NTNU
Norwegian University of
Science and Technology

Becoming a project manager

A cross-sectional study of French engineers' challenging transition from technical specialists to project managers

Marie Daden

Master of Science in Project Management
Submission date: June 2018
Supervisor: Ola Edvin Vie, IØT

Norwegian University of Science and Technology
Department of Industrial Economics and Technology Management

Problem description

The purpose of this master's thesis is to understand how and why French engineers' transition from technical specialists to project managers is challenging. Using both theory and the personal experience of French engineering-backgrounded project managers, this master's thesis studies the main challenges experienced by French engineers when becoming project managers, the roots of these challenges, as well as what could help them easing their transition.

Foreword

This master's thesis is written as completion to the Master of Science in Project Management, at the Norwegian University of Science and Technology in Trondheim. The associated research took place from January to June 2018.

I am a French engineering student doing a double degree in Norway. There is actually a partnership between my engineering school called École Centrale Marseille, and NTNU which enables French engineering students to get a double degree. In that respect, I made the choice, two years ago, of studying project management at NTNU.

Bearing the above in mind, I wanted my master' thesis to address both the engineering and the project management sides of my education. Reading Hill's (2003) research study on the transition experienced by a salesperson when he or she becomes a sales manager during my master's thesis' preparatory work gave me the idea of studying the transition experienced by French engineers when becoming project managers.

One may consider my master's thesis as being very personal, however I think that the majority of French engineers experiencing such kind of transition can definitively identify themselves in the topics addressed by this master's thesis.

Acknowledgments

I would like to thank my supervisor Ola Edvin Vie. His valuable insights and directions gave me needful guidance to write this master's thesis. Furthermore, I would like to thank the participants to my research study for their time, interest and helpful advice.

Abstract

The primary purpose of this thesis is to answer the following research question: *How and why is French engineers' transition from technical specialists to project managers challenging?*

Using both theory and the personal experience of French engineering-backgrounded project managers, it will be showed that the challenges mainly come from the motivations that drive French engineers' process of becoming a project manager. Moreover, the gap that exists between French engineering education programs and today's industry expectations will also appear as one of the main reasons why French engineers' process of becoming a project manager is challenging. Furthermore, it will be established that when engaging into this process, French engineers experience changes that affect their beliefs, working approach and inner-selves, making it therefore challenging. The never-ending and intrusive nature of the process will also explain why it is challenging. Then, the influence of others as well as the role played by failure on French engineering-backgrounded project managers' learning process will be emphasized.

Finally, potential solutions that could help easing French engineers' process of becoming project managers will be introduced. Among these potential solutions are the modification of teaching methods when it comes to soft skills-oriented courses, the involvement of more industry professionals in French engineering education programs, the use of coaching to develop newly promoted project managers' soft skills and the enhancement of project managers' selection processes.

Key words: becoming, engineering education programs, French engineers, hard skills, leadership, project managers, soft skills.

Summary

First of all, I will develop a theoretical framework based on literature of particular interest for answering my research question. Then, this empirical framework will be used to analyze the empirical data I have collected when interviewing French engineering-backgrounded project managers. Finally, I will discuss my findings and answer my research question.

Table of contents

Problem description ..... ***i***

Foreword ..... ***iii***

Acknowledgments ..... ***v***

Abstract ..... ***vii***

Summary ..... ***ix***

Table of contents ..... ***xi***

List of figures ..... ***xvii***

List of tables ..... ***xvii***

Abbreviations ..... ***xvii***

1. Introduction ***1***

1.1. Project management **1**

1.1.1. The traditional approach to project management 1

1.1.2. The need for a new approach to project management 3

1.2. Selection of project managers **6**

1.3. French engineers' distinctiveness **7**

1.4. Summary and structure of the paper **11**

2. Literature ***13***

2.1. Leadership **13**

2.1.1. Situational leadership 13

2.1.2. Transformational leadership 14

2.1.3. The influence process school 15

2.1.4. Summary 16

2.2. Engineering leadership **17**

2.2.1. A technical specialist 17

2.2.2. Soft skills 17

2.2.3. Engineering education programs' flaws 19

2.2.4. On-the-job training 19
2.2.5. The choice of project management 20
2.2.6. Summary 20

2.3. Becoming 21

2.3.1. A philosophical concept 21
2.3.2. Experiential learning 22
2.3.3. A new individual 23
2.3.4. Summary 23

2.4. The transition challenges 24

2.4.1. Soft skills-related challenges 24
2.4.2. Managing organizational complexity 24
2.4.3. Technical professionals 26
2.4.4. Summary 28

2.5. Easing the transition 28

2.5.1. Bridging the gap between engineering education programs and the expectations of today's business and industry 29
2.5.2. Organizational practices 31
2.5.3. Selection of project managers 33
2.5.4. Summary 33

2.6. Theoretical framework 34

3. Methodology 37

3.1. Sampling cases 37

3.2. Data collection 38

3.2.1. Research design 39
3.2.2. Research method 42

3.3. Data analysis 44

3.3.1. Management 44
3.3.2. Analysis 44
3.3.3. Interpretation 45

3.4. Quality criteria 45

3.4.1. Credibility 45
3.4.2. Transferability 47
3.4.3. Dependability 47
3.4.4. Confirmability 48

3.5. Personal remarks 48

4. Empirical data 51

4.1. Backgrounds 51

4.1.1. Education background 51

4.1.2. Professional background 52

4.1.3. The choice of project management 53

4.2. Project management 53

4.2.1. The good project manager 54

4.2.2. Selection of project managers 56

4.2.3. Project management tools, methods and processes 56

4.2.4. Project management: a two-sided discipline? 57

4.3. The leadership aspect of project management 58

4.3.1. The good leader 58

4.3.2. Exercising authority 59

4.3.3. The political aspect of leadership 61

4.4. Learning what it means to be a project manager 61

4.4.1. Mentorship 61

4.4.2. Learning on-the-job 62

4.4.3. Training courses 63

4.4.4. Soft skills: innate or not innate? 66

4.5. French engineering education 67

4.5.1. The Franco-French engineer mold 67

4.5.2. French engineering education programs' flaws 67

4.6. The transition 67

4.6.1. Evolution of project managers' practices 68

4.6.2. Evolution of project managers' self-confidence 70

4.6.3. When project managers consider themselves as such 71

4.7. Managing leadership challenges 72

4.7.1. Today's workplace complexity 72

4.7.2. Organizational complexity 73

4.7.3. Assertiveness 73

4.7.4. Conflicts 74

4.8. Easing the transition 75

4.8.1. Soft-skills oriented classes 75

4.8.2. Involvement of professionals 75
4.8.3. Personalized coaching 76

5. Analysis and discussion 77

5.1. The choice of project management 77
5.1.1. Analysis 77
5.1.2. Discussion 77

5.2. Situational leadership 78
5.2.1. Analysis 78
5.2.2. Discussion 79

5.3. Developing soft skills 80
5.3.1. Analysis 80
5.3.2. Discussion 80

5.4. French engineering education programs 81
5.4.1. Analysis 81
5.4.2. Discussion 81

5.5. Learning processes 82
5.5.1. Analysis 82
5.5.2. Discussion 83

5.6. Changes 83
5.6.1. Changing one's mind 83
5.6.2. Changing one's working approach 84
5.6.3. Changing one's self 84
5.6.4. Discussion 85

5.7. Challenges 85

5.8. A never-ending process 86
5.8.1. Analysis 86
5.8.2. Discussion 86

5.9. Easing the process 88
5.9.1. Engineering education programs' reform 88
5.9.2. Coaching 88
5.9.3. Selection of project managers 89
5.9.4. Discussion 89

6. Conclusion 91

6.1. Answer to the research question 91

6.2. Practical implications 93

6.3. Further research 93

6.3.1. Certifications and MBAs 93

6.3.2. Cross-sectional research design 94

6.3.3. Identity 94

6.3.4. Non-French project managers 95

6.3.5. The influence of gender 95

Bibliography 97

APPENDIX 101

A-1: E-mail sent to project managers (French version) 101

A-2: E-mail sent to project managers (English version) 102

A-3: Semi-structured interviewing guide (French version) 103

A-4: Semi-structured interviewing guide (English version) 106

A-5: Participants' characteristics 108

List of figures

Figure 2.3.1: Matrix organization, from the Project Management Institute (2013, p. 24).....26

List of tables

Table 1.3.1: French higher education system (Universities / Grandes Écoles) 8
Table 1.3.2: Two years of classes préparatoires' courses and associated ECTS credits.....9
Table 1.3.3: Two years of engineering school' courses and associated ECTS credits 10
Table 2.2.1: Dimensions of an engineering leader, from Kumar and Hsiao (2007, p. 19) 18
Table 2.3.1: Influence of organizational structures on projects, from the Project Management Institute (Institute, 2013, p. 22).....25
Table 2.6.1: Theoretical framework.....35
Table 3.2.1: Characteristics of the participants.....40

Abbreviations

ECM	École Centrale Marseille

1. Introduction

As previously mentioned in the abstract, my research question is the following:

How and why is French engineers' transition from technical specialists to project managers challenging?

The purpose of this introduction chapter is thus to explain how I have come to this research question. In that respect, the field of project management will first be introduced. Then, I will focus on the selection of project managers among technical specialists. The third point will, for its part, emphasize on French engineers' specificity. Finally, the last point will summarize the three first ones and present the overall structure of this paper.

1.1. Project management

The field of project management being the starting point of my research study, I have felt it necessary to introduce it in the very first chapter of this paper. However, and because project management is a large field, I do not pretend to be exhaustive. The following points will only introduce the reader to the aspects of project management that I consider especially important for understanding the reasoning behind my research question. In that respect, the traditional approach to project management will firstly be presented. Then, the reasons why a new approach to project management is needed will be introduced.

1.1.1. The traditional approach to project management

Project management is defined by the Project Management Institute (2013, p. 5) as *"the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements"*. Other definitions, although older, do not differ significantly. Indeed, Oisen (1971, as quoted by Atkinson, 1999, p. 337) defines project management as *"the application of a collection of tools and techniques to direct the use of diverse resources toward the accomplishment of a unique, complex, one-time task within time, cost and quality constraints"*.

It should be emphasized that, instead of including the term project in his definition, Oisen mentions its main characteristics: uniqueness, complexity, and temporary nature.

The Project Management Institute's PMBOK® Guide, is well known for adopting and promoting a traditional approach to project management (Andersen, 2006, Špundak, 2014, Cicmil and Hodgson, 2006). According to Atkinson (1999), the time, cost and quality triangle is the success criteria of traditional project management. This notion is covered by the term *project requirements* in the Project Management Insitute's (2013, p. 5) definition. Traditional project management appears therefore as being characterized by the application of tools and techniques to project activities with the purpose of achieving project objectives while respecting time, cost and quality constraints.

Moreover, the Project Management Institute (2013) identifies five different project management Process Groups through which project management is accomplished. These five project management Process Groups are: initiating, planning, executing, monitoring and controlling, closing. Each of these five Process Groups is associated with specific inputs, actions and activities that should be performed, tools and techniques that should be used, and resulting outputs (Institute, 2013).

Other scholars describe traditional project management using groups of activities. For example, Gehring (2007) argues that traditional project management activities comprise defining problems, planning work, allocating resources, and controlling tasks. In line with this, Gane (2001) suggests that traditional project management focuses on activities such as planning, control, resource management, cost and time estimation, etc. The division of project activities into groups as well as the use of methods, tools and techniques to orchestrate these activities appear therefore as key characteristics of the traditional project management approach.

Furthermore, another aspect of traditional project management is the project life-cycle. Indeed, despite the existence of variations in size and complexity between projects, the Project Management Institute (2013) argues that all projects follow the same generic life-cycle framework. This framework includes four stages which, in order of occurrence, are: starting the project, organizing and preparing, carrying out the project work, and closing the project. Moreover, each of these four stages is characterized by a specific output which should be finalized and accepted in order to go on to the next stage. This division of projects into life-

cycle stages reflects Kotter ‘s (2008) idea that traditional project management produces order and consistency.

Bearing the above in mind, the traditional project management approach appears as a very systematic and standardized approach to project management. Indeed, following this approach, project life-cycle stages are standardized, project activities are standardized, the tools and techniques used to perform project activities are standardized, even the success criteria are standardized. Williams (2005, p. 498) refers to traditional project management *“as a set of normative procedures which appear to be self-evidently correct”*. It feels to me that project managers only have to perform the project activities in the right order, within the right life-cycle stage, to use the adequate tools and techniques, to deliver the specific outputs at the end of each life-cycle stage, and to respect the time, cost and quality previously established constraints to successfully achieve the project’s objectives. In line with my opinion, Cicmil and Hodgson (2006) argue that the traditional project management approach tends to consider project managers as *implementers*, narrowing their role to control and planning activities. Other scholars have levelled criticisms against the standardized nature of the traditional project management approach and suggested the need for a new approach to project management (Andersen, 2006, Shenhar, 2004, Koskela and Howell, 2002, Maylor, 2001, Špundak, 2014, Cicmil and Hodgson, 2006). The next point will therefore address some of the main reasons why a new approach to project management is needed.

1.1.2. The need for a new approach to project management

As previously mentioned, criticisms against the standardized nature of the traditional approach to project management have been leveled up by some scholars.

Andersen (2006, p. 16) suggests that the most serious weakness of the traditional project management approach is its tendency to believe *“in total rationality”* and that the project tasks are *“clearly defined and unambiguous”*. Similarly, Špundak (2014, p. 941) refers to the traditional approach as a *“rational and normative approach”* which assumes that *“projects are relatively simple, predictable and linear with clearly defined boundaries which all makes it easy to plan in detail and follow that plan without much changes”*. However, change appears as an inherent component of today’s projects. Indeed, Aarseth et al. (2016) argue that due to the intrinsic nature of a project, its temporary nature and uniqueness, projects inevitably face

unforeseen events and issues. In such situations, Aarseth et al. (2016) argue that it is *"necessary to intervene and make decisions, initiate new processes, resolve conflicts and get projects back on tracks, or over to a new track"*. Traditional project management, which focuses on planning, decision-making and monitoring activities, is not sufficient in such situations (Aarseth et al., 2016). This appears therefore as a flaw of traditional project management.

