concept is not clear and a clarification is needed, I can schedule a meeting with the team and make things clear.”

Respondent 6: “[the FE] requires a bit of formalisation. Not too much otherwise it would cause a loss of flexibility of the whole process, but an adequate amount of it helps in taking formal decisions instead of improvised decisions.”

Respondent 2: “[HDM] is a new methodology we are trying to implement for some new projects. The premises are good, but we have not yet had tangible results.”

Respondent 3: “We have been using HDM for 2 years now. It is a long process, it might be expensive because testing hypothesis and assumption is often time consuming, but the outcome is significant, since it makes misinterpretations impossible to happen.”

5.5.3 Complexity

Project complexity is the last element of the fuzziness addressed in the semi-structured interviews. Respondents were asked to define its impact in the Front-End phase, and which strategies or techniques have to be adopted in order to reduce problems caused by complexity. There has been a general consensus on the definition of complexity, and interviewees agreed on considering structural complexity as the main issue. Furthermore, interviewees agreed on considering that there is not a standard strategy to deal with complexity, since it varies from on project to another. Anyway, from the suggestion of every participant, it was possible to identify some common techniques and approaches used in practice. This will be shown in the table below, together with the number of respondents who are using them.

Table 4. Strategies and Techniques Used by the Participants

Strategy or Technique	No. of interviewees using it
Definition of Hierarchies	5
Cooperation and Communication	5
PM budgeting, scheduling, risk analysis	6
Preliminary Technology Assessment	4

Source: Created by the authors

Definition of hierarchies provides stability to the system since it can reduce the communication overhead by limiting information flow to direct superiors and subordinates. Cooperation among functions and departments impacts positively on complexity reduction, because it makes knowledge available to the whole firm in the Front-End. Respondents stated that the existence of a multifunctional team proved to be necessary to achieve success in Front-End phase, but trust and effective communication among members of the team was found critical. Time scheduling, activity plan, budgeting and risk analysis are typical project management techniques employed to proactively manage structural complexity. Lastly, preliminary technology assessments are greatly related to an efficient management of the Front-End phase, because it enables project manager to identify technological requirements of the project before investing time and resources on it.

Respondent 4: “ Complexity, let’s see: I would refer to the parts that constitute the project, the number of parts, the characteristic of each part and how they are interconnected.”

Respondent 3: “we usually use time scheduling, activity plan and budgets as tool to map and analyse structural complexity.”

Respondent 5: “..structural complexity can be managed through what we define as integration, that is to say communication and coordination.”

Respondent 2: “An early technology assessment means considering if the product can be developed, which technical solutions is needed and at what cost. Complex projects tend to be rejected or postponed if they require complex technologies.”

6. Discussion of the Findings

The present chapter will compare the results obtained by the researchers examining the interviews, thus the findings, with what has been examined in the literature review and the final aim is to answer to the research question. We started examining the perception of the Front-End phase, its importance and then discussing how project managers define it and what is their approach towards this phase. The chapter will continue showing which strategies are more employed and why some of them are preferred over others for this specific phase of a project.

6.1 Project Managers' Perception of the Front-End Phase

The focus of this research is on project definition phase, also known as Front-End, therefore the authors decided to start the discussion talking about how project managers define it and its role inside their organizations. It is necessary to begin the discussion here, in order to follow the order of the literature review. The aim of this section is to compare what is the project managers' perception of the Front-End phase and what is state in the literature.

Analysing the literature it can be seen that there are several terms used to define this specific phase, therefore there is a general disagreement. Some authors call it Front-End phase of project (Williams & Samset, 2010; Winter, Smith, et al. 2006), others use different names such as initiation phase (Besner & Hobbs, 2006a, 2006b) or project definition (Cano & Lidón, 2011; Morris, 1997; Neal, 1995; Whelton et al., 2002). During the interview process the researchers have understood that also for the project managers that have been interviewed do not exist a single name used to designate this phase. As is understandable from the previous chapter of this thesis, interviewees when asked about this phase employ dissimilar names such as *project conception*, *initiation phase*, *Front-End phase*, *pre-study* and *fuzzy Front-End*.

The aim of the researchers, during the first part of the interviews, was to understand the interviewee's point of view about this phase thus, what definition do they use for it. In order to be clearer a list of definition has been written down in the table below.

Table 5. Main Characteristics of the Front-End Phase

1	It is a preliminary phase in which significant decisions about the efficient allocation of resources are made
2	It is the phase when decisions are taken in a context of uncertainty and ambiguity
3	It is an iterative phase that precedes the operative phase of the project
4	It is the phase where Project managers and Project Teams can implement strategies to reduce the fuzziness and manage the Front-End effectively.
5	It is the phase when decisions undertaken in the Front-End phase have consequences throughout the whole project life cycle

Source: Created by the authors

The first point is focus on the significant decision that are made about the allocation of resources, thus to the importance of decision making in this phase. As already mentioned before, authors state that choices made early on in a project have significant affects later, with lower initial strain on resources. Precisely for this reason, the importance of decision making in the Front-End phase of projects has been thoroughly researched and established (Faniran et al., 2000). Indeed, Front-End management is strongly associated with the process of decision making in the first phase, also known as conception phase of the project lifecycle , of a project. This implies that the Front-End in Project Management is important due to the fact that decisions made in this stage are known to have significant influence on subsequent project expenditures, strategies and overall success (Faniran et al., 2000) where low costs are associated with major changes (Williams and Samset, 2010). This is because the cost to change any aspect of the project is low at the early stages, but increases rapidly in the final stages. From the analysis of the interviews the researchers found out that the early phases of the project delivery process are the biggest opportunity areas to build in value, reduce overall project cost, reduce the potential for expensive changes later on in the project, and minimize the probability of project failure. The most relevant decision is clearly on the clients' endorsement to go ahead with the project, which also implies the way in which the resources will be allocated.

Several authors have sustained this point of view (Whelton et al., 2002, p. 199; Kähkönen, 1999, p. 625; Williams & Samset, 2010, p. 39), defining this phase as everything that occurs before to the final decision to invest in the project.

Analysing the interviewees thought, it must be said that not everyone was on the same line about this point i.e. some project manager said that since they are operating with innovation not always the project is completely defined in this initial phase. Anyhow the clients' decision on investing or not in a project must be secure from the beginning, when the general idea is conceived. It is clear that there are some disagreeing opinions regarding this phase, but more clear evidence will rise in the following sections.

Following the order of the table above, the second definition is concerned about the three elements that cause fuzziness (ambiguity, complexity and the uncertainty) and, therefore what needs to be done in this phase to reduce them. For Stevens (2014) this is the focal point of this phase characterized by lack of information to perform a particular task, lack of understanding and misinterpretation of events, facts, and data and finally the complexity of foreseen what has to be done in the near future.

Moreover, this phase is important because there is a need to generate and share the knowledge among the team (Nobelius and Trygg, 2002, pp. 52-55).

The common response of the interviewees was that in order to reduce the three factors that lead to fuzziness and increase the effectiveness of the project, application of strategies is necessary. In addition to that, is important to state clear from the beginning what is the client request and do not leave anything to the imagination. More information the project manager can get, more detailed the analysis can be and that will lead to better final results.

This “collaborative process”, defined by Whelton et al.(2002, p.203), can be sometimes underestimated by companies but for all the people interviewed is a process where sharing information among the team and reach a common understanding about the problem may lead to different possible solutions. Bearing in mind the size of the companies analysed, SMEs, for certain project managers the best solution can be found

also in other department, therefore, knowledge sharing can be the key to success in this phase.

Repeatedly the interviewees referred to the Front-End phase as the one that generally comes before the operational stage of the project, which helped the researchers to clearly define where this phase really begins and ends. For many of them this phase lies on the organizational part of the project, starting from having a general idea of what needs to be done for then reaching the potential final conception of it, therefore the ultimate decision to finance the project. The level of uncertainty and ambiguity present in this phase can explain this. Ability of the project manager is then to (i) to reflect on the actions undertaken and control their consequences on the other stages of the project; (ii) to modify and adapt the scope of the project as response to new findings; (iii) to ensure that all the participants have the same understanding of the project. In line with this, Artto et al. (2001, p.257) define that the Front-End phase it begins when the initial idea is conceived, and it ends when the decision to finance the project is taken.

The fourth definition relies on the possibility to adopt strategies in order to reduce the fuzziness of the Front-End phase of a project. The authors identified several strategies that can help the companies to reduce the level of the ambiguity, complexity and uncertainty but these strategies will be discussed in the following sections.

This part is also called learning process, when the project team discuss about the possible outcomes and solutions of the project, thus is a preliminary plan of what it has to come next. The interviewees state that a more detailed planning, in term of resources and time, is done in the next step of a project but in the Front-End phase is important to have an overall idea of what the project is going to do, in terms of resolving problems providing initial solutions. One of the problem that normally arise in the innovative SMEs is about not defining properly from the beginning who is the ultimate users and what is the ultimate fine of the product or of the process.

This is not discussed by prior studies, but according to Kähkönen (1999, p.9), suggesting and providing preliminary actions denotes good skills in problem solving, and the ability to forecast the near future.

The fifth definition that the researchers provide for this phase is centralized on the fact that all the decisions undertaken in here have consequences throughout the whole project life cycle. Many authors including Faniran et al. (2000) came to the conclusions that a suitable project ensures that there is strong and sound decision-making right from the start of the project, as this helps to avoid unproductive expenditure of money, resources and time. In other words, the Front-End is laced with early warning signs that are indicative of the project's performance, where the available time will be rather long enough for project managers to take the right corrective actions in the subsequent stages (Haji-Kazemia et al., 2012). Therefore, all the decisions taken in this phase of a project are likely to have an impact on the overall project lifecycle. As mentioned in the previous chapter respondents argued that a well-managed Front-End phase can be translated into significant benefits in the other phases of a project, because they have ready solutions/strategies to adopt as soon as a problem arise.

Finally the researchers are able to identify the most relevant differences from the discussed in the previous arguments and the data analysed from the data collection. These following point are the ones that previous literature miss to discuss and therefore are value added of the research:

- The existence of kind of a plan on preliminary actions taken by Project managers in order to save time and resources in the succeeding phases;
- The existence of an organizational phase that comes before the operational part of a project;
- The importance of knowledge sharing as an internal instrument to provide solutions.

6.2 Project Managers' Perception of the Innovation

Innovation in the literature is defined as an iterative process that takes its cue from the perception of a new market opportunity for an invention based on technology (Utterback, 1996, p. 14), is then related to the process of converting an idea into a good or service that can offer higher value to customers, achieving profitable growth, and the final aim is to gain competitive advantages in the marketplace. Examining the answers obtained from the interviews the common understanding of innovation is to do something completely new or in a different way. Interviewees when interrogated about it they discussed the possibility of having two kind of innovation: positive and negative. Normally innovation ought to be positive, be a significant progressive change and therefore help to advance a process or a product. Moreover, as Adler discussed in the 1992 (p.26) there is no innovation without the two steps of production and commercialization. The respondents also argued on the difference between innovation and creativity, linking the two concepts together and stating the impracticality of having innovation without creativity. In addition to that they talked about the difficulties of innovate for two main reasons: (i) a market that is not completely prepared and very few companies are actually well managing the Front-End phase; (ii) the limited amount of time and resources available for SMEs and (iii) the too many few investments made in the last decades.

6.3 The Role of the Front-End Phase

Not all the interviewees were on the same line when asked about defining the importance of the Front-End phase. Some of them were more inclined on believing that this phase can be considered equal or even less vital than the others simply because the actual usage of resources is limited if compared to other phases, such as project implementation. This depends also on the kind of industry that the SMEs are operating with, in fact most of the respondents state that the role of this phase is not easy to explain, it is a very complex process in which companies need to know and understand about the complexity of it, due to the existence of multiple variance and the unmet needs that can help to feed a new product development process. This goes against what the literature discusses, especially considering Morris (1998) when he defined the Front-End as an essential stage due to the significance of the choices that can be made, and due to the chance given to the project managers to set up the tone for the entire project lifecycle.

In the other hand, anyhow, those who claimed that is the most significant stage of the project relied on the fact that the general objectives and goals are determined. The possibility of misunderstanding or set them in a way that is not conclusive might lead to implication and thus not providing good solution to possible problematic situations in the following phases. The PMBOK Guide (PMI, 2008, p.17) states that the cost to change any aspect of the project is low at the early stages, but increases rapidly as the project progresses and is at its highest in the final stage.

Table 6. Importance of the Front-End based on the Respondents' Evaluation

Opinion	Respondent	Example Quote
The Front-End is an important phase	#1, #3,#5	“..it’s not possible to build a house starting from the roof, or from the walls. Foundations come first, like Front-End and planning in every project thus is the most important phase.”
The Front-End is just as important as the other phases	#2, #6	“It’s the phase in which expectations are set, but it’s not more important than the others. All phases are equally important, for the sake of the project.”
The Front-End is not the most important phase	#4	“...it’s a significant phase, but I wouldn’t say it’s the most important. Think about executing a project. It’s a really complex mission, because you have to coordinate a wide range of activities, teams, manage the budget, ensure transparency with regards to finance, sustainability etc.”