Furthermore, several scholars emphasize the existing inconsistency between traditional project management and today's business environment (Williams, 2005, Hill, 2003, Špundak, 2014, Aarseth et al., 2016). According to Špundak (2014), traditional project management is wrong when assuming that projects have clear boundaries and are consequently isolated from their environment. In that respect, Špundak (2014) argues that because changes is an inherent component of today's dynamic and complex business environment, this is also true for projects within this environment. However, traditional project management characterized by a linear chain of tasks fails to deal with the complex and dynamic nature of today's business environment which involves *"higher number of tasks and complex interrelations"* (Špundak, 2014, p. 941). Koskela and Howell (2002, p. 12) even claim that *"in the present big, complex, and speedy projects, traditional project management is simply counterproductive; it creates self-inflicted problems that seriously undermine performance"*.

Consequently, traditional project management tends to assume that reality is controllable (Cicmil and Hodgson, 2006, Andersen, 2006, Špundak, 2014) but at the same time projects, by their very nature and the nature of the environment within which they take place, induce changes. Hill (2003, p. xiii) suggests that *"organizations can only meet the tough challenges of today's environment if they have effective managers-capable of coping with both complexity and change"*. Therefore, it appears that there is something lacking in traditional project management to address today's business environment's main challenges.

In line with the above, Shenhar (2004) argues that the need for a new approach to project management arises from the dynamic nature of the current business environment as well as the globalization of the competition. According to Shenhar (2004), project management should not only focus on the achievement of time, cost and quality objectives, but also on the way a project can help an organization differentiating itself from its competitors. In this respect, Shenhar (2004) introduces a new approach to project management, called strategic project leadership®, which goes further than the traditional approach as it considers projects as tools to create

competitive advantage and lead the marketplace. Shenhar (2004) suggests that it is no longer sufficient for project managers to achieve operational objectives, they are indeed increasingly required to adopt a strategic perspective. Shenhar (2004) argues that strategy is not reserved anymore for the executive level, project managers should become real leaders, performing project leadership as well as project management. In line with this, Rosenbaum (1991) suggests that the fast-paced competitive technological environment induces a need for *hybrid managers*, able to deal with both technical aspects and strategic objectives.

Another argument put forward by scholars to legitimize the need for a new approach to project management, is that projects generally involve a multitude of stakeholders with different interests. Among these stakeholders are for example the team members, the project owner, and senior management. Aarseth et al. (2016) argue that traditional project management, characterized by methods and procedures, is not enough to get all these different people and their different interests working together in the same direction to reach the objective of the project. Indeed, dealing with a multitude of stakeholders with different interests may induce problematic situations such as conflicts, for which traditional project management does not provide any solution. Aarseth et al. (2016) suggest therefore that there is a need for project managers to assume leadership responsibilities. Moreover, both Gehring (2007) and Aarseth et al. (2016) underline the fact that all the different people involved in a project have different interests but also, different skills. In that respect, Gehring (2007) argues that if a project manager does not manage to get people to use their skills congruently then these skills can quickly become useless to the project. However, according to Gehring (2007, p. 45), traditional project management activities *"are not sufficient to control all the complex elements associated with management of personnel on a project"*. Bearing that in mind, Gehring (2007) argues that there is a need for project managers to exercise leadership. In line with this, Shenhar (2004) suggests that there is no better place for performing both roles of manager and leader than in a project context.

Bearing all the above in mind, the need for a new approach to project management seems to be legitimized by three main arguments. First of all, the intrinsic characteristics of a project induce a certain level of uncertainty, which consequently means that unforeseen events and changes can occur during a project. In such a context, a normative approach cannot be of any support to adapt to those changes and get the project back on tracks. Then, a new approach to project management is needed to face the dynamic and complex nature of the current business

environment. Finally, a project involves many stakeholders with different interests and skills, and getting those people working congruently cannot be achieved by only using traditional project management. To face these challenges, several scholars have suggested a new approach to project management. This new approach considers leadership as an inherent component of project management. Consequently, this new approach induces the need for project managers to exercise leadership. However, the next point will show that because of the process adopted by most organizations to select project managers, this requirement may not be satisfied.

The concept of leadership is not explained in this introduction chapter, but will later be, in point *2.1. Leadership*.

1.2. Selection of project managers

It has previously been mentioned that, in order to cope with the dynamic and complex nature of today's business environment, project managers must be *hybrid* and thus able to exercise leadership. However, this point will show that because of the process adopted by most organizations to select project managers, this requirement may not be satisfied.

Indeed, Davis (1981), Thornberry (1987), Rosenbaum (1991), Walker and Peterson (1999, as quoted by Gehring, 2007) as well as Hodgson et al. (2011) bring into light the most widespread practice among organizations for selecting project managers. This practice consists of promoting worthy technical employees project managers. Lewis (2001) refers to those technical employees who became project managers as *accidental project managers*. According to both Lewis (2001) and Nixon et al. (2012) *accidental project managers* shoulder project management responsibilities, even though they do not fully understand their role.

Davis (1981) suggests that the transition from technical specialist to project manager is sometimes difficult. Indeed, those people are promoted because of their high technical skills, and may therefore lack the interpersonal skills (Rosenbaum, 1991, Thite, 1997) required to assume the leadership side of project management. Strohmeier (1992, p. 45) even argues that project managers, with technical backgrounds, are sceptical about the importance of interpersonal skills which they consider as "*vague and irrational"*.

Furthermore, Thornberry (1987), Thite (1997) as well as Gehring (2007) argue that project managers coming from technical backgrounds have things-oriented competences, making them able to deal with the technical aspect of the project. However, Graham and Englund (1997, as quoted by Gehring, 2007) argue that the technical aspect of a project is often the smallest and easiest part. According to Gehring (2007), *accidental project managers* may therefore fail to deal with the leadership side of project management. Walker and Peterson (1999, as quoted by Gehring, 2007, p. 50) even suggest that *"only with blind luck does an organization get a person having the right aptitudes into project management."*

Consequently, when selecting project managers among worthy technical employees, organizations run the risk that those project managers lack the interpersonal skills necessary to assume the leadership side of project management.

Engineers being technical employees, the previous points have raised a major issue regarding the transition they experienced when becoming project managers. Bearing that in mind, the following point will focus on French engineers' specificity.

1.3. French engineers' distinctiveness

This point aims at introducing the reader to the French specificity when it comes to engineers. It will be mainly based on sources in French but also on my personal knowledge.

French engineers' distinctiveness lies in the duality of the term engineer. Indeed, in France, the term engineer designates either a title or a professional status. When it comes to the professional status, there is no regulation. It commonly refers to a technical-oriented position only open to people with as master's degree. However, the title of graduate engineer, or *ingénieur diplômé* in French, is controlled and protected by law. Indeed, this title can only be delivered by higher engineering education establishments, called *Grandes Écoles*, which have been allowed to do so by a special committee controlled by the French Minister of Education. Currently, 244 engineering schools are authorized to deliver the title of graduate engineer. My engineering school, ECM as mentioned in the foreword, is among these.

Moreover, to obtain their engineering degree, French students must undertake a two-phase education program:

- Two years in a preparatory school, *classes préparatoires* in French, which include very intensive courses prior to passing a highly competitive national examination;
- Then, depending on their examination results, they enter one of the 244 *Grandes Écoles* for three years.

The following table illustrates this two-phase program and compares it to the common French university program.

Levels *(years)*		French higher education *(Universities / Grandes Écoles)*	
		Universities	Grandes Écoles *Business schools* *Engineering schools*
9	18 semesters (+9 years)	*State diploma of doctor of medicine*	
8 7	DOCTORATE 16 semesters (+8 years)	Doctorate *(PhD)*	
6	12 semesters (+6 years)	*State diploma of doctor of dental surgery, State diploma of doctor of pharmacy*	*Specialized Master - MS, Master of Business Administration - MBA*
5 4	MASTER 10 semesters (+5 years) - 300 ECTS	Master	Grandes Écoles *Engineering degree, Business school diplomas*
3	LICENCE *(Bachelor)* 6 semesters (+3 years) - 180 ECTS	Licence *(Bachelor)*	
2 1	4 semesters (+2 years)		Classes Préparatoires *(Preparation for admission to Grandes Écoles)*

Table 1.3.1: French higher education system (Universities / Grandes Écoles)

Furthermore, Bouffartigue and Gadéa (1997) suggest that because of their historic heritage, French engineering schools rely on a success model promoting high level of knowledge. But not any kind of knowledge, an abstract, esoteric, and theoretical knowledge based on a deductive reasoning (Bouffartigue and Gadéa, 1997).

Both Table 1.2.2 and Table 1.2.3 illustrate the above, as they present all courses I have been taught during my engineering education, from *classes préparatoires* to engineering school. These tables only illustrate my personal experience. However, the objective here is to give the reader an example of which kind of subjects can be included into a French engineering program.

Two years of *classes préparatoires*			
First year		Second year	
First semester	ECTS Credits	Third semester	ECTS Credits
Mathematics	12	Mathematics	10
Physics and Chemistry	8	Physics	8
Industrial engineering sciences	2	Chemistry	1
Computer sciences	2	Industrial engineering sciences	4
Introduction to scientific research methodology	1	Computer sciences	1
French literature and Philosophy	2	Introduction to scientific research methodology	2
English	2	French literature and Philosophy	2
Spanish (optional)		English	2
Physical Education	1	Spanish (optional)	
Second semester	ECTS Credits	Fourth semester	ECTS Credits
Mathematics	12	Mathematics	10
Physics and Chemistry	8	Physics	8
Industrial engineering sciences	2	Chemistry	1
Computer sciences	1	Industrial engineering sciences	4
Introduction to scientific research methodology	2	Computer sciences	1
French literature and Philosophy	2	Introduction to scientific research methodology	2
English	2	French literature and Philosophy	2
Spanish (optional)		English	2
Physical Education	1	Spanish (optional)	
	60		60

Table 1.3.2: Two years of classes préparatoires' courses and associated ECTS credits

Two years of *engineering school*			
First year		Second year	
Fifth semester	ECTS Credits	Seventh semester	ECTS Credits
Mathematics	3	Mathematics	3
Introduction to Algorithmic	2	Computer sciences: Data storage and processing	2
Mechanical and Process engineering	4	Control engineering	2
Chemistry	4	Management	1
Quantum Physics	3	Multidisciplinary project	6
Signal theory	4	Personal and Professional Development	1
Electronic engineering	3	Foreign languages: English - Spanish	3
Management	3	Chemical reaction engineering	2
Physical Education	1	Finance and Strategy	2
Foreign languages: English - Japanese	3	Central international	2
		Computer sciences: Web programming	2
		Electrical engineering	2
		Human and social sciences	2
Sixth semester	ECTS Credits	Eigth semester	ECTS Credits
Mathematics	2	Foreign languages: English - Spanish	3
Signal and Information theory	2	Engineering internship	6
Mechanical and Process engineering	4	Introduction to the public stake in energy and tranvserse aspects	3
Chemistry	3	Nuclear energy	4
Statistical Physics	2	Solar energy	3
Economics and Administration	2	Marine, Wind and Hydraulic energies	4
Transverse project	3	Biomass and Hydrogen energies	2
Foreign languages: English - Japanese	3	Transverse aspects of sustainable energies	2
Physical Education	1	Project	3
Optics: Sensors and Instrumentation	3		
Economic philosophy	3		
Object-oriented Design and Modelling	1		
Project Management	1		
	60		60

Table 1.3.3: Two years of engineering school' courses and associated ECTS credits

It is quite clear when looking at both previous tables that technical subjects such as, mathematics or computer sciences, occupy a predominant position in French engineering education programs. Consequently, Davis' (1981) argument that the transition from high-level technical specialists to project managers is difficult may be particularly true for French engineers.

1.4. Summary and structure of the paper

To put it in a nutshell, a new approach to project management that considers leadership as an inherent component of it has been introduced by scholars to face the challenges of today's dynamic and complex business environment. Therefore, project managers must exercise leadership. However, because project managers are usually selected among worthy technical specialists, such as engineers for example, they may not possess the skills required to exercise leadership. Their transition from technical specialists to project managers may therefore be difficult. Moreover, French engineering education programs predominantly focus on the development of their students' high-level technical knowledge. Therefore, French engineers' transition from high-level technical specialists to project managers may be particularly challenging. In that respect, this master's thesis will try to bring out the nature of the transition's challenges as well as their roots. My research question is therefore the following:

How and why is French engineers' transition from technical specialists to project managers challenging?

To answer this research question, this paper involves seven main chapters, including the introduction. The second chapter will introduce the essential theoretical underpinnings necessary to answer my research question. Throughout this chapter theoretical propositions will be developed in order to create a theoretical framework. Then, the third chapter will aim at justifying the methodology I have adopted to conduct my research study. Furthermore, the fourth chapter will present the empirical data I have collected. These data will be then analyzed in the fifth chapter, using the theoretical framework previously developed. The results will be discussed in the sixth chapter. Finally, my research question will be answered in the conclusion.

2. Literature

This chapter, which includes six main points, aims at providing the essential theoretical underpinnings necessary to answer my research question. Throughout the first five points, I will try to develop theoretical propositions, which will all be gathered in the last point. Then, these theoretical propositions will be used in chapter *5. Analysis* to analyze the empirical data I have collected.

2.1. Leadership

It has been showed in the introduction chapter that the traditional approach to project management fails to overcome the challenges of today's dynamic and complex work environment. A new approach to project management has therefore been introduced by scholars to bridge the existing gaps. This new approach has introduced leadership as an inherent component of project management. But what does leadership mean? Actually, there is little agreement on the definition of leadership. Indeed, Stogdill (1974, p. 7) claims that *"there are almost as many different definitions of leadership as there are persons who have attempted to define the concept"*. Bearing that in mind, I have made the decision to only describe the concept of leadership through theories that I consider of particular interest in the context of my research study. In that respect, this part will describe three different leadership theories, which in order of appearance are: the situational leadership theory, the transformational leadership theory, and finally the influence process school. As previously mentioned, I will develop theoretical propositions throughout this point. These propositions will be spell out in point *2.1.4. Summary*.