Source: Created by the authors

Last point discussed on the importance of the Front-End of innovative SMEs by the authors with the interviewees has been the common pitfalls that may arise in the process. The common literature lack of describing the major problem that may rise, it only states that this process is designed to create and prepare potentially viable innovation for insertion into the formal R&D process (Reid & de Brentani, 2004, p. 38). The respondents identified three major factors thus the authors decided to insert them in the figure below.

Table 7. Common Pitfalls of the Front-End

#	Pitfalls
1	Lack of understanding about how communications works in the enterprises’ structure
2	Lack of understanding of what is the customers demand
3	Miscalculation of the rate of return (ROR) base on the estimation cost and a very risky price scenario

Source: Created by the authors

The first is linked to the necessity of the project manager to have a deep understanding of how the customers think and how the environment works. This misunderstanding might lead to a bad management of the Front-End phase. The second problem is tied to the team working on this phase, where the members may suffer during the process of comprehending the customers’ needs and thus they might end up spending lots of time and resources to decipher them. Another possible option is that the team lack in

recognizing the unmet customers' needs, and they might develop a product or a service that is not in line with the customers' demands. The third pitfall is, on the other side, more concerned about the financial estimation of the return on the initial investments. As the respondent number four (4) states explicitly, "*It happens quite frequently that miscalculation of the ROR leads to influence and affect the good performance of the project.*", therefore the project managers and their teams should spend more time trying to figure out different scenarios with different strategies that can generate solutions. The project managers that are accountable for the success or failure of a project (PMI, 2013, p. 25) have standard responsibilities such as:

- Planning, Executing and closing projects
- Managing teams
- Managing Expectations

When the PMI (2013, p.25) debates about the project expectation it also discusses the financial estimation, where the project managers are the ultimate accountable for it, but it does not seem to consider it as a possible pitfall. As mentioned in the previous chapter this type of pitfalls are more common in innovative SMEs that develop new products or ideas.

6.4 Front-End Strategies

One of the goals of this research is to understand the choices that practitioners perform in managing the Front-End phase of a project. A major point of discussion is the understanding that the division of the elements of the Front-End in uncertainty, equivocality and complexity is fully reflected in practice. All respondents were aware of the existence of these three elements, although with slight differences. In fact, understanding the nature of the Front-End is the first step to fully comprehend which are the variables to consider and choices to undertake to efficiently manage this phase.

6.4.1 Uncertainty

As it was reasonable to expect, successful management of the Front-End phase is firmly based on efficient reductions of uncertainty (Herstatt & Verworn 2004, pp. 26). The concept of uncertainty is widespread within the organisational environment and is widely recognised in the analysed companies. Findings show that practitioners address primarily the issues related to uncertainty, and only in the second place they focus on the other two elements. Similarly to what observed by Moenart et al. (1995, p. 18) the management of uncertainty accompanies all stages of the life cycle of a project, but is especially important in the early stages when the level of uncertainty is high due to the limited amount of information on the project and on the critical variables. Especially in Front-End phase, the level of uncertainty affects the estimates and the consistency of the objectives, and the expectations of the various stakeholders are reflected in the set of risks assumed for a given project. Contextually, if the project is similar to those already addressed in the past, previous information about those projects can be used to mitigate the uncertainty. Instead, it is more difficult when there is no previous experience about a project or it has an innovative nature, in line with the argument of Khurana and Rosenthal (1997, p. 74).

An interesting point is the distinction of uncertainty and risk provided by practitioners. Understanding the difference between these two concepts explains why it is not possible to use risk management techniques to manage uncertainty. Semi-structured interviews clarified that managing risks does not mean managing uncertainty since the two notions

are separated. Risk is perceived as a phenomenon that can be quantified and that describes vulnerability. Through risk analysis techniques it is possible to observe the likelihood and the impact of risks on the project, helping practitioners in identifying mitigation plans to reduce the likelihood of the risk occurring, or to reduce its consequences. On the contrary, interviewees agreed with the idea of Weick (1995, p. 26) that uncertainty is less susceptible to analysis, because it still exists after every risk has been identified. Furthermore, it emerged from the interviews that uncertainty represents not only the negative factor that has to be mitigated, but also the opportunity that has to be seized. Therefore, uncertainty embodies both desirable opportunities and undesirable unexpected outcome. Uncertainty in the Front-End phase must be managed to avoid unexpected outcomes and at the same time to exploit opportunities.

In order to deal efficiently with the uncertainty in the Front-End phase, practitioners agree with the literature about the existence of a specific life cycle of the uncertainty (Cleden, 2009, p. 16; Schoemaker, 2002, p. 22). Through the analysis of this life cycle, project managers can detect the phase they are in, and therefore identify the best strategy to manage uncertainty. This idea perfectly reflects what was mentioned in the theoretical background of this research. Therefore, the classification of the strategies in Knowledge-Centric, Anticipation, Resilience and Problem solving follows the same logic presented in the theoretical background.

Findings demonstrate that Knowledge-centric strategies are the most widely used by practitioners since all six respondents have confirmed that uncertainty could be primarily managed through strategies that aims to its reduction. Hence, Forecasting model and Knowledge Map are efficient solutions to deal with the lack of information and knowledge that it is typical of the Front-End phase of any project. These two strategies can be implemented in parallel. On one hand, the Knowledge map can visually identify the areas where more information is needed, clarifying what is known in relation to the project through the idea of *“mapping what we know and what we don’t”* – Respondent 3. Organising knowledge about the project into a structure is an efficient way to reveal knowledge gaps, representing the first step to the conversion of uncertainty in something known that can be managed through risk management tools and techniques. Moreover, gaps in the Knowledge Map highlight where uncertainty might exist, which is valuable information for project managers in order to be more vigilant for early warning signs of unexpected outcomes. On the other hand, the Forecasting Model provides the ability to visualise future states of the project by identifying project drivers and the relationships among these variables. The more accurate the variables, the less uncertainty there is about the future, and the more precise the decision making process becomes. Although all the respondents use the Forecasting Model, the construction of this model could be difficult, because some drivers may be hidden or they might only appear in the future. Similarly, the relationships between the drivers may not be easy to understand, or they could change during future phases of the project life cycle. For this reason, the model needs accurate information about the project drivers and their relationships, since considering wrong drivers or underestimating some relationships leads to the creation of useless scenarios for the project. However, necessary information can be easily obtained from a Knowledge map. For this reason, it is suitable that the two strategies are conducted in parallel, so that one supports the other (Turner, 2008, p. 55).

The ability to forecast how strategic aspects of a project will advance over time is one of the project manager’s most significant skills. It provides a way to anticipate weaknesses, that is, where and when uncertainty might hit the project. By anticipating

problems, they can be more effectively managed. An anticipation strategy relies on modelling future behaviour and outcomes of key stages of the project. Anticipation strategies come into play when (i) the Forecasting model is incomplete, due to difficulties in correctly identifying project drivers and relationships, or poorly understood or (ii) when it is hard to identify the most likely outcome of future states. A useful and less structured approach is the Scenario building strategy. Developing a scenario involves an intuitive leap into the future to visualize a particular project state or project outcome, not worrying about the sequence of events that lead there. Respondents claimed that particularly in innovative projects, scenario building helps in simplifying of the future outcomes: five respondents out of six consider scenario building a valid anticipation strategy, since it allows project managers to jump straight to the big picture and then, by thinking backwards, identify the patterns that lead to that outcome. Interviewees also stressed the importance of considering both positive and negative outcomes. In fact, considering positive scenario helps in understanding which are the successful factors to focus on, while negative scenarios assist in understanding what should be avoided.

The other anticipation strategy identified within the semi-structured interviews is represented by multiple explorations. This is the case when is not possible to identify project drivers at all (Cleden, 2009, p. 73). Multiple explorations don't aim to model the future or to make assumptions about future scenarios. As the name suggests, the strategy is intended to explore different options (and reveal the problems likely to be encountered) through a series of experiments/explorations, which generate knowledge about the hidden uncertainty that may be impossible to gather any other way.

Surprisingly, only one respondent out of six – respondent 3- admitted to adopt this strategy in order to anticipate uncertainty. He argued that multiple explorations might expose uncertainty that can be dealt with on time, saving the project considerable time and money, or even preventing the project from failure. On the contrary, other interviewees claimed that multiple explorations are time consuming and require an excessive quantity of investments. The positions on this type of strategy are conflicting, but it is intuitive to understand that it is a strategy used only by the largest company, which usually has more time and resources to allocate to its projects. Smaller companies commonly do not have the same amount of time and resources, thus they prefer to focus Scenario building, which is less time and money consuming, but it offers reliable results.

When it is not possible for a company to “map” uncertainty or to adopt strategies to behave proactively and thus anticipate uncertainty, resilience strategies come into play. Minimize the impact of unexpected outcome and uncertainty is the objective of resilience strategies. Firstly, agility is a feature on which the majority of the companies analysed has decided to focus, especially because it can provide a rapid response to an unexpected consequence. Agility allows recognizing early warning signals and thus allows increasing flexibility within a project. It also indicates how fast a project can adapt and cope with uncertainty (Cleden, 2009, p. 88). Respondents have suggested a number of factors that make it possible to give agility to a project, namely (i) taking small steps, easy to conceptualize and manage and that can be retraced when it becomes clear that they head to the wrong direction; (ii) working iteratively, allowing it to identify opportunities to address the uncertainty; (iii) scanning for problems, identifying early signals for unexpected outcomes. Furthermore, respondent 4 stressed the importance of the willingness to change what does not work in a project. If this does not

happen, one might risk to make the same mistakes of the past, ignoring an opportunity to learn.

Fast learning loops are implemented by half of the analysed companies - respondent 1,4,5. Logically, this strategy has great attention within smaller firms, as they are more likely to change direction or suddenly react to unexpected problems. In fast learning loops, each task touches successively higher stages of completion at the end of each cycle. Moreover, the frequency and rapidity of each cycle allows sufficient opportunity for the lessons of the previous cycle to be incorporated in a reasonable time.

Finally, some considerations on the problem solving strategies are due. The logic behind it is that problems and uncertainty are two faces of the same coin. Problem framing is used to consider an area of uncertainty and remove the problems that could arise from the uncertainty itself. As stated by respondent 2, *“problem framing allow us to approach uncertainty from a unusual perspective, from the root of the problem. Problem framing often reveals new uncertainty, the existence of which was unknown to us.”* Subsequently, the strategy of solution finding will find a way to efficiently manage the uncertainty. Respondents pointed out that, before implementing the solution, it should go through a validation process. Synthetically, project managers should check that the solution is compatible with the objectives within the context of the framed problem, and should consider the implications that adopting this solution would entail.

6.4.2 Equivocality

Some scholars argue (Frishammar et al., 2011, p. 554; Gidado 1996, p. 214; Herstatt et al., 2004, p. 43) that there is no hierarchy between uncertainty, equivocality and complexity. However, as the theoretical background of this research has shown, uncertainty is the only element literature focuses on the most, putting on a secondary level the other two elements. This consideration is reflected in practice, as not all analysed companies take specific measures to deal with equivocality. The smallest company interviewed - Respondent 1 - does not consider at all the impact that equivocality can have on a project. However, its justification lies in the fact that, being a company with few employees, it is easy to solve any form of ambiguity at the base through meetings to avoid any misunderstanding. In addition, the extremely small size allows the firm to quickly take, at low costs, corrective measures in case of misinterpretation. Three of the companies interviewed – Respondent 4,5,6 - are used to adopt a strategy centred on the formalization process. The purpose is to reduce the ambiguity by adding explicitness from the very beginning to the Front-End phase in order to encourage stability in the subsequent development process (Gidado, 1996, p. 216).

The remaining two companies – Respondents 2,3 – argue that equivocality is as important as uncertainty. Furthermore, equivocality can be more than uncertainty if not reduced in timely fashion. For this reason, those two companies decided to implement the model described in the theoretical background as Hypothetical-Deductive Method (HDM). Equivocality arises from multiple interpretations, and interpretations can be understood as hypotheses, hence these can be tested through the HDM. Nevertheless, interviewees agreed with Brun and Saetre (2009, p. 584) about stressing the importance of testing both the interpretations and the assumption, thus removing the hypotheses that prove to be unfounded, and giving clarity to the overall project. From Respondent 2's experience it was possible to identify one of the weaknesses of this approach: if an interpretation is excluded, the underlying set of assumptions remains unchallenged, so it also remains a cause for persistent ambiguity.

Finally, it can be observed that there is a correlation between the size of the enterprise and the importance assigned to the equivocality. Implementing measures to reduce the equivocality is highly dependent on the availability of resources and time that the company assigns to each project. The fewer resources are available, the less attention is given to the ambiguity. Assuming that the presence of equivocality could paralyze the entire Front-End phase, as previously described in the theoretical background, project managers should focus their attention on identifying alternative techniques or strategies, to proceed to an efficient reduction of the ambiguity that meets the constraints in terms of time and resources of small and medium-sized enterprises.

6.4.3 Complexity

The analysis of complexity was the most difficult among the three elements. This is because there is limited information about complexity in the literature, and thus it was not possible to define common strategies to efficiently reduce complexity. General understanding is that a complex project should be decomposed into sub-components that are managed individually, to be able to operate with less complex parts of the project. However, from the semi-structured interview, it has been possible to identify some techniques and approaches that are used as substitute for a standard strategy. Respondents indicated (i) definition of hierarchies, (ii) cooperation and communication, (iii) Project Management techniques and (iv) preliminary technology assessment.