2.1.1. Situational leadership

One of the main leadership theories is the situational leadership theory. This theory, first introduced by Hersey and Blanchard (1969), is based on the amount of support, or *relationship behavior*, and direction, or *task behavior*, a leader should provide depending on the situation. Indeed, Hersey et al. (1979) suggest that different situations imply different leadership styles.

On one hand, Hersey et al. (1979) define relationship behavior as the extent to which the leader listens, provides support and encouragement, and involves the followers in the decision-making

process. While, on the other hand, Hersey et al. (1979) define task behavior as the extent to which a leader spells out to followers what to do and how to do it. These two factors are in other words based on the readiness of the follower which is the subordinates' ability and willingness to perform the task (Hersey et al., 1979).

Bearing that in mind, Hersey et al. (1979) identify four leadership styles: delegating, participating, selling, and telling. For example, if a follower is willing but unable to carry out a task, then the leader should provide high support and encouragement as well as clear and specific instruction. This style refers to a selling leadership style. Finally, this school, as opposed to other schools of leadership which considered that leaders are born and not made, believes that leadership can be learnt.

2.1.2. Transformational leadership

Another theory of leadership is transformational leadership. Transformational leadership has first been introduced by Burns (1978) at the end of the 1970s, and then expounded upon by Bass (1985). Bass (1990a, p. 21) suggests that transformational leadership is exercised:

> *"when leaders broaden and elevate the interests of their employees, when they generate awareness and acceptance of the purposes and mission of the group, and when they stir their employees to look beyond their own self-interest for the good of the group".*

For their part, Müller and Turner (2010, p. 438) suggest that transformational leadership focuses on *"development of visions, presence of charisma, respect and trust"*. Bass (1990b) introduces three factors characterizing transformational leaders: charismatic, meet the emotional needs of employees, and finally intellectually stimulate employees.

Transformational leadership can be related to the highest stage of Maslow's (1943) pyramid, which is self-actualization needs. Actually, the self-actualization stage deals with the human desire for self-fulfilment, realizing personal potential, and seeking personal growth. However, Bass (1990b) suggests that transformational leaders manage to stimulate their employees intellectually, to make them achieve things they did not feel capable of. Moreover, transformational leaders can take the role of mentor to help *"those who need help to grow and develop"* (Bass, 1990b, p. 21). Therefore, it can be said that transformational leadership is in a sense related to self-actualization needs.

2.1.3. The influence process school

The influence process school has been defended by some scholars such as Hersey et al. (1979, p. 418) who define leadership as *"the process of influencing the activities of an individual or a group in efforts toward goal accomplishment"*. In line with this, Northouse (2018) refers to leadership as *"a process whereby an individual influences a group of individuals to achieve a common goal"*. Moreover, Northouse (2018) argues that influence is the sine qua none of leadership, which means that, according to him, leadership does not exist without influence.

Furthermore, leadership and power have a strong relationship. Indeed, according to Northouse (2018) power is part of the leadership influence process. In line with this, Hersey et al. (1979, p. 418) define power as the leader's influence potential, in other words *"the resource that enables a leader to induce compliance or influence followers"*. French et al. (1959) introduce five major types of power: referent power, expert power, legitimate power, reward power, and coercive power. Referent and expert powers relate to personal powers, while legitimate, reward, and coercive powers relate to position powers. Leaders could therefore use their position powers, in other words the fact that the function of leader has formally been assigned to them, to consolidate their leadership position within their team. However, Northouse (2018) claims that the person to whom the leader position has formally been assigned does not always become the real leader. Indeed, informal leaders are perceived as the most influential members of the team due to their personal powers. Moreover, according to Fischer (1974, as quoted by Northouse, 2018) *"being verbally involved, being informed, seeking others' opinions, initiating new ideas, and being firm but not rigid"* are positive communication behaviors that account for informally becoming the leader of a team.

The influence process school appears to be of particular interest for twenty-first century project managers. Indeed, Sotiriou and Wittmer (2001) have studied, by looking at both project leaders and team members' perceptions, the efficiency of different methods of influence used by project managers. As a result of this, Sotiriou and Wittmer (2001) suggest that professionally challenging projects are the factor which influences the most project team members' behaviour. Indeed, they demonstrate that motivating project team members by providing them with challenging tasks is more efficient than any other method of influence, such as exercising coercive or reward powers for example. The importance of providing challenging tasks to project team personnel will be addressed in more details in point *2.4.3. Managing technical*

professionals.

2.1.4. Summary

As previously introduced, the objective of this point is to develop theoretical propositions which will then be used to analyse the empirical data I have collected.

Regarding leadership theories, this part has described three of them that I consider of particular interest in a project context. First of all, regarding situational leadership, I feel that it can help project managers handling the human component of projects by adapting their leadership styles to the team member's personality. Therefore, the first theoretical proposition I have developed based on the situational leadership theory is:

> *L1: Project managers must adapt their leadership style depending on the team member's personality.*

Then, it has been mentioned that, as opposed to other leadership theories which considered that leaders are born and not made, situational leadership believes that leadership can be learnt. This is an important issue considering that engineering-backgrounded project managers usually lack the skills necessary to exercise leadership. I have made the choice to refer to the skills necessary to exercise leadership as soft skills. Therefore, the second theoretical proposition I have developed based on the situational leadership theory is:

> *L2: Project managers can learn leadership by developing their soft skills.*

When it comes to transformational leadership and the influence process school, they both appear to be of particular interest in a project context, as stimulating project team members by providing them with intellectually challenging tasks is more efficient than any other method of influence. Therefore, the third and theoretical proposition I have developed based on both the transformational leadership and the influence process school theories is:

> *L3: Project managers must challenge their team members intellectually to make them grow.*

2.2. Engineering leadership

The introduction has showed that engineering-backgrounded project managers may lack the skills required to assume the leadership aspect of project management. As a reminder, from now on these skills will be referred as soft skills This part will therefore try to understand why engineers lack soft skills. Moreover, as previously mentioned, I will develop theoretical propositions throughout this point. These propositions will be spelt out in point *2.2.6. Summary*.

2.2.1. A technical specialist

Thornberry (1987) emphasizes the complete opposition existing between the skills required to be recognized as a successful project manager and the skills rewarded in an engineer. Indeed, on one hand, Thornberry (1987, p. 60) describes engineers as *"experts in a specific area"* and refers to their skills as things-oriented. According to him, these skills make them able to deal with the technical aspects of the organization. On the other hand, Thornberry (1987, p. 60) argues that a project manager position requires people-oriented skills, as well as *"a broad-functional perspective"*. In line with this, Kumar and Hsiao (2007, p. 19) argue that engineers tend to focus on technical aspects and consequently *"overlook the broader picture"*. Moreover, Thornberry (1987) suggests that engineers tend to put their functional area first, while project managers' top priority is the project itself. This issue will be described in more details in point *2.4.4. Managing technical professionals*. When moving towards a project manager position, Thornberry (1987) argues that developing soft skills is the most challenging for engineers.

2.2.2. Soft skills

The new approach to project management, previously mentioned in the introduction chapter, considers leadership as an inherent component of project management and induces therefore the need for project managers to possess soft skills. In line with that, Kumar and Hsiao (2007) emphasize the importance for engineers, assuming leader positions in today's workplace, to possess both technical and soft skills. Similarly, Ramazani and Jergeas (2015, p. 43) suggest that because of today's business environment complexity *"project managers need to be able to rapidly respond to changing economic, social and technical situations"* and therefore to possess soft skills.

According to both El-Sabaa (2001) and Gillard (2009) project managers' leadership has a huge impact on projects' success. Gillard (2009) even argues that project managers' technical skills are not the prerequisite to their success. Today's project managers, evolving in a more and more complex business environment, have to exercise leadership and therefore to possess excellent soft skills (Gillard, 2009).

Kumar and Hsiao (2007, p. 19) introduce eleven dimensions of an engineering leader which are gathered in the following table:

Dimensions of an engineering leader	Nature of the skills
Ability to build succesful teams and work with teams to accomplish project goals	Soft
Ability to motivate, insprire, respect, and reward the team members	Soft
Ability to evaluate potential risk and willingness to take calculated risk for the success of the project	Hard and Soft
Thorough understanding of duties of an engineer including service to the community	Soft
Sound technical skills within his/her area of expertise, and ability to identifiy and recruit other team members with skills needed for successful completion of the project	Hard
Clear vision of potential outcomes and ability to strategize to achieve them	Soft
Value transparency, honesty, integrity, and high ethical standards in decision making	Soft
Ability to communicate effectively, both written and oral	Soft
Ability to listen carefully and learn from others	Soft
Understand the importance of responsiveness to his/her clients, both internal and external	Soft
Empathy for what he or she does	Soft

Table 2.2.1: Dimensions of an engineering leader, from Kumar and Hsiao (2007, p. 19)

The predominance of soft skills over hard ones is quite clear.

2.2.3. Engineering education programs' flaws

The importance for today's project managers to possess excellent soft skills has been emphasized in the previous point. However, Kumar and Hsiao (2007) identify the flaws of current engineering education programs when it comes to introduce students to soft skills. Indeed, Kumar and Hsiao (2007) emphasize the fact that traditional engineering education programs are mainly aiming at developing students technical skills, also referred as hard skills, and that there is no real focus on skills such as communication, leadership or management. In line with this, Bellinger (2002) suggests that because of the too technically demanding nature of engineering programs, students tend to not have time for non-technical oriented courses. Kumar and Hsiao (2007) do not suggest that the development of students' technical skills should not be the primary objective of engineering education programs. Nevertheless, they argue that mastering technical skills is not enough to master the challenges of today's dynamic and complex business environment. Graduates must also get the education and experience that allow them to learn the basics of project management and leadership (Kumar and Hsiao, 2007). In line with that, Rao (2014, p. 43) argues that *"soft skills complement the hard skills in evolving students as successful professionals"*.

Moreover, Ramazani and Jergeas (2015) suggest that engineering students are not well prepared for facing the level of complexity of today's business environment. According to them, engineering education programs do not provide students with enough training on subjects such as "*economic modelling [and] simulation"* (Ramazani and Jergeas, 2015, p. 43).

2.2.4. On-the-job training

Engineering education programs fail to prepare their students to the requirements of today's dynamic and complex business environment. Consequently, how newly promoted engineering-backgrounded project managers manage to develop their soft skills? Actually, the common practice consists of learning on-the-job. Kumar and Hsiao (2007, p. 19) refer to this practice as *"learning the soft skills the hard way"*. According to Paton et al. (2010, p. 160), project managers' on-the-job training is an *"experiential learning"*. This concept will be later described in point *2.3.2. Experiential learning*. Thornberry (1987) considers this on-the-job training as a risky practice, both for the newly promoted project manager and the organization itself. Indeed, according to him, when assigning a project to a newly promoted project manager,

organizations run the risk of facing major issues such as cost overruns and delays. Furthermore, a project failure can affect the newly promoted project manager's *"career aspirations, self-confidence, and esteem"* (Thornberry, 1987, p. 60).

2.2.5. The choice of project management

According to Rynes et al. (1988), Roberts (1994), Johnson and Sargeant (1998), and Hodgson et al. (2011) moving towards a managerial position is seen as a promotion for engineers. Rynes et al. (1988, p. 239) argue that engineers move towards managerial positions *"primarily because of organizational reward structures that favor managerial over technical or professional careers"*. Similarly, both Roberts (1994) and Johnson and Sargeant (1998) identify the lack of career opportunities for engineers who want to grow as technical specialists as being the main reason why engineers move towards managerial positions. In line with that, Perry (1983, as quoted by Roberts, 1994, p. 563) argues that, unlike an engineer, *"a doctor doesn't need to become a hospital administrator to be recognized"*. When engineers' transition from technical specialists to project managers is driven by their quest of recognition, Rynes et al. (1988) suggest that their skills and abilities may not match the actual requirements of the position.

2.2.6. Summary

The above has showed that engineers, assuming leader positions in today's business environment, must possess excellent soft skills. However, engineering education programs fail to develop their students' soft skills as they mainly focus on the development of high-level technical knowledge. Therefore, the first theoretical proposition I have developed based on the theory introduced in point *2.2.3. Engineering education programs' flaws* is the following:

> *E1: Engineering education programs fail to prepare students to the challenges of today's business environment.*

Furthermore, it has been mentioned that experiential learning is the main learning process in which project managers engage to develop their soft skills. Therefore, the second theoretical proposition I have developed based on the theory introduced in point *2.2.4. On-the-job training* is:

E2: Engineering-backgrounded project managers develop their soft skills through experiential learning.

Finally, potential reasons that would explain why engineers make the choice of moving towards managerial positions have been mentioned. The associated theoretical proposition is the following:

E3: A lack of recognition and opportunities in the technical career path make engineers move towards managerial positions.

2.3. Becoming

The primary objective of this part is to better understand the concept of becoming, and more precisely of becoming a project manager. In that respect, the philosophical nature of the concept of becoming will be described in the first point. Then, the two other points will introduce the changes experienced by engineers during their transition from technical specialists to project managers. Moreover, as previously mentioned, I will develop theoretical propositions throughout this point. These propositions will be spelt out in point *2.3.4. Summary*.

2.3.1. A philosophical concept

When it comes to the philosophical concept of becoming, Heraclitus is the main reference. Actually, according to Heraclitus, nothing is but everything is always becoming (Poster, 1996). In other words, Heraclitus believes that everything keeps changing, that the universe is in a continuous state of flux and all appearances of constancy are false (Poster, 1996). Therefore, Heraclitus associates the concept of becoming to continuous change.