Four respondents – 2,3,4,6 – stated that a clear definition of hierarchies is a useful technique to provide stability to the whole system, because it reduces the communication overhead by limiting the transfer of information. However, this is also a significant constraint, since limiting the flow of information to reduce complexity might cause increases in uncertainty and/or equivocality (Boukis & Kaminakis, 2014). The majority of interviewees also stated that cooperation and communication are useful approaches to reduce structural complexity. Communicating and sharing information within the organisations facilitates the dissemination of knowledge, while cooperation among functions influences positively complexity reduction. As all interviewees were project managers, it was logical that all have resorted to Project Management techniques as possible tools to reduce complexity. Moreover, findings show that structural complexity has to be managed proactively. Time scheduling, activity-plan, risk analysis, quality plan and budgets are important techniques that are needed for effective management of complexity. Nevertheless, it emerged from semi-structured interviews that project managers should consider how structural complexity impacts on project constraints (time, cost, scope) in order to manage project complexity in an effective way.

Lastly, a preliminary technology assessment is critically linked to an efficient management of the complexity in the Front-End phase, because it enables the project manager to identify technological requirements of the project before investing time and resources on it. Although the literature put on the same level of importance of all three elements of fuzziness, from the semi-structured interviews it appears that complexity is perceived as secondary factor. Opinion of the researchers is that this is due to the fact that only small and medium-sized firms, which do not deal with large and complex projects in everyday life, represent the sample.

7. Conclusions

The aim of this chapter is to answer the research question and provide a summary of the findings. Therefore, the authors start with the discussion of the role of the Front-End phase, moving to the three elements that cause fuzziness in this phase and then identify the most relevant strategies adopted in the Front-End stage. The chapter will include also the limitation of the thesis, the managerial implications and it will ends with the suggestion for further research.

7.1 Answering the Research Question

This section is concerned with the final aim of the study, answering the research question and summarizing the key points that have emerged.

- *What are the specific strategies implemented by project managers to reduce the limitations of the Front-End phase?*

Analysing the literature it can be seen that the Front-End phase is not something easy to explain, it is usually defined with different names and understandings depending on the researchers. The importance of this phase is founded on the principle that significant decisions must be taken about the efficient allocation of resources and strategies that, if done it properly, may lead to an increase of effectiveness and thus the success of the whole project. According to the literature and to the practitioners the early stages of a project have to be considered as a big opportunity to reduce the overall project cost, to minimize the expensive changes that may occur later on in the project and along with that the probability of a failure of the project.

Not all the practitioners that have taken part of this thesis have the same understanding of it, and not all of them consider this phase as important as it is.

Nonetheless there are certain points and elements that no matter what all the Project Managers interviewed share. First of all there is a need for knowledge sharing, which can be defined as the activity through which the information must be exchanged among the enterprise, in order to acquire a great amount of data useable to set up the phase. Therefore, a collaborative learning process must be developed to pinpoint the causes and sources of the three elements of fuzziness in the Front-End phase: uncertainty, ambiguity and complexity. The existence of this three elements in the Front-End phase cause fuzziness, therefore in order to reduce this to the minimum the practitioners employ different strategies according to the project, the sector and the resources available by the enterprise.

Most of the interviewees agreed on the necessity of constructing sort of a preliminary plan of the actions that need to be addressed, but also how the team will act to solve problematic situations that may arise during the following steps. All of the respondents recognized the presence of a so called “organizational” phase, which comes before the operational one, and agreed on being the phase that gives a tone to the entire project.

At the same time as some project managers relied more on planning and severe controlling to minimize deviations boost efficiency, in other companies all the relevant tasks were included premature in the process, some even during idea generation in order to ensure that all the data and the points of view were taken into concern right from the begin.

According to the practitioners, in SMEs, certain issues may rise during the execution of this phase; the first is a lack of proper knowledge sharing among the organization, followed by the project managers' lack of understanding of the final consumers' demand, and finally the miscalculation of the rate of return based on the estimation cost and a very risky price scenario.

From the literature review, it was possible to understand why the Front-End phase of a project presents difficulties in its management. The fuzzy nature of this phase is generated by the simultaneous presence of three elements, indicated as uncertainty, equivocality and complexity. The identification of these elements constitutes a significant step forward, because, as Reid and de Brentani, (2004) argue, oftentimes decision makers are not able to efficiently manage the Front-End phase because they ignore the main features. Moreover, frequently the Front-End phase is not efficiently managed because the decision makers are only aware of the role the uncertainty, and disregard the consequences of not managing of equivocality and complexity.

The literature generally assigns equal importance to each of these three elements, because each of them equally contributes to the creation of the fuzzy nature of the Front-End phase. However, it emerged from the literature that some authors give more importance to the uncertainty at the expense of the other two elements. This was confirmed by semi-structured interviews that were conducted to collect empirical data. All project managers interviewed were aware of the dangers that result from inefficient management of uncertainty, while only a few were aware of the problems caused by the complexity and equivocality. Once properly identified and analysed these three elements, it was necessary to identify how project managers can respond to the challenges launched by uncertainty, complexity and equivocality. The result was a definition of a set of response strategies available to project managers. The strategies were obviously identified to respond to each of the three elements, and their classification reflects this logic.

The results show that the idea that the uncertainty has a predominant role is reflected in practice, as the analysis of its response strategies are various, while those relating to the complexity and equivocality are scarce. This explains why a broad set of strategies to cope with uncertainty has been identified. Project managers can efficiently deal with uncertainty implementing knowledge centric strategies to reduce uncertainty, anticipation strategies to anticipate it, resilience strategies to mitigate its impact and problem solving strategies to solve uncertainty. Instead, there are very few ways to respond to equivocality and complexity. While for equivocality it is possible to methodology discussed by the literature, which actually is expensive to implement in practice, for the complexity there is not a standard strategy, and practitioners had to adapt techniques from other organisational fields. In addition it was noticed that the implementation of such strategies is related to the size of the company. While uncertainty is managed independently of the company size, and hence the resources allocated to each project, equivocality and complexity directly depend on the size. The more resources a company has available, the greater is the attention paid to the management of the complexity and equivocality.

7.2 Limitations of the Study

The concern of this thesis is evaluating the role of the Front-End phase linked with the most appropriate project management strategies employed by practitioners in the Italian innovative SMEs. The authors considered that the elements of national culture might

assume a significant role, thus they opted for focusing the scope on only one country in order to have more relevant results and to not lessen the significance of the research. The study is then conducted in a way that the data collection has been done from a particular point of time, meaning that the time horizon is cross-sectional based.

In addition to that, the researchers are aware that examining innovative SMEs that operate in different sectors (i.e. Manufacturing, IT, Construction) may affect the choices of the strategies to employ in the Front-End phase. Moreover, the size of the company may be an additional limitation, in the sense that medium enterprises normally have more resources and time to dedicate to this phase than micro and small ones, thus get better results out of it.

The educational background of the respondent can play an important role for this research, but all the interviewees were covering project managers' positions in the organization, therefore the ones that lack on PM certifications were able to compensate with experience on the field. The authors saw a number of 6 respondents as valuable to explore the strategies employed in the innovation industry, regardless the sector in which they operate.

All the respondent that have taken part of this thesis were fluent in English, therefore the semi-structured interviews have been conducted primarily in English cutting down the possible limitation of having to translate their answers and quotations.

The amount of time available to deliver this research was limited, therefore it can be considered as a limitation of the study. Nevertheless further research should be conducted analysing more participants in order to make the results more generalizable.

Finally, as stated by Saunders, Lewis and Thornhill (2009), the authors are conscious that certain issues regarding reliability, validity and generalizability associated with different form of bias may have been arisen during the study.

7.3 Practical Implications

The authors examined 6 different practitioners' opinions that hold a project managers' role in Italian innovative small and medium enterprises and manage. The framework chosen to observe how practitioners manage and organize the Front-End phase came to light to be valuable and useful. However, it is impossible to state the existence of one single way to lead efficiently this phase, because all the enterprises observed in this study turned out to show different concern towards the management of the Front-End phase. Even though the majority of the respondents agreed on the importance of the Front-End phase, some of them believe that this phase has the same value of the other ones. A message to them could be to understand the significance of the decision making in this phase, since the cost of the actions taken here may lead to better results in term of success of the project.

Researchers such as Kim and Wilemon (2010, p.16) debated about knowledge sharing and that the employment of it can ensure a competitive advantages to both party, the company and the project itself. Advice that the authors might give to practitioners could be to implement knowledge sharing practises and set a more flexible organizational structure, letting the data to be easily spread among the employees.

Results showed that SMEs often renounce to implement some typologies of strategies due to the poor allocation of resources for some projects. The advice that the authors want to give might seem trivial, but it is to enhance more the early stages of a project, particularly the Front-End phase. This is motivated by the fact that reduction of uncertainty, equivocality and complexity through the implementation of specific strategies lead to a better management of this phase, but especially because it gives the

possibility to companies to make changes, even radical adjustments, in a project when their cost is very low and the time interval available to implement these changes is sufficiently long.

7.4. Theoretical implication

The starting point of this study was, as already argued earlier in this thesis, the lack of other researches in the field of management of the Front-End phase of projects. With this study the authors strongly believe they have provided new insights on the subjects, expanding the prior literature. The identification of a set of response strategies might be a solid base for future research on the Front-End phase, with the aim of checking whether the results obtained from this study can be also applied, for example, to the context of large enterprises. Moreover, it is opinion of the authors that the results of this study can be tested in future researches in areas different from the innovation context. Furthermore, the empirical data of this study could be generalised not only within the Italian Innovative SMEs, but also in the context of countries that have a similar economic and cultural background, such as other countries of the European Union. Additionally, the authors of this study are aware that the identification of response strategies might lead to a definition of useful guidelines to manage the Front-End phase for countries that have transitioning economies. Lastly, the improvement of the Front-End phase, obtained through reductions of its limitations, can easily turn into an improvement of the overall success of the projects, leading to an increase of the presence of SMEs in the economic context of a country. As a result, improvement in SMEs performance might imply an overall increase of the job opportunities, enhancing the overall economic and social conditions of the country.

7.5 Validity and Reliability Revisited

This section is focused on revisiting the validity and reliability notions considering what has been written in the previous chapters of this research.

The generalizability is centred on the possibility of generalizing the data obtained from the findings from a single sample to a wider one. Since this thesis is been developed as an exploratory case study, the generalizability is not the main concern of the authors, anyhow some of the results might be useful to be generalized. This is in line with the sampling techniques adopted for this study, which permitted the authors to choose a sample enough purposeful, the Italian innovative SMEs, to be able to answer the research question. Many researchers, such as Miles and Huberman (1994, p. 27) and Mason (1996, p. 93), recognize this approach as a valid one in qualitative research, referring to theoretical sampling and purposive.

On the contrary, the aim of the internal validity is focused on guarantee that the results that we want to reach or measure are accomplished. The list of question, introduced in the appendix as a interview guide, were used for every single interview and they were constructed in such a way that were targeting the respondent in order to get the answers and, the data necessary to resolve the research question. A deep analysis of the literature has been done in order to build the list of interview questions, and accordingly to Saunders et al. (2009, p. 373) about their principles of content validity, all the contents were discussed.

The last notion that needs to be explained is the reliability. It is concerned with the replicability of the research and whether the ultimate results of the study are reliable. In line with what several authors discussed (Marshall & Rossman, 1999, cited in Saunders

et al. 2009, p. 328; Silverman, 2006, p. 283), to achieve reliability it is necessary a transparent overview of the research protocol and a well stated research decision.

For all these reason the authors of this study believe that the goal of reliability has been accomplished.

8. References

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Appendix

Interview guide

The first round of questions were asked in order to find out the educational background of the respondent and to set the atmosphere before to go into the more detailed one.

- ✓ What is your educational background?
- ✓ What is your position in the organization?
- ✓ What prior experience do you have?
- ✓ How many project have you been part of in your career?

The second round of questions were targeting their knowledge about the topic and to understand whether they consider this phase as an important step in order to reach project success or not.

- ✓ How would you describe your job? What kind of projects do you (or your enterprises) do?
- ✓ Could you explain in few words the Front-End phase in your company?
- ✓ How would you describe innovation?
- ✓ What are the general outputs (results) of the Front-End phase?
- ✓ Who's involved in the Front-End phase (are they the same ones who do the actual work in the project or somebody else)?
- ✓ Can you name the main challenges that you encounter in this initial phase?
- ✓ What are the common problems/pitfalls in the fuzzy Front-End phase?
- ✓ How do you ensure the common understanding of the definitions and objectives in this phase?
- ✓ Do you consider project definition as something that is done only at the beginning of the project? Do you usually go back to it (iterative process) after/when realizing that there was a misunderstanding?
- ✓ How important do you consider this phase for you as a Project Manager? Why?
- ✓ How important do you consider this phase for your company? Why?

After analysing the elements forming the front-end, it is helpful to look at what are the strategies undertaken by management to achieve reductions of uncertainty, ambiguity and complexity.