Carlsen's (2006) conceptualization of becoming as a process echoes Heraclitus' theory. Indeed, Carlsen (2006, p. 133) considers becoming as a process of *"change and […] continuous movement of uniquely passing presents"*. Furthermore, he also describes the process of becoming as *"a stream of experiences"* (Carlsen, 2006, p. 145). In that respect, the influence of experience on project managers' becoming process will be the topic of the following point.

2.3.2. Experiential learning

Kolb (1984, p. 41) defines experiential learning as *"the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience."* In line with this, Paton et al. (2010) suggest that newly promoted project managers learn from watching people and then reproducing what they have seen. They even argue that a lot of knowledge is gained by newly promoted project managers either when they do not manage to reproduce what that have seen or when they see other people doing things wrong (Paton et al., 2010).

Furthermore, Burgoyne and Hodgson (1983, p. 391) study natural learning, which they define as *"learning that happens outside of teaching/training situations deliberately contrived to bring about learning"*. Similarly, Kotnour (2000, p. 393) considers experience as the source of knowledge creation and *"the path by which improvement takes place"*. In the context of natural managerial learning, Burgoyne and Hodgson (1983, p. 394) introduce five processes of learning among which is *"gradual and tactic change in orientation or attitude on the basis of cumulative experience"*. To illustrate this process of learning, Burgoyne and Hodgson (1983) take the example of a manager who has unconsciously changed his opinion and attitude as a result of his ongoing experience. Therefore, according to Burgoyne and Hodgson (1983), experience over time, and the accumulation of information which comes along it, unconsciously shape and influence managers actions and attitudes. In line with this, Hill (2003, p. 7) refers to the process of becoming a manager as a *"gradual and tacit change"*, which involves *"the accumulation of evidence and experience"*.

Moreover, Hill (2003, p. x) suggests that *"becoming a manager is a transformational experience for which there are few shortcuts"*. To illustrate this transformational process, Hill (2003) compares managers to new parents who, as time goes by, learn what it means to be parents. In that respect, Hill (2003) argues that when managers accumulate experience, they start understanding and accepting their responsibilities, and therefore they start learning what it means to be a manager.

2.3.3. A new individual

The previous point has showed that project managers learn from experience. Hill (2003, p. 7) argues that the accumulation of experience induces the erosion of the individual's *"set of beliefs, attitudes, and values"* to build up a new one. Bennis (2009, p. 52) agrees with Hill's concept of a new individual as he suggests that *"a person does not gather learnings as possessions but rather becomes a new person with those learnings as part of his or her new self"*.

Furthermore, both Kotnour (2000) and Hill (2003) emphasize the need for continuous learning: *"We now know for sure that managers must prepare themselves for a lifetime of learning and personal reinvention" (Hill, 2003, p. xv)*.

2.3.4. Summary

Carlsen (2006) considers becoming as a process of change. Moreover, Kotnour's (2000) and Hill's (2003) argument that project managers need to continuously learn strengthen the idea of a never-ending process. Therefore, the first theoretical proposition I have developed based on these theories is the following:

B1: Becoming a project manager is an unstable and never-ending process.

Furthermore, it has been showed that when engaged in experiential learning, project managers' perception of things changes with the accumulation of experiences. Consequently, the proposition associated to this theory is the following:

B2: Experience over time, and the accumulation of information which comes along it, change project manager's way of seeing things.

Finally, both Hill (2003) and Bennis (2009) suggest that project managers reinvent themselves while accumulating experiences. The theoretical proposition I have developed based on this is then:

B3: Becoming a project manager induces a continuous erosion of the project manager's individuality and the creation of a new one.

2.4. The transition challenges

This part aims at presenting some of the main challenges faced by project managers.

2.4.1. Soft skills-related challenges

Strohmeier (1992) has conducted a survey on 117 senior project managers working in a German aerospace company, with the objective of investigating the soft skills-related challenges faced by project managers. Bearing that in mind, Strohmeir's (1992) survey suggests four main areas of challenges: influence and motivation, conflicts, communications, and finally teamwork and cooperation.

2.4.2. Managing organizational complexity

Project teams often involve people with diverse backgrounds and functional loyalties (Thornberry, 1987), who are often unknown to each other and therefore not used to work together. Not only making these people working together as a team is a very challenging task for project managers, but also both Gehring (2007) and Paton et al. (2010) argue that the structure of projects' parent organizations makes project managers' exercise of authority, and therefore exercise of leadership, challenging. Sotiriou and Wittmer (2001) distinguish between two types of authority: project authority and supervisory authority. Project authority refers to *"the right to suggest to others what needs to be done and when it needs to be done"* (Sotiriou and Wittmer, 2001, p. 16). While supervisory authority is *"the right to make decisions that must be followed by others"* (Sotiriou and Wittmer, 2001, p. 16).

Sotiriou and Wittmer (2001) argue that project authority, that is possessed by project managers, is not as influential as supervisory authority, which is in most organizational structures not possessed by project managers. Therefore, Sotiriou and Wittmer (2001) argue that project managers experience an *authority gap* when it comes to influence their team members' behaviour. In line with this, Aarseth et al. (2016) dedicate an entire chapter to the issues of authority raised by organizational complexity. In that chapter, Aarseth et al. (2016) introduce several models of authority linked to different organizational structures. Aarseth et al. (2016) widely draw their models of authority from the Project Management Institute's PMBOK®

Guide (Institute, 2013). In this guide, it is possible to find Table 2.3.1. which summarizes the influence of the organizational structure on project characteristics such as the project manager's authority.

Organization Structure / Project Characteristics	Functional	Matrix			Projectized
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Low	Low to Moderate	Moderate to High	High to almost Total
Resource Availability	Little or None	Low	Low to Moderate	Moderate to High	High to almost Total
Who manages the project budget	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Project Management Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time

Table 2.3.1: Influence of organizational structures on projects, from the Project Management Institute (Institute, 2013, p. 22)

The Project Management Institute (2013) suggests that the organizational structure has a strong influence on the project manager's authority. Indeed, according to Project Management Institute (2013), a functional organization provides little to none authority to the project manager, while a projectized organization provides full authority to the project manager. The balanced matrix organization, in the middle, provides little to moderate authority to the project manager (Institute, 2013). Being the main organizational structure of the 21st century, I have decided to only describe in more details the influence of a matrix organizational structure on project managers' authority.

Gehring (2007) takes the example of a project manager who is designated project leader in a matrix organization to underline the issues of authority raised by this organizational structure. Indeed, as shown in Figure 2.3.1, the members of the project team report directly to a functional manager and moreover "*are either temporarily assigned to the project, or spend only part of their time working on the project"* (Gehring, 2007, p. 45).

Consequently, in that context, although the project manager is responsible for the achievement of the project objectives, he or she does not have direct authority over the members of the project team (Gehring, 2007, Thornberry, 1987). But how can things get done when project

managers have responsibility over everything and authority over nothing (Sotiriou and Wittmer, 2001, Gillard, 2009)? The structure of authority, in a balanced matrix organization, creates therefore a challenging leadership situation for project managers. Gehring (2007) argues that project managers should exercise strong project leadership in such a kind of organizational structure to handle personnel management.

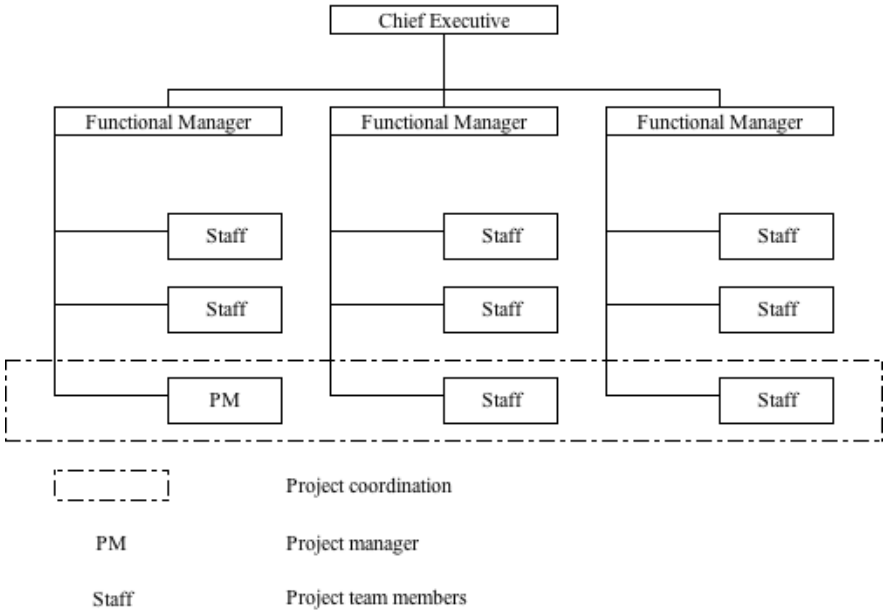

Figure 2.3.1: Matrix organization, from the Project Management Institute (2013, p. 24)

2.4.3. Technical professionals

This point will present the specific expectations of technical professionals in a project team context as well as the consequences of those expectations on engineering-backgrounded project managers' working approach.

Technical professionals are highly skilled specialists who do not share the same expectations as the other members of a project team. Indeed, Rosenbaum (1991) emphasizes the fact that technical professionals have devoted a lot of time and energy to the development of their career, and consequently have specific expectations when it comes to their contribution to a project. Rosenbaum (1991, p. 55) describes technical professionals as "*achievement-oriented people who seek motivation from their work"*. In line with that, Gehring (2007, p. 45) argues that technical specialists are motivated "*by the work itself and their individual contributions"*.

Rosenbaum (1991) mentions that technical specialists need to be stimulated by their work and to achieve challenging tasks that require the fully application of their skills and knowledge to commit to a project. Therefore, the first leadership challenge faced by project managers when dealing with technical professionals is to get them committed to the project. Moreover, Rosenbaum (1991) suggests that technical professionals desire a high level of autonomy when it comes to set goals and make decisions, which means that they would prefer to be self-managed than being under the control of a project manager. This need for self-control creates a second challenging leadership situation for project managers as it raises the issue of how people who refused to be in some way controlled can be managed. According to Rosenbaum (1991) traditional project management principles may fail to deal with the management of technical professionals, project managers require therefore a specific training. The incompatibility of technical specialists with the principles of traditional project management is also underlined by Forsberg et al. (2000, as quoted by Gehring, 2007, p. 45) who argue that *"teams of highly skilled technicians often make costly errors simply because the members fail to understand or follow a disciplined, systematic approach to project management."*

Furthermore, Shenhar's (2004) new approach to management, Strategic Project Leadership®, goes further than the traditional approach as it considers projects as tools to help an organization differentiating itself from its competitors. Consequently, according to this new approach, projects' objectives should be aligned with the organization's goals. However, Rosenbaum (1991) argues that technical specialists have a tendency to prioritize the pursuit of their professional's goals at the expense of the organization's ones. In line with this, Strohmeier (1992, p. 46) argues that employees with *"exaggerated career goals"* may be a threat to cooperation within the team. This loyalty to their profession creates a third challenging leadership situation for project managers as it raises the issue of how to align individual and organizational goals.

Getting high-skilled people committed to a project, managing people who refuse authority and control, as well as aligning individual and organizational goals are the three main challenging leadership situations created by the involvement of technical professionals within a project team. To face these leadership challenges, project managers require a particular training.

Furthermore, the above concerns engineering-backgrounded project managers themselves. Indeed, they are technical specialists in a project team. Therefore, issues such as technical specialists' need for self-control and tendency to prioritize the pursuit of their professional's goals at the expense of the organization's ones show the extent to which engineering-backgrounded project managers have to change their working approach when moving towards a managerial position.

2.4.4. Summary

First of all, it has been showed that the main challenges faced by project managers are soft skills-related. Therefore, from this theory I have developed the following proposition:

TC1: Influence, motivation, conflicts, communications, and finally teamwork and cooperation are among the most challenging areas for project managers.

Then, organizational complexity raises issues of authority for project managers, as they usually have responsibility over everything and authority over nothing.

TC2: Organizational complexity makes it difficult for project managers to exercise leadership.

The point *2.4.3. Technical specialists* has raised issues such as technical specialists' need for self-control and tendency to prioritize the pursuit of their professional's goals at the expense of the organization's ones. These issues, show the extent to which engineering-backgrounded project managers have to change their working approach when moving towards a managerial position. The theoretical proposition associated with this is therefore:

TC3: When moving towards a project manager position, engineers must change their working approach.

2.5. Easing the transition

This chapter aims at introducing solutions that could potentially make engineers' transition from technical specialist to project managers easier. The first point will present potential solutions that can help bridging the gap between engineering education and the expectations of

today's business and industry. Then, the second point will deal with organizational practices. The third point will introduce potential improvement of project managers' selection process. Moreover, as previously mentioned, I will develop theoretical propositions throughout these points, which will be gathered in the last point.

2.5.1. Bridging the gap between engineering education programs and the expectations of today's business and industry

This point focuses on the actions that could be undertaken by both engineering education establishments and industry to bridge the gap that exists between them.

2.5.1.1. Engineering programs

Farr and Brazil (2009, p. 8) accuse young engineers of naivety when it comes to *"the optimum mixture of technical and non-technical skills needed to be a success"*. Indeed, they suggest that the majority of young engineers are not aware of the crucial importance of soft skills. To tackle this lack of awareness, Farr and Brazil (2009, p. 8) suggest that engineers should develop their soft skills as early as possible so they have more time *"to grow into a leadership role"*.

In line with that, Kumar and Hsiao (2007, p. 18) reject the idea that leaders are born, and have even gone as far as saying that *"leadership could be born out"* when proper education and training are provided. According to them *"the seed for producing engineering leaders must be sowed in basic engineering classes"* (Kumar and Hsiao, 2007, p. 19).

In that respect, Kumar and Hsiao (2007) suggest that engineering programs should evolve in order to better prepare graduates to the challenges of today's ever-changing world.