- ✓ Are you familiar with the three elements of fuzziness of the Front-End?(uncertainty, ambiguity and complexity)?
- ✓ Can you name some general strategies used in the initial stage/Front-End of a project?
- ✓ What are the actual strategies or techniques used in your company in the initial phase?
- ✓ What are the most-used? Do they vary from project to project or there are some standard ones?

Interview request

Good morning company X,

We are two Italian postgraduate students doing a Master in Strategic Project Management at Umeå University, Sweden. We are currently working on our master thesis and looking extensively for good contacts to possibly conduct an interview as part of the empirical research for our thesis.

We have conducted a pre-research in the Italian top innovative SMEs to identify a list of valid candidates/companies to submit our questions; your nominative has been selected from a list of over 100 companies since you are one of the company leader.

The aim of the thesis is to explore the practices and strategies that innovative SMEs employ in the early phases of their projects, in the understanding that the initial phase is important to ensure project success through front-end management. Our goal is to explore and, moreover, describe the strategies employed by Italian companies during the initial phase, also known as Front-End phase.

We assure you that the interview would not take much of your time, as we understand the value of it. However the input that you would provide us is vital for our research. The interview would be held by telephone (or by Skype, if possible), and of course we will adapt to your schedule. Confidentiality and anonymity is guaranteed as per our School's Academic Ethics Guide.

Please be kind in letting us know if you would like to participate or if you could possibly refer us to someone else in your organization who might be interested, or in case you just would like to know more about the research do not hesitate to contact us. Here below you will find the e-mail addresses of the two researchers with their LinkedIn profile.

Massimo Biei Massimo.biei@gmail.com (<https://it.linkedin.com/in/massimo-biei-9059556>)

Marco Abate Marc.abate@virgilio.it (<https://it.linkedin.com/in/marco-abate-411a7943>)

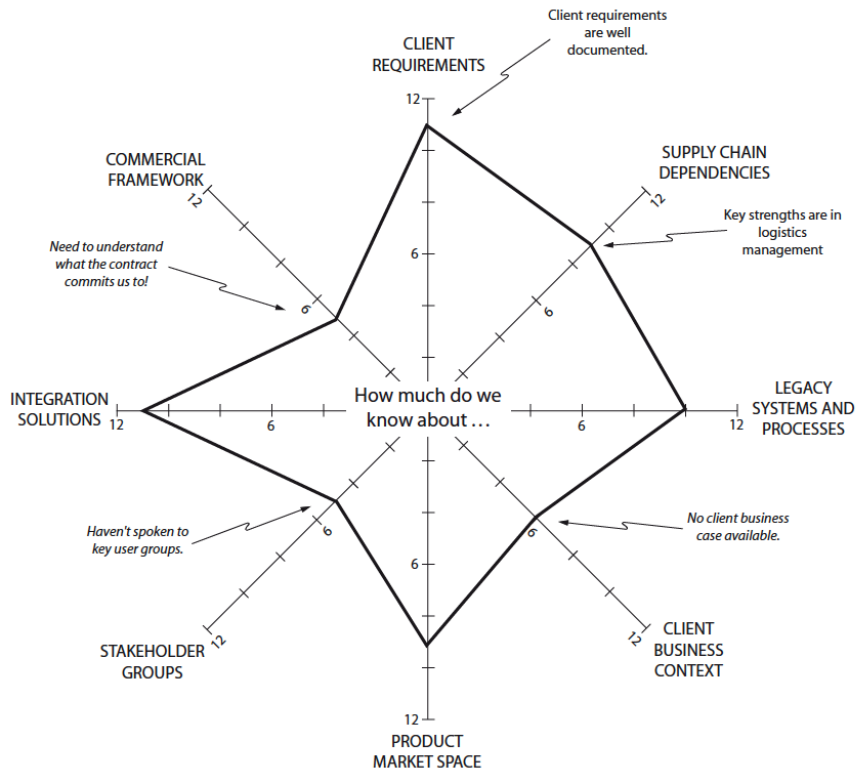
Waiting for your response we would like to thank you in advance for your attention and time.

Kind Regards,
Yours sincerely,

Massimo Biei & Marco Abate

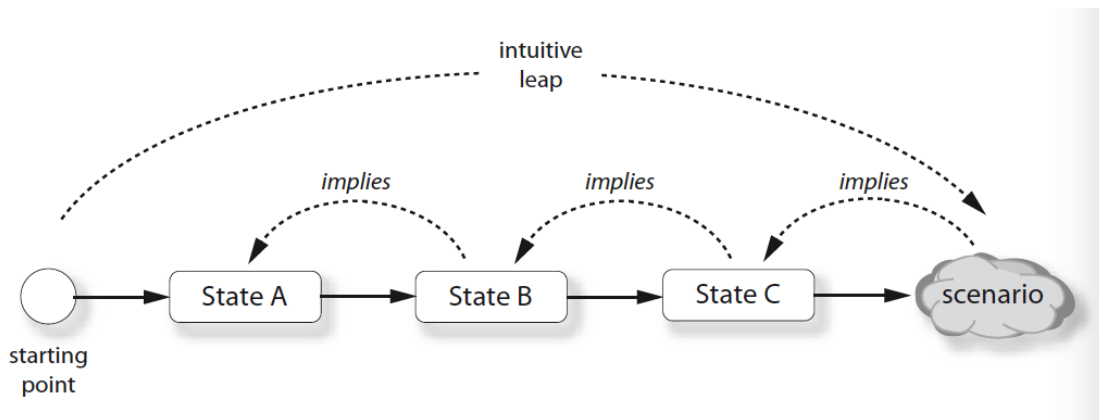
Strategies figures

- 1) An example of a Knowledge Map integrated with a scoring system. Low scoring regions indicate areas of high levels of uncertainty, which need more attention.



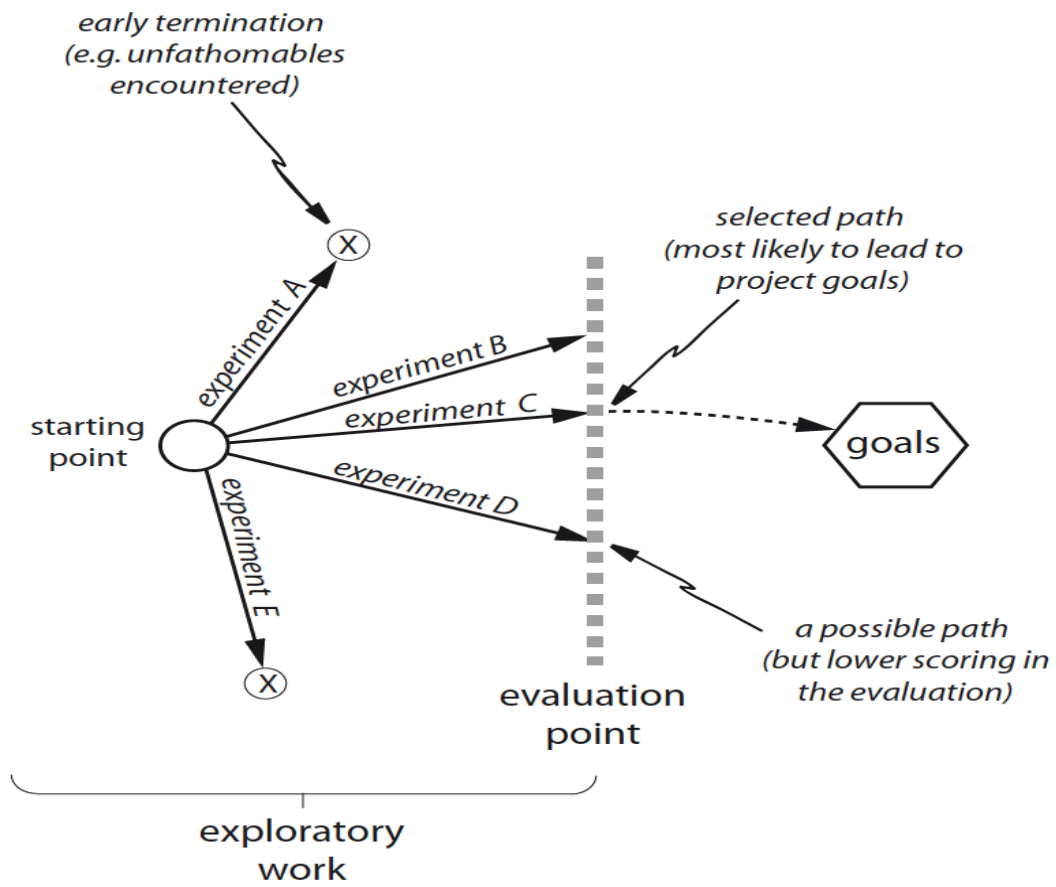
Source: Cleden (2009, p. 62)

- 2) Intuitive leap to develop a future scenario, followed by backward thinking to identify the key factors in order to reach that scenario.



Source: Cleden(2009, p. 80)

- 3) Each exploration (or experiment) is conducted in parallel and adjust a different key variable.



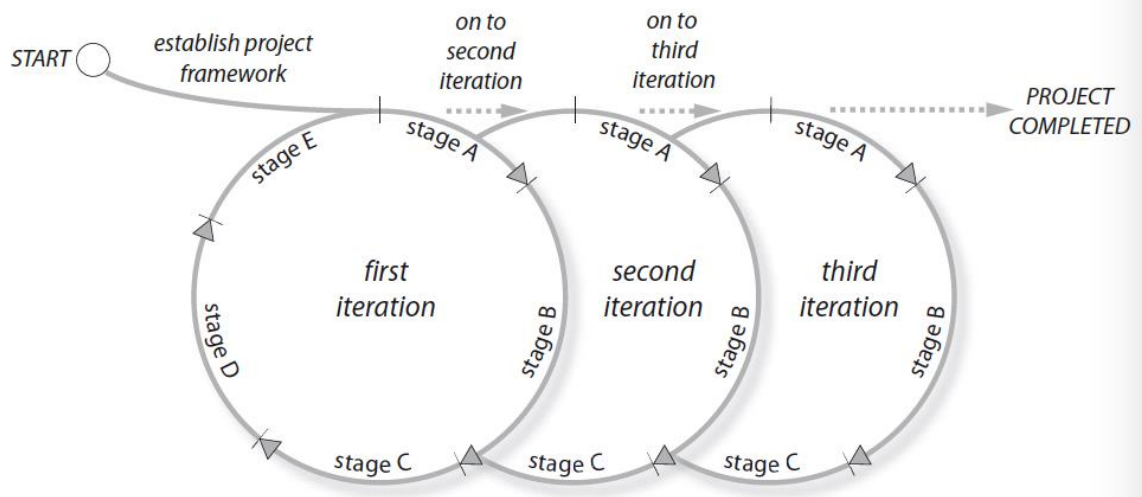
Source: Cleden (2009, p. 84)

- 4) Sequential stages vs Iterative stages. Fast learning loops strategy deal with uncertainty in small steps, each loop completes in the next step.

SEQUENTIAL stages

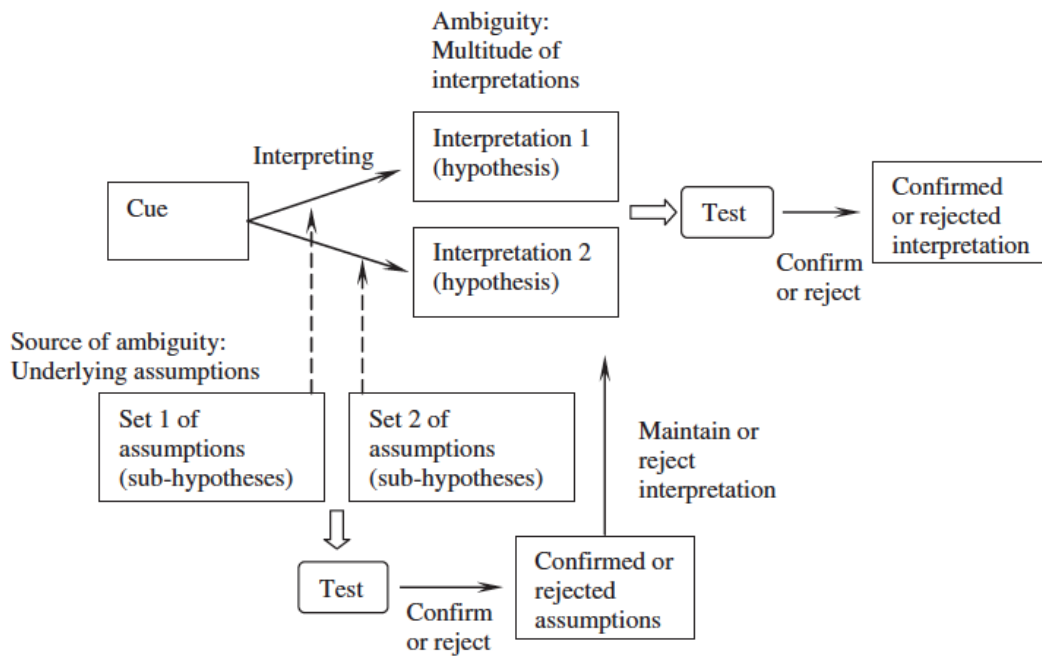


ITERATIVE stages



Source: Cleden (2009, p. 92)

5) HDM – Hypothetical Deductive Method



Source: Brun & Saetre (2009, p. 591)