However, Pulko and Parikh (2003) suggest that teaching soft skills to a large group of engineering students is a very challenging task. Indeed, they suggest that the main issue comes from engineering students' attitudes towards soft skills-oriented courses. According to Pulko and Parikh (2003), a majority of engineering students finds these courses useless and does not consequently make the effort of attending. Engineering students' negative attitude towards soft skills-oriented courses can partially be explained by teachers' failure to teach such kind of topics *"in a way that is palatable to students"* (Pulko and Parikh, 2003, p. 243). However,

Pulko and Parikh (2003) also argue that this attitude towards soft skills-oriented courses is especially true when it comes to male engineering students. According to them, male engineering students tend to be over-confident about both their hard and soft skills, and refuse to act on the advice of their teachers.

Pulko and Parikh (2003) argue that traditional lecturing, characterized by one-way communication, fails to teach soft skills to engineering students and that *"a modified teaching approach is required"*. To describe this modified teaching approach, Pulko and Parikh (2003, p. 244) introduce four characteristics :

- Dynamic;
- Interesting;
- Practical, and
- Organized to manage tactically the attention span of the audience.

To be effective, a soft skills-oriented course must involve the participation of the students the teacher must not be the only one to talk. Pulko and Parikh (2003) advice teachers to use storytelling (real examples), group exercises and role playing (simulations) to make a lecture more dynamic. In line with that, Kumar and Hsiao (2007, p. 20) *"students learn best when they receive education complemented with experiments or hands-on training"*.

Nealy (2005) argues that bridging the gap between today's business and industry demands and engineering education programs requires those aiming at teaching soft skills to engineers to change and adapt their teaching methods. Indeed, Nealy (2005) suggests the replacement of traditional teaching and learning models by new ones which involve students more. Similarly, Kumar and Hsiao (2007) argue that the implementation of soft skills-oriented courses should go hand in hand with the modification of teachers' teaching style.

2.5.1.2. Involvement of professionals

Pulko and Parikh (2003) suggest that the industry has encouraged engineering programs to include more and more soft skills-oriented courses. But the industry itself can help bridging the existing gap between engineering education programs and the reality of today's workplace. Indeed, both Kumar (2000) and Rao (2014) argue that engineering education establishments should encourage the involvement of industry professionals in their programs. According to

Rao (2014, p. 45), regular interventions of industry professionals *"bring awareness among the students about the industry expectations"*. In line with that, Kumar (2000, p. 3) suggests that industrial professionals help engineering education programs *"by providing practical experience"* and making students aware of the crucial importance of non-technical skills, such as communication and teamwork. Moreover, Kumar (2000) gives some advice to engineering education establishments on how to involve industry professionals in their programs. In that respect, he argues that industry professionals can present seminars or workshops, or even supervise working groups. Rao (2014), for his part, makes some suggestions to the industry. Indeed, he argues that the industry should *"send volunteers to educational institutions to teach employability skills in the classrooms"* (Rao, 2014, p. 46).

2.5.2. Organizational practices

This point focuses on the actions that could be undertaken by organizations in order to help their engineering-backgrounded project managers' transition.

2.5.2.1. Training

According to Nyhan (1998), Hill (2003) and Suikki et al. (2006), competence development is one of the main critical strategic factors that ensures organizations' competitiveness. Therefore, in today's dynamic and very competitive business environment, organizations must ensure the development and enhancement of their employees competences (Suikki et al., 2006). Bearing that in mind, this point will help the reader understanding how organizations can help project managers developing and enhancing their soft skills.

As previously mentioned in point *2.4.1. Soft skills-related challenges*, Strohmeir (1992) identifies four main areas of interpersonal problems faced by senior project managers; these areas being influence and motivation, conflicts, communications, and finally teamwork and cooperation. Strohmeier (1992) argues that because of the great importance of soft skills within the context of a project, organizations should support and establish personnel-development measures to help senior project managers handling soft-skills related problems. Personnel-development measures are not clearly defined by Strohmeier (1992), however here the term is used as a synonym of a course of action taken to develop and improve senior project managers'

interpersonal skills. In light of this, three different types of personnel-development measures are then introduced by Strohmeier (1992): group-oriented development programs, problem-oriented measures for organizational development, individual development measures. According to Strohmeier (1992), group-oriented development programs are of particular interest for technical-backgrounded project managers. Indeed, Strohmeier (1992) suggests that competent technical employees, such as engineers, are generally expected to learn soft skills while doing the job. However, according to him, group-oriented development programs may *"avoid [this] risky 'trial-and-error' procedure"* (Strohmeier, 1992, p. 47).

Furthermore, when it comes to problem-oriented measures for organizational development, Strohmeier (1992) argues that soft skills-related problems involve many people and cannot therefore be solved by the project manager alone. Personnel development measures should therefore involve other people, such as the project team for example, but also should involve the organization itself. Indeed, Strohmeier (1992) suggests that personnel development measures need the support of the whole organization. Similarly, Suikki et al. (2006) argue that organizations should provide conditions to ensure personnel development measures. In line with this, Rosenbaum (1991, p. 58) argues that personnel development "*is, in most cases, only possible against the backdrop of an organization that demands such development […] and provides incentives for achieving it"*.

Finally, individual development measures refer to measures such as support and personal counselling, and aim at examining problems faced by project managers *"with regard to a specific project situation"* and establishing afterwards, appropriate measures and goals to reach (Strohmeier, 1992, p. 47).

2.5.2.2. Coaching

Berg and Karlsen (2007, p. 4) define coaching as *"the process of challenging and supporting a person or a team to develop ways of thinking, ways of being and ways of learning"*. Thompson and Cox (2017) consider coaching as being a potential solution to newly promoted project managers' lack of soft skills. According to them, coaching *"encourages informal learning and guided reflection"* (Thompson and Cox, 2017, p. 64). Similarly, both Kombarakaran et al. (2008) and Walker and Dart (2011) mention coaching as being useful when it comes to develop project managers' soft skills. In line with that, Ramazani and Jergeas (2015) emphasize the role

of coaching in project managers' continuous development. Finally, Suikki et al. (2006) suggest that experienced project managers can take the role of coaches and help newly promoted project managers developing their skills.

2.5.3. Selection of project managers

As mentioned in previous point *2.5.2. Organizational soft skills development-related practices*, Strohmeier (1992) shares the idea that organizations should support and establish personnel-development measures to help project managers developing and enhancing their soft skills. However, Strohmeier (1992, p. 47) argues that personnel development measures is a good approach only when project managers already possess *"the necessary potential for interpersonal growth"*. In other words, Strohmeier (1992, p. 47) suggests that project managers with *"no fundamental social competence"* will not be able to develop and enhance their soft skills through personnel development measures. He therefore emphasizes the importance of an appropriate selection process.

Similarly, Thornberry (1987, p. 61) argues that *"not every engineer […] should become a project manager"*. Indeed, he suggests that the best engineers are not always the best candidates for project manger's positions. According to him, average engineers with the requisite soft skills may fulfill the task the best. Furthermore, Thornberry (1987) makes a case for organizations to provide a clear and realistic preview of the job to potential candidates. This way, newly promoted project managers' expectations will match the reality of the job.

2.5.4. Summary

Three main potential solutions have been introduced. First of all, it has been showed that traditional teaching methods fail to teach soft skills to engineering students. New methods should therefore be used. These methods should place particular emphasis on the involvement of students and on the application of learning, through simulation exercises for example. Furthermore, engineering education programs should involve more interventions of industry professional to bring awareness among students about today's industry expectations. The associate theoretical proposition if the following:

ET1: A modified teaching approach is required to teach soft skills to engineering students and engineering education programs should involve more industry professionals to bring awareness among the students about today's industry expectations.

Then several scholars consider coaching as being useful when it comes to develop newly promoted project managers' soft skills. The associated theoretical proposition is therefore:

ET2: Coaching is a potential solution to newly promoted project managers' lack of soft skills.

Finally, it has been argued that the best engineers are not always the best candidates for project manger's positions. Moreover, organizations should provide a realistic preview of the project manager job to potential candidates, so their expectations match the reality. The associated theoretical proposition is then:

ET3: Project managers' selection processes must look beyond engineers' technical skills and provide a realistic preview of the job to potential candidates.

2.6. Theoretical framework

This point aims at gathering the fifteen theoretical propositions that have been developed throughout this chapter. These propositions are presented in the following table:

Topics	Code	Theoretical propositions
Leadership	L1	Project managers must adapt their leadership style depending on the team member's personality.
	L2	Project managers can learn leadership by developing their soft skills
	L3	Project managers must challenge their team members intellectually to make them grow.
Engineering leadership	E1	Engineering education programs fail to prepare students to the challenges of today's business environment.
	E2	Engineering-backgrounded project managers develop their soft skills through experiential learning.
	E3	A lack of recognition and opportunities in the technical career path make engineers move towards managerial positions.
Becoming	B1	Becoming a project manager is an unstable and never-ending process.
	B2	Experience over time, and the accumulation of information which comes along it, change project manager's way of seeing things.
	B3	Becoming a project manager induces a continuous erosion of the project manager's individuality and the creation of a new one.
The transition challenges	TC1	Influence, motivation, conflicts, communications, and finally teamwork and cooperation are among the most challenging areas for project managers.
	TC2	Organizational complexity makes it difficult for project managers to exercise leadership.
	TC3	When moving towards a project manager position, engineers must change their working approach.
Easing the transition	ET1	A modified teaching approach is required to teach soft skills to engineering students and engineering education programs should involve more industry professionals to bring awareness among the students about today's industry expectations.
	ET2	Coaching is a potential solution to newly promoted project managers' lack of soft skills.
	ET3	Project managers' selection processes must look beyond engineers' technical skills and provide a realistic preview of the job to potential candidates.

Table 2.6.1: Theoretical framework

This theoretical framework will be used in chapter *5. Analysis* to help me analyzing my empirical data.

3. Methodology

The objective of this chapter is to justify the methodology I have adopted to answer my research question. In that respect, the way I have selected the participants to my research study will first be described. Then, the second point will introduce the reader to both my research design and method. The way I have analyzed, managed and interpreted my empirical data will be presented in the third point, while the fourth will assess the quality of my research study. Finally, this chapter will end on my personal feeling about what I have experienced when writing this master's thesis.

I have chosen to mainly base the following points on Bryman's (2012) social research methods theory.

3.1. Sampling cases

This point aims at describing the way I have selected the participants to my research study. Bryman (2012, p. 14) defines sampling cases as *"the selection of cases (in this case people) who are relevant to the research questions."*

As previously mentioned, I wanted my master's thesis to be personal. Therefore, I have made the choice to interview project managers coming from my French engineering school. As an ECM student it is really convenient for me to have access to a list of former engineering students who are now or have once been assuming project manager positions. Indeed, ECM makes an online alumni search engine available to its students. Bearing that in mind, I have performed a search on the basis of two key words, project and manager. The alumni search engine has then displayed a list of former students who appear best to correspond to these key words, in decreasing order of relevance. The resulting list contains 131 different former students who are now or have once been assuming project manager positions.

Among these 131 project managers, the first thirty-five have been asked via email to participate in this research study. This email can be found in appendix A-1 and A-2 (French and English versions respectively). Ten of them have responded positively. I could have found other project managers to interview by sending tens of other emails. However, in the context of a master's

thesis, I feel that dealing with more than ten different interviewees is difficult timewise. Therefore, I have made the choice of stopping to search for participants after receiving ten positive answers.

Unfortunately, two of the ten project managers who first agreed to participate in my research study, cancelled afterwards. Due to time issues, I have not managed to find substitutes. previously. Therefore, I have interviewed a total of eight former ECM students who are currently or have at one point been working as project managers. Time issues have therefore constrained the number of cases included in my research study.

However, it was very important that both genders were represented by the group of participants. Indeed, my purpose was in any case to study the differences that might exist between female and male project managers, therefore I did not want my research study to be gender-oriented. Furthermore, at ECM, about 29% of all students are women. In the context of this study, two out of eight participants are women, which is equivalent to 25%. My sampling is consequently quite faithful to the ECM's general population. Moreover, in order to grasp the challenging nature of the transition experienced by an engineer when moving towards a project manager position, the group of participants had to include different levels of experience. The experience range goes from six to eighteen years, with a median of eleven and half years. If these requirements would not have been met, I would have continued to search for participants.

Bearing the above in mind, my sampling can be described as a purposive sampling (Bryman, 2012). Indeed, the primary objective of a purposive sampling is to select cases (in this case French engineering-backgrounded project managers) depending on their relevance to the research question (Bryman, 2012). Therefore, a purposive sampling is non-probabilistic.

3.2. Data collection

Bryman (2012, p. 14) defines data collection as the action of *"gathering data from the sample so that the research questions can be answered."* Therefore, the primary objective of this point is to describe how I have gathered my empirical data. In that respect, first the dual nature of my research design will be described. Then, my research method will be introduced.

3.2.1. Research design

The two following first points will describe the dual nature of my research design, while the third one will present another research design that I could have used in the context of my research study.

3.2.1.1. Cross-sectional research design

This point aims at justifying why the research design I have chosen to adopt can, on one hand, be considered as being a cross-sectional research design.

Bryman (2012) bases his definition of a cross-sectional design on three main characteristics: plurality of cases, at one point in time, and finally quantifiable data. Therefore, to legitimize the choice that I have made to adopt such a kind of research design, the following paragraphs will aim at ensuring that each of the three cross-sectional design's main characteristics is fulfilled by my research study.

More than one case:
For the purposes of this study, I have interviewed a total of eight project managers who represent more than one case in the sense that they have different levels of experience, work in different fields of activities, work in different countries, are of different genders, etc. Those differences are illustrated by the following table:

Characteristics	Value	Frequency	Percent
Gender	Female	2	25
	Male	6	75
Years of experience	[0, 6]	1	12,5
	[7, 12]	3	87,5
	[13, 17]	3	87,5
	[18, ∞]	1	12,5
Field of activity	Aeronautics	1	12,5
	Automotive	1	12,5
	Energy	6	75
Location	Brazil	4	50
	France	1	12,5
	Norway	2	25
	USA	1	12,5

Table 3.2.1: Characteristics of the participants

For more details on the differences existing between the eight participants, a complete description of their characteristics can be found in appendix A-5.

This plurality of interviewees and experiences allows me to capture the evolutions and changes experienced by engineers when moving towards a project manager position. This is why the cross-sectional design works within the context of my research study.

At a single point in time:

Within the framework of a cross-sectional research design, data should be collected *"more or less simultaneously"* (Bryman, 2012, p. 59). The ten interviews have been carried out from January 23 to March 6 2018. However, in the context of a social research study, less than two months is considered as simultaneously.

Quantitative or quantifiable data:

Usually, a cross-sectional research design is associated with quantitative data (Bryman, 2012). However, I have made the choice of collecting empirical data using a semi-structured

interviewing guide. Consequently, the data I have collected are qualitative data. Nevertheless, Bryman (2012) suggests that qualitative data can be also used in some cases within the framework of a cross-sectional design. So, my research study can still fall into the framework of a cross-sectional design. The choice of conducting a qualitative research will be explained in more details in point *3.3.2. Research method*.

Bearing the above in mind, the research design I have chosen to adopt can be considered, on one hand, as being a cross-sectional research design. However, the following point will aim at justifying why the research design I have chosen to adopt can, on the other hand, be considered as being a case study research design.

3.2.1.2. Case-study research design

The previous point has showed that the design of my research study features characteristics of a cross-sectional research design. So why am I saying that my research design can to some extent be considered as a case study?

The idea seems pretty senseless, even more when knowing that Bryman (2012, p. 66) describes a case study research design as a *"detailed and intensive analysis of a single case"*, which is the opposite of a cross-sectional research characterized by *"the collection of data on more than one case"* (Bryman, 2012, p. 58).

However, it has previously been presented in point *3.2. Sampling cases* that the eight interviewees come from the same French engineering school, ECM. Bearing this in mind, Bryman (2012) suggests that a research on a single school is one of the best-known type of studies based on a case-study research design.

As a conclusion, my research study can be described as a qualitative research providing *"case-study evidence"* (Bryman, 2012, p. 68) within the framework of a cross-sectional design.

3.2.1.3. Potential research design

I have made the choice of interviewing eight engineering-backgrounded project managers with different levels of experience. This plurality of interviewees and experiences allows me to

capture the evolutions and changes experienced by project managers over the years. However, I could have focused on only one single engineering-backgrounded project manager and followed him/her over several years. In such a context, I would have interviewed him/her *"on more than one occasion"* (Bryman, 2012, p. 76) to study his/her transition process. Bryman (2012) refers to such kind of research designs as longitudinal. Obviously, a longitudinal research design is not a potential option in the context of a six-month master's thesis.

3.2.2. Research method

Bryman (2012, p. 46) defines a research method as *"a technique for collecting data"*.

My research study focuses on the transition experienced by French engineers when moving towards a project manager position. This transition being a very personal experience, I did not want my research method to be a hindrance to the interviewees' own uniqueness. I have therefore made the choice to use a semi-structured interviewing guide, which is a less structured approach, when collecting data. Indeed, according to Bryman (2012, p.12) a semi-structured interviewing guide enables the researcher to:

> *"[…] keep more of an open mind about the contours of what he or she needs to know about, so that concepts and theories can emerge out of the data."*

Therefore, during each of the eight interviews conducted, a real conversation has been created between the interviewee and me. This way interviewees have been allowed to give their own account of the transition they have experienced when becoming project managers. Consequently, not all the interviewees have addressed the same exact topics. Some relevant topics have thus been addressed by only one interviewee. Using a more structure approach, such as a questionnaire for example, would have enabled me to have more control over the topics addressed by the interviewees. Every single relevant topic would have then been addressed by all the participants to my research study. However, I feel that a questionnaire would have curbed the participants' initiative to express what they have truly experienced.

The semi-structured interviewing guide I have developed consists of seventeen questions, divided into eight different sections:

- Education and professional backgrounds;
- Project manager;

- Discovering the role and responsibilities of a project manager;
- Personal evolution;
- Leadership;
- Past and present challenges;
- Developing skills, and
- Easing the transition.

For example, in the section *Developing skills*, the following questions can be found:

- *Have you tried to develop your abilities to communicate, deal with conflicts, motivate a team, etc. through training courses, workshops, simulation exercises?*

  Yes: when in your career? What has been the influence of these on your leadership skills?

  No: do you think that these could have been helpful for you? When in your career?
- *With whom in your company do you speak about leadership?*

The rest of the questionnaire can be found in appendix A-3 and A-4 (French and English versions respectively).

To develop my interviewing guide, I have drawn my inspiration from Hill (2003) who used a semi-structured interviewing guide in her research study on the transition experienced by a salesperson when he or she becomes a sales manager. Hill's (2003) interviewing guide includes thirty-three questions, divided into four different sections:

- The Sales Manager Position;
- The Transition;
- Background Information, and
- Conclusions.

I have mainly been inspired by both the second and third sections. However, my interviewing guide is far from being just a copy and paste of Hill's (2003). Indeed, I have been inspired by the main ideas that were behind Hill's (2003) questions but I have adapted them to the specific context of my research study.

I submitted my interviewing guide to my supervisor and corrected it according to his feedback before putting in into practice. Moreover, after the first interview, I have swapped questions three and four to enhance the conversation flow. The interviewing guide present in appendix A-3 and A-4 is the final version.

3.3. Data analysis

Bryman (2012, p. 14) defines data analysis as *"the management, analysis, and interpretation of the data."*

Bearing that in mind, this point aims at describing how I have managed, analyzed and interpreted the empirical data gathered.

3.3.1. Management

The eight interviews have been conducted in French. Three of them have been conducted via Skype, while the five others by phone. I have used a recording software to tape the interviews. I have also taken some notes during them, primary to write down my personal feeling and perception, but also to ensure that I will collect some empirical data regardless of what happens to the recording. Then, after being done with all the interviews, I have transcribed them. I have made the transcriptions in French in order to remain faithful to the very meaning of the words used by the interviewees.

3.3.2. Analysis

After transcribing the interviews, I have reduced the data collected, grouping textual material into categories. Each category reflects a specific topic addressed by one or several interviewees and is called after it. For example, conflicts, charisma, curiosity, hard skills, hierarchical authority, are among the categories I have used to reduce my empirical data. This categorization of the data can be considered as what Bryman (2012) called coding. Then I have built the empirical chapter using these categories and it is only when writing this chapter that I have translated the textual material. Among all, the translation phase has been the most time consuming. Indeed, remaining faithful to the very meaning of the words is a very difficult task.

Furthermore, one point which should be emphasized here, is that I have conducted my interviews and started transcribing them before starting working on chapter *2. Literature*. I have then kept going back on forth between my empirical data and the literature chapter. Therefore, when reading the theoretical framework I have developed, one may feel that it fits a bit too much and that I did not manage to take a step back from my empirical data. However, I would say that doing so has helped me finding the most interesting literature for my research question but does not call my independence into question.

3.3.3. Interpretation

According to Bryman (2012, p. 13), when interpreting data, the social researcher:

> *"[…] is seeking to link the process of making sense of the data with the research questions that provided the starting point, as well as with the literature relating to retirement and also with the theoretical ideas the authors use to illuminate the issue."*

In that respect, I have interpreted my empirical data using the theoretical framework developed through the literature chapter. My process has been to associate empirical data to one or more theoretical propositions dealing with the same topic. Then, I have determined whether or not empirical data were confirming the theoretical propositions, and the potential reasons why.

3.4. Quality criteria

The primary objective of this point is to assess the quality of my research study. This point is mainly based on Guba and Lincoln's (1982) theory. Indeed, Guba and Lincoln (1982) introduce four quality criteria tailored to the specific nature of qualitative research. In that respect, the following points will discuss whether or not my research study meets these four quality criteria.

3.4.1. Credibility

The first quality criteria to be mentioned by Guba and Lincoln (1982) is credibility. According to them, when it comes to the credibility of a qualitative research study, the crucial question for the social researcher is *"do the data sources (most often humans) find the inquirer's analysis,*

formulation, and interpretations to be credible (believable)?". Similarly, Schwandt (1997, as quoted byCreswell and Miller, 2000, p. 124) defines credibility as *"how accurately the account represents participants' realities of the social phenomena and is credible to them"*.

I have not had the opportunity yet to make the participants to my research study read my findings, so I do not know if they find them credible. However, I have made sure to respect my interviewees' words. Indeed, thanks to my research method, a real conversation has been created between each interviewee and me. This way interviewees have been allowed to give their own account of the transition they have experienced when becoming project managers. Then, after being done with all the interviews, I have transcribed them. I have made the transcriptions in French in order to remain faithful to the interviewees' words. It is only when writing the empirical chapter that I have translated the textual material. In the empirical chapter, I have made the choice of using a lot of direct quotations from the interviewees to give a more realistic picture of their own experience. Moreover, my research design does not involve any field observation of the participants. It should be emphasized that the presence of the social researcher can introduce distortions in the sense that it can change or influence participants' behavior. In such a case, the data collected may not be very representative of the social phenomena. However, as I have collected data about past events that I did not witness, I have not introduced any distortion or bias in my empirical data. For all these reasons, I would say that my findings are representative of the reality of French engineering-backgrounded project managers' social phenomena.

Furthermore, as previously mentioned, I conducted my last interview on March 6 of this year. Then, in late March I attended several job interviews in Paris. These job interviews were for positions as project engineer or project management consultant, so very project management-oriented. During each interview, I was asked to introduce the topic of my research study as well as my progress. Reactions to this description were very positive. Indeed, every single interviewer found the topic very interesting and very representative of the majority of French engineering-backgrounded project managers. They all had, at least once, to work with an engineering-backgrounded project manager who was not really comfortable with the leadership side of project management. Thus, the fact that people, completely external to my research study, but used to work with French engineering-backgrounded project managers found it interesting and representative of the reality stands for its credibility.

3.4.2. Transferability

When it comes to transferability, Guba and Lincoln (1982, p. 248) suggest that the social researcher must provide a purposive sampling to *"maximize the range of information collected and to provide most stringent conditions for theory grounding"*. As previously mentioned in point *3.1. Sampling cases*, my sampling is purposive. I have indeed selected the participants to my research study, in my case French engineering-backgrounded project managers, depending on their relevance to my research question. Consequently, the nature of my sampling stands for the transferability of my findings.

Furthermore, as introduced in point *3.3.2. Research method*, the questions of my semi-structured interviewing guide have been inspired from the ones used by Hill (2003) when conducting her research study on new first line sales managers in a securities firm and a computer company, both located in the US. In the context of this research, Hill (2003) has studied the transition experienced by a salesperson when he or she becomes a sales manager. The cases studied by Hill (2003) are clearly not the same as the ones I have studied. However, Hill (2003, p. 341) argues that *"the evidence strongly suggests that managerial jobs are remarkably similar in their basic responsibilities"*. Moreover, Hill (2003) has tested her interviewing guide on managers working in other areas such as research and development, consulting or even accounting, and the results have been consistent. Therefore, the fact that Hill's (2003) interviewing guide has already been tested and approved in other contexts, justifies the transferability of my research study.

3.4.3. Dependability

Guba and Lincoln (1982) define dependability as a synonym of stability. In other words, assessing dependability consists of determining whether or not reproducing the same research study under other circumstances (time, location, etc.) would change the social researcher's findings.

In the context of my research study, I have collected data about past events. Therefore, if I interview the same participants in five or ten years, these events would be the same. The only difference, would be that they would have gathered much more experience. However,

participants may face some difficulties remembering events that took place a long time ago. So, their account of the transition they have experienced when becoming project managers may be slightly different.

Furthermore, if another social researcher decides to conduct the exact same research study on engineering-backgrounded project managers coming from another French engineering schools or coming from another country, the results would be probably close to mine. Indeed, engineering education programs' lack of focus on the development of students' soft skills, which will appear as one of the main reason why engineer's transition from technical specialists to project managers is challenging, is global. Indeed, the literature I have used in chapter *2. Literature* is not specifically focusing on French engineers, but on engineers in general. Therefore, the same literature could be used. Moreover, my interviewees work in different fields of activity and in different countries, not only European (France and Norway), but also in North and South America (US and Brazil). Therefore, my interviewees are representative of a wide range of engineers. Consequently, the diversity that exists among my interviewees stands for the dependability of my findings.

3.4.4. Confirmability

When assessing confirmability, Guba and Lincoln (1982, p. 248) suggest that social researchers must verify *"that each finding can be appropriately traced back through analysis steps to original data, and that interpretations of data clusters are reasonable and meaningful"*.

I have made sure to introduce my empirical data in a specific chapter, and then to analyze them in a separate one. When analyzing my empirical data, I first refer to the data I am specifically focusing on, so the reader can keep track of my reasoning.

3.5. Personal remarks

This point aims at describing what I have personally experienced when writing this master's thesis for the last six months.

What I have been surprised the most by, is the very uniqueness of each interview. Even though I have used my interviewing guide to direct a bit the interviews, each of them is very unique.

This was actually one of my main objective when deciding to use a semi-structured interviewing guide. However, where I have some regrets is when there is only one single interviewee who has talked about a very interesting topic. In that respect, I think that I could have been better in conducting my interviews. Indeed, I should have sometimes guided the conversation more towards specific topics. I think that this comes also from the fact that I have developed my interviewing guide and conducted the interviews before actually starting to write the literature chapter. Therefore, when I conducted the interviews I did not really know which topics were more interesting than others. If I would have done it the other way, my interviewing guide would have probably been different. At the same time, I think that this can also be seen as an advantage as the theory emerges from the empirical data.

Another point I would like to emphasize here, is the large amount of time it has taken me to translate my interviews. I have not translated everything, but still, this step has been very time consuming as I have made sure to respect the interviewees' words. I should have probably used less direct quotations from the interviewees. But my objective when doing so was to give the reader a very detailed picture of what is experienced by French engineers when moving towards a project manager position.

4. Empirical data

The objective of this chapter is to provide the reader with the empirical data I have collected through the different interviews conducted. The amount of data collected being very large, the following point will only present data I have considered as being of particular interest when answering my research question. Furthermore, due to the less structured nature of my interviewing guide, not all the interviewees have addressed the same exact topics. Some relevant topics have thus been addressed by only one interviewee. These resulting data will then be analyzed in chapter *5. Analysis* in the light of the empirical framework that has been developed on chapter *2. Literature*.

To protect the anonymity of the eight interviewees, I have chosen to use fake names when referring to them. A complete profile of the eight interviewees can be found in appendix A-5.

4.1. Backgrounds

The primary purpose of this point is to present both interviewees' education and professional backgrounds, as well as the way how and the reasons why they have moved towards a career in project management.

4.1.1. Education background

As explained in previous chapter *3. Method*, all the eight interviewees come from the same French engineering school. However, these eight engineers did not graduate the same year. Indeed, the first to graduate, graduated in 1995, while the last one, graduated in 2004. Not all of them specialized in the same engineering field either. Indeed, five different specializations are represented by these eight engineers. Four of them, have taken a marine engineering specialization, while the four others have picked one among the following list: mechanical engineering, electronic engineering, industrial design and management of the innovation, and finally acoustic engineering.

Moreover, three among these eight engineers have completed their engineering diploma with a master's degree. Indeed, after being graduated from ECM, Rachel did a master's in business

administration. There she took very diversified courses, such as human resources, business management, law or even finance courses. During the interview, Rachel emphasizes the non-technical nature of the courses she had followed there. For his part, George did a master's in marine technology. There he followed oil-industry driven courses. Finally, Anthony did a master's in entrepreneurship but did not describe the type of courses he followed there.

Nevertheless, when it comes to project management, and despite some differences in the interviewees' education backgrounds, none of them has followed very advanced courses during their engineering education. Rachel suggests that she was only taught some basics:

> *"We received theoretical trainings, but they were very very limited." (Rachel, [13,17], automotive)*

In line with Rachel, both Louis and Michelle suggest that they were taught few project management courses during their engineering education. Anthony, Charles, Eric, George and William, for their part, argue that did not follow any project management courses.

However, all interviewees unanimously emphasize the technical nature of the courses they followed at ECM.

4.1.2. Professional background

Among the eight interviewees, none of them has started their career as a project manager. Indeed, the former positions of the eight interviewees can be found in appendix A-5.

Six among the eight interviewees have started their career as engineers. For example, both William and Charles started their careers as project engineers and argue that over the years their responsibilities have increased until reaching the ones of a project manager:

> *"First, I was in charge of a small thing. And then from one year to another, I was in charge of ever greater tasks, until at one point the size of the task matches the size of a project. That is how I have moved towards a project manager position." (William, [7,12], energy)*

The two others, Rachel and Anthony, have respectively started as a project management consultant and a sales manager. Both of them have not started their career occupying technical

specialist positions but are still considered as technical specialists due to their technical oriented education.

4.1.3. The choice of project management

Among the eight interviewees, most of them consider their project manager position as a natural evolution of their career. For example, since his graduation, William has always wanted to work in a project mode:

> *"I did not want to be an engineer only doing calculation, I wanted to stroll around, go on different sites, interact with other professions, discover and learn new things." (William, [7,12], energy)*

After a mechanical modeling-oriented internship in an automotive company, Rachel realized that she did not want to do that for the rest of her life. She indeed suggests that she needs a job involving communication and social interaction. Therefore, after getting her master's in business administration, Rachel decided to follow a career in project management:

> *"I do have technical skills, and yes I do want to work in technical fields, but no I do not want to do technical things myself, I want to work with people." (Rachel, [13,17], aeronautics)*

However, other reasons for moving towards a project manager position have been mentioned by two interviewees. Indeed, Eric's former position involved many on-site interventions, and after five years of doing so he wanted to stop. He therefore moved towards a project manager position which does not involve any on-site intervention. Similarly, George took a project manager position because of the harsh work conditions induced by his former job. Indeed, before moving towards a project manager position, George had worked on an offshore oil platform for about four years.

4.2. Project management

This point aims at introducing how the interviewees see project management as well as some of its main components.

4.2.1. The good project manager

When asked about the definition of a good project manager, most interviewees introduce both the notions of soft and hard skills. According to the interviewees, soft skills refer to skills such as interpersonal skills, while hard skills refer to technical skills.

Indeed, Rachel suggests that when it comes to project management, technical knowledge is not the most important. However, Rachel argues that the most important skills to be successful as a project manager are interpersonal skills. According to Rachel a good project manager possesses soft skills such as good communication, active listening, intellectual curiosity, ability to gather people, etc. Rachel illustrates her opinion with her own experience:

> *"When I started working within this new scope, nine months ago, I did not have any technical knowledge of it and it has not been a problem at all. People with whom you are working, are indeed very capable of understanding that you do not have technical knowledge. However, it is important to listen and be attentive to these people." (Rachel, [13,17], aeronautics)*

Moreover, according to Rachel, to be successful, a project manager must have a clear inclination for the job.

Similarly, George has also been in charge of projects that were completely outside of his technical skills set. According to him, it was not a problem at all as he could rely on the expertise of other people. However, in such kind of projects, George suggests that a project manager must know how to put his/her managerial and soft skills forward. Moreover, George describes a good project manager as a methodical person with abilities such as communication, active listening and empathy.

Eric also emphasizes the importance of soft skills for project managers. Communication, listening, availability, capacity of influence, and adaptability are among the most important according to him. Eric even argues that soft skills make the difference between a good project manager and a bad one. But he suggests that soft skills are the most difficult skills to develop. Indeed, according to him, activities such as planning, cost and risk assessment, procurement, etc., involve skills that can be learnt using methods. Eric refers to these activities as *"exact sciences"*. Eric has learnt these *"exact sciences"* through training courses provided by his

company. However, when it comes to developing soft skills, Eric suggests that it can be very difficult for some project managers. Eric even considers the development of his soft skills as being the aspect of project management he has struggled the most with.

For his part, Louis is more balanced regarding the respective importance of hard and soft skills. Indeed, according to him when one moves towards a project manager position, he/she must show to his/her team that he/she has the legitimacy to assume the position. For him, one must possess the necessary experience as well as both technical and interpersonal skills to have this legitimacy.

> *"With this legitimacy, you gain the confidence of the team, suppliers and clients to move forward. This confidence needs to be gained, it is not given. And this is how you acquire your project manager dimension." (Louis, [18,∞], energy)*

However, Louis suggests that technical incompetence is less significant than managerial incompetence. Louis also refers to a good project manager as a curious person, who likes asking questions, who has great communication and listening abilities and who has a real inclination for the job.

Nevertheless, Michelle emphasizes the fact that a lack of advanced knowledge in some areas creates other problems. Indeed, according to Michelle, it could be challenging for a project manager, who does not have any technical knowledge on the project field, to establish himself/herself as the leader of the project and to mobilize people around him/her. In such situations, Michelle does not rely on her technical skills, but on her interpersonal skills as well as on her capacity to identify risks:

> *"Even when I did not have any knowledge on a product, I was warning people against potential risks. First people were doubtful, as they knew I did not know anything about the product. But when finally, these risks happen, two or three times, then they trust you and your capacity to lead the project, and things fall into place". (Michelle, [13,17], automotive)*

4.2.2. Selection of project managers

In both William's and Charles' companies, project managers are selected among the most performing technical employees. However, William adds that his company attaches great importance to candidates' attitude towards other people. Indeed, he suggests that when selecting new project managers his company focuses on the candidates' curiosity, ability to communicate with other people and learn from them, inclination to solve problems and inclination for the job itself. The names of the potential candidates, who have been identified as having the right attitude, are then given by the middle management to the top management.

4.2.3. Project management tools, methods and processes

Rachel started her career as a project management consultant in a French consulting company, in the late 90s. When asked if she tended to use more project management tools and methods back then, she emphasizes on the non-development and non-recognition of these project management methods and tools at that time in France:

> *"Back in the 90s, project management was a non-existing discipline in France. All these methods were not really known or deployed, therefore I definitively did not use them. But really because they did not exist. We were discovering on-the-job." (Rachel, [13,17], aeronautics)*

Such as Rachel, George started his career as a project engineer in the late 90s and was not using any project management method either:

> *"I started in the late 90s, in 1998, and actually, it was not before the 2000s that companies started to be more structured and tried to standardize their methods and project technical executions." (George, [7,12], energy)*

However, he suggests that today's project managers have access to loads of methods and tools. According to him, standardized project management methods or processes are particularly useful in the context of international companies as they enable people to work the same way regardless of their geographic location. Bearing that in mind, George argues that one of the main objectives of the training courses offered by his company is to spread a uniform message across all its centers worldwide and create therefore a *"common language"*. However, George argues that standards must never prevail over common sense. According to him, project

managers must remain pragmatic and rational when using standardized methods or processes to avoid foolish mistakes.

According to Eric, a project manager can feel, in the first instance, more confident when following project management methods or processes. However, he argues that methods and processes fail to deal with the important aspect of projects that is people:

> *"I have never purely and simply relied on processes. On the contrary, I feel that if project managers limit themselves to the implementation of processes, then they will not get what they want. Project managers have to listen to people and their constraints, understand their needs and why they do not want to cooperate. Project managers have to make people working together towards the same objective […] and usually trying to impose something to people by means of a process, does not work." (Eric, [13,17], energy)*

Michelle emphasizes the very established nature of her company's development process. However, Michelle differentiates between theory and practice. Indeed, experience has made her realized that some stages of the development process are much more demanding than others. According to her, when it comes to less demanding stages, compromises can be me made depending on the project. While, very demanding stages cannot be circumvented. Michelle refers to project managers with the ability to adapt the development process to the project as agile project managers. According to Michelle, a project manager must also know how to interpret the KPIs to conduct strategies.

Charles, Louis, and William have, for their part, never used any project management tools, methods or processes:

> *"I have always been 'freestyle' when doing project management." (William, [7,12], energy)*

4.2.4. Project management: a two-sided discipline?

Michelle identifies two aspects of project management. On one hand, she describes the first aspect of project management as being *"what you can learn"*. By this, she refers to project management tools, methods and processes that can be used to assess projects. On the other hand, she considers the second aspect of project management as being leadership. When it comes to leadership, Michelle argues that innate qualities are required and therefore, people

who do not possess these qualities will never be good leaders. This issue will be addressed in more details in point *4.5.5. Soft skills: innate or not innate?*. However, Michelle suggests that some project managers can compensate their lack of leadership abilities by a good technical expertise. This will be later addressed in point *4.3.2.1. Compensating a lack of leadership abilities*.

In line with Michelle' opinion, George differentiates between a control aspect of project management and a people-oriented aspect. According to George, the control aspect of project management involves methods, budget, schedule as well as KPIs, and aims at monitoring the project. When it comes to the people-oriented side of project management, George argues that it involves listening, empathy, communication, adaptation, stress and conflicts management. According to him, the primary objective of this side is to deal with the different actors of a project. Later in the interview, George describes a good project manager as a person with a methodical approach while he describes a good leader as a people-oriented person. Therefore, it can be deduced that the second aspect of project management mentioned by George is leadership.

Therefore, both Michelle and George clearly introduce leadership as an inherent aspect of project management.

4.3. The leadership aspect of project management

Bearing the previous point in mind, the following points will describe how the interviewees define the notion of leadership in a project context.

4.3.1. The good leader

To describe the notion of leadership in a project context, most of the interviewees have listed the skills they believe a good leader must possess.

For her part, Michelle describes a good leader as a person who possesses:

> "*[…] communication qualities, the ability to gather and mobilize people around the same objective, charisma, foresight […] in the true sense of the word which is to have*

the ability to anticipate what will happen, as well as the ability adapt." (Michelle, [13,17], automotive)

In line with Michelle's description, Rachel describes a leader as a charismatic person. According to her, it must be someone people want to follow. Moreover, she differentiates between a good project manager and a good leader. According to her, when it comes to project managers the focus is on the team. Indeed, she argues that if the team runs very well, then the project manager is considered as a good project manager. While, when it comes to good leaders, she argues that the focus is on the leader himself/herself and on his/her ability to bring the team with him/her.

For Louis, leadership is a stronger word than manager. He argues that a lot of charisma, humbleness, adaptation capacity, listening as well as vision and skills in a particular area are necessary to be a leader. He also argues that a leader has the ability to bring people together as a team, to motivate them, and make them work toward the same objective.

George describes a good leader as a people-oriented person, who has the ability to motivate, gather and bring people together toward the same goal.

For his part, Eric describes a leader as a person who acts as a guide, a role model. According to him, a leader must be honest, confident, positive, humble as he/she must accept to rely on the expertise of others when he/she does not possess the adequate set of skills. Moreover, Eric thinks that being considered as a leader is a very difficult task. He even argues that 95% of a project success is due to the project manager's ability to exercise leadership.

Charles considers that a good leader must have a vision, must know how to communicate it, and to make people stick to it. He also emphasizes the complete opposition existing between the skills required to be recognized as a good leader and the skills rewarded in a technical employee.

4.3.2. Exercising authority

As previously mentioned, Michelle argues that the leadership aspect of project management requires innate qualities that cannot be learnt. Therefore, according to her, people who do not

possess these qualities will never be good leaders. However, she adds that experience has showed her that a project manager, in the case of a very technical project, can compensate a lack of leadership skills by a good technical expertise:

> *"[...] when one is the manager of a technical project, he or she is very involved in the product development, technical skills are therefore required, as well as a good understanding of the product. In such a case, I would say that a project manager can naturally establish himself/herself as a leader thanks to his/her technical knowledge. He or she can compensate, maybe his/her lack of other skills, a lack of charisma for example, by technical recognition or a good technical expertise." (Michelle, [13,17], automotive)*

However, Michelle makes it clear that the above is only true for project managers of very technical projects. Indeed, she suggests that functional project managers, in the case of a matrix organizational structure, do not have any hierarchical authority over their team members. Moreover, most of the time these people come from different professional horizons and teams. Therefore, there is no natural unity between these people and the project manager has to mobilize his/her team members around the same objective and make them work together. To exercise authority in such a situation the project manager cannot only rely on his/her technical expertise, he/she has to exercise leadership.

In the same vein, Eric takes the example of recurring projects within which project managers play more a coordinating role than a leading one:

> *"In such a project, the project team is well-oiled, they know exactly what they have to do, the level of uncertainty is very low, the project manager has only an administrative role." (Eric, [13,17], energy)*

Eric considers such projects as a perfect start for non-experienced project managers. However, he emphasizes the fact that this is only true for recurring projects with low uncertainty. In the case of complex projects, Eric argues that the project manager's ability to exercise leadership is key to the project success.

4.3.3. The political aspect of leadership

According to William, project managers' leadership should be very visible. To illustrate his point, William draws a parallel with a presidential election. According to him, to be followed a presidential candidate should look like a president:

> "*Would he/she manage to wear the suit of president? Would he/she look like a president?" (William, [7,12], energy)*

William argues that this is also true for project managers and characterizes this aspect of leadership as advertising. According to him, engineering-backgrounded project managers should work on this particular aspect of leadership. For his part, William is still working on it. When it comes to the advertising aspect of leadership, William argues that French engineering students tend to be disadvantaged compared to business students. This point will be later discussed in point *4.4.1. Engineering education programs' flaws*.

Moreover, according to Louis, the bigger the project, the higher the importance of the political dimension. Indeed, Louis argues that technical complexity does not grow with the size of the project, but the political dimension does.

For his part, George suggests that when things are going well in a project, reporting to the hierarchy is a very easy task. However, when the project falls behind or faces technical issues, he argues that the project manager has to be very convincing and show his/her abilities as a speaker.

4.4. Learning what it means to be a project manager

This point aims at describing how the interviewees have managed to catch the scope of the project manager role over the years.

4.4.1. Mentorship

Mentorship appears as a common practice in most interviewees' companies. For example, when Eric started as a project manager, he was working in pair with a more experienced project

manager. In Michelle's company, newly promoted project managers are placed under the supervision of a mentor. This mentoring role can be either played by a project director, who is in charge of all the projects of a department, or by the department director himself/herself. The mentor follows the projects' KPIs, which depending on the project can involve budget, planning, resources or degree of innovation. Michelle herself, is currently in charge of small group of newly promoted project managers.

Similarly, George's company uses mentorship to support newly promoted project managers. George suggests that the mentoring role is played by hierarchical superiors, and that he is now one of these mentors. In George's company, newly promoted project managers are very quickly autonomous and responsible of their scope, but they have to report regularly to their mentors. He refers to this mentorship as *"distant support"*. Moreover, George emphasizes the importance of the mentor's open-mindedness:

> *"There are very close-minded mentors, who are afraid of being eaten by the people under their responsibilities if they share too much of their knowledge." (George, [7,12], energy)*

For his part, George considers knowledge sharing as being the very objective of mentorship and therefore tries to remain open to improve the skills of the people who work with him.

4.4.2. Learning on-the-job

Michelle argues that project managers realize the scope of their position on-the-job. According to her, this scope varies from company to company. In line with this, Louis argues that he has learnt everything he knows about project management while doing the job.

Both Rachel and William emphasize the importance of learning from the others:

> *"Within a project, you start at one point, in a certain area of competence, and then from this point, you can reach out other areas of competence by watching and talking to the other actors of the project." (William, [7,12], energy)*

William argues that being curious is what has helped him the most catching the scope of the project manager role. He emphasizes the importance for newly promoted project managers to work with as much different project managers and project teams as possible. According to him,

witnessing different styles of project management makes it possible for newly-promoted project managers to do their *"shopping"*. In other words, William suggests that newly-promoted project managers can learn from others' practices and decide which practices or ways of working they want to be part of their own project management style.

Similarly, Eric emphasizes the role played by his colleagues in his learning process:

> *"There is a very good atmosphere in my company, people help each other a lot. When I started, I was not only trained, I was also supported. If I had questions, my colleagues were very keen to answer them." (Eric, [13,17], energy)*

Eric refers to the above as an *"in-house training"* that has made him learn by himself while doing the job. According to him, learning from others, sharing of experience, asking for tips and advice, are informal learning processes that allow non-experienced project managers to learn the tricks of the trade. Eric suggests that from this amount of informal knowledge, project managers then shape their own personality, their own way of doing things. This can be related to William's previous saying.

4.4.3. Training courses

The following point will describe the current practices adopted by organizations when it comes to developing their project managers' skills and the interviewees' opinion on them.

Seven out of eight project managers have participated in training courses organized by their company. Among the main topics addressed by these training courses are: communication, managing conflicts, dealing with difficult people, dealing with hierarchical superiors, influencing people without any hierarchical power, managing crisis, leadership, mobilizing a team, etc. However, Eric, George and Charles mention that these training courses can also focus on project management activities such as planning, contract, cost and risk assessment, procurement, etc.

All interviewees suggest that these internal training courses often spread over a short period of time, from two days to one week:

"Training courses are not very long, they most of the time are two-day, three-day or one- week training modules, but every time they hit the nail on the head." (William, [7,12], energy)

According to the seven interviewees who have already participated in training courses, theory is first covered and then practical case studies and situation simulation exercises, tailored to the company, are used. These training courses can also take the form of personality tests.

Moreover, the content of these training courses is often inspired from project management standards such as PMI or Prince:

"Training courses, at least the ones I have participated in, were at 95% based on PMI and Prince standards, the last 5% were internal methods." (George, [7,12], energy)

Most of the time, these training courses are internal to the company. However, sometimes companies pay the services of consulting companies or management schools, specialized in such kind of training courses:

"Our company pays training courses to its engineers that help them breaking out of the very Franco-French engineer mold, to develop management and leadership skills, and as far as I can see they are truly effective." (William, [7,12], energy)

According to the interviewees, the main purpose of these training courses is to develop project managers' soft skills. However, interviewees have mixed views on their effectiveness.

Indeed, Rachel emphasizes the fact that project managers often leave these training courses with the feeling of not having learnt so much. However, she thinks that these training courses spread messages. Indeed, she argues that as they always deal with the same general ideas, people are keeping immersed in the same very general concepts, and therefore without realizing it, little by little, these recurring messages change people way of seeing things. Moreover, Rachel suggests that these training courses enable people, who come from the same company but who are not used to work together, to meet:

"Every time I participate in training courses I find it very interesting, mainly because during these two or three days you are with people that you don't know, so you learn how to discover them, it is very rewarding humanly." (Rachel, [13,17], aeronautics)

Similarly, George emphasizes the networking side of these training courses. Indeed, according to him, their main value comes from their power to make people, with different positions and roles in the company, meet and talk.

Furthermore, both Michelle and William argue that training courses enable project managers to put things in perspective:

> *"There are things that I have naturally been doing, but when you need to give some thought to a situation and when you really need to think about what is going on, I think that this kind of trainings allow us to take a step back." (Michelle, [13,17], automotive)*

> *"It is directly useful, and sometimes you just need to accept certain things that, when you are an engineer with a very technical education, you may find a bit esoteric. There are lots of personality tests that enable us, as good engineers, to put things in perspective and to think deeply about ourselves." (William, [7,12], energy)*

For his part, Eric argues that training courses are useful only and only if participants have already a certain on-the-job experience:

> *"Having a previous on-the-job experience before starting following training courses is a real advantage. Indeed, it is then much easier to associate the theory with specific situations. Thus, I have no regrets about not receiving any training courses at the beginning of my career, I did not feel any need for it." (Eric, [13,17], energy)*

Moreover, Eric makes it clear that training courses do not change or transform a project manager. According to him, training courses only give tools and theories to which a project manager can cling to. Eric emphasizes on the reassuring aspect of training courses:

> *"When during a training course you recognize a situation that you have already experienced, then you realize that other project managers are facing the same issues, you are not alone." (Eric, [13,17], energy)*

Eric argues that training courses do not substitute the on-the-job experience as well as the inner work a project manager must do to *"force himself/herself to change"*.

4.4.4. Soft skills: innate or not innate?

Michelle and Rachel both think that soft skills are to some extent innate:

> *"To be good at this job […] you first need interpersonal skills, and these are not necessarily things that one can learn. It is actually difficult to teach these things to people; interpersonal skills are to some extent innate." (Rachel, [13,17], aeronautics)*

As previously said in point *4.3.1. Leadership*, Michelle identifies two aspects of project management: project management tools, methods and processes on one hand, and leadership on the other hand. When it comes to the second aspect, Michelle thinks that innate qualities are required:

> *"You need to have certain innate qualities, there are things that you cannot learn even if you know all the tools, if you do not have these intrinsic qualities, then you cannot learn them." (Michelle, [13,17], automotive)*

Bearing the above in mind, Michelle and Rachel both think that soft skills cannot be learn. Rachel even argues that bad project managers are characterized by a lack of soft skills and that training courses may not work for them:

> *"There are project managers that I find really bad at doing their job because they do not have interpersonal qualities, and in spite of all the training courses we have, I think that they will never have them." (Rachel, [13,17], aeronautics)*

Similarly, Eric argues that all project managers are not leaders:

> *"A project manager can be given the formal status of leader, and should actually be in practice, but the difficulty is that we [project managers] are not all leaders." (Eric, [13,17], energy)*

When it comes to leadership, Eric differentiates between three categories of project managers:

> *"For some of us, it is not a problem at all, others will never be leaders, and then there are those in the middle." (Eric, [13,17], energy)*

4.5. French engineering education

The following points will introduce the interviewee's view on French engineering education.

4.5.1. The Franco-French engineer mold

Both George and Michelle argue that when it comes to technical skills, ECM's broad-based scientific education has been a real advantage. Michelle has, over her career, worked with different products involving very different technologies, most of them being beyond her field of predilection. However, her basic knowledge in several technical areas has helped her a lot with quickly understanding the general problematic of projects and getting a proper grasp of the technical related issues.

4.5.2. French engineering education programs' flaws

William is, for his part, much more critical towards French engineering education programs. Indeed, according to him, when it comes to leadership, French business schools tend to better prepare their students than engineering ones. He argues that very soon business students are put on a pedestal:

> *"As early as the integration week starts, business students are told that they are the best, the future leaders of the world." (William, [7,12], energy)*

While in engineering schools the speech is quite different:

> *"We, as engineering students, are told that there is still a lot of things to learn, that we will have to study hard to succeed." (William, [7,12], energy)*

William argues that this helps business students positioning themselves as leaders much more easily than engineers students do.

4.6. The transition

The primary objective of this part is to present the main changes experienced by the interviewees throughout their transition from engineers to project managers.

4.6.1. Evolution of project managers' practices

Michelle suggests that risk management is the area where she has improved the most over the years:

> *"I am much better at identifying the risks of a project, as well as at establishing an action plan to mitigate those risks." (Michelle, [13,17], automotive)*

According to Michelle, newly promoted project managers, coming from technical positions, easily identify technical related risks. However, when it comes to organizational risks and establishing action plans, Michelle argues that they tend to face more difficulties. She even argues that the ability to establish an action plan to minimize as soon as possible a risk or evaluate its occurrence probability, constitutes the main difference between experienced and less experienced project managers.

Louis suggests that experience has changed his opinion on the importance of planning. Indeed, when he started as a project manager, Louis considered planning as purposeless. However, experience has made him aware of the very importance of planning.

Rachel argues that over the years she has become better at selecting the right people to work with. She has also learnt what she can and cannot ask to people. Indeed, depending on the project team member's personality, Rachel adapts several aspects of her project management style such as the level of delegation, the level of autonomy, and communication:

> *"[...] there are people to whom you can delegate a lot of things, without any need of pushing them, while other people need to be closely surrounded. There are people who are very autonomous, so you can give them quite broad guidelines, and there are others you constantly need to be behind their back. There is also communication, there are some people with whom you can be blunt, while with others communicating is more complicated." (Rachel, [13,17], aeronautics)*

Over time, Rachel has also learnt that some people need more frequent recognition of their work than others. Indeed, some of their project team members explained to her that they were not happy at work because she did not tell them regularly that they were doing a great job:

"[...] there are some people who need to be constantly told, every time they are doing something, that they are doing a good job, to be reassured." (Rachel, [13,17], aeronautics)

She explains that she had to learn to do it because it was not important for her:

"I was not doing it because it was not important for me, there are some people for whom it is not important, I do not need to be told every single week that I am doing a great job, however I like when my work is recognized once in a while." (Rachel, [13,17], aeronautics)

Similarly, when he started as a project manager, George expected his team members to be 100% autonomous and to do their assigned tasks with almost no support from him. However, he quickly realized that this was only working with few people. Indeed, he suggests that some people need more guidance and motivation than others to perform their assigned tasks. Therefore, such as Rachel, George had to work on himself.

Louis also emphasizes on the importance of adapting the management style to the team member:

"You need to understand each of them, understand where they come from, and why they are here." (Louis, [18,∞], energy)

Moreover, Louis explains that a project manager cannot deal with every project team member the same way, he or she has to adapt his/her style to their motivation. Indeed, according to Louis, young team members, will get their teeth into the project, will race against time, to deliver it in time and in budget. While very experienced team members, who has little left to proof, will not give their all in the project.

"As a project manager you need to bring everybody along with you, but everybody is not 100% effective, you may have made a mistake when recruiting the team. So, either you manage to motivate everybody and make them effective, or it is the others who are going to compensate." (Louis, [18,∞], energy)

Bearing the above in mind, Louis emphasizes the importance of an effective recruitment of team members. Louis also adds that team members who do more than the others need to be

recognized for their work and contribution to the project. This recognition can take the form of a bonus.

Charles suggests that engineering-backgrounded project managers tend to be over-achievers. He even argues that this mentality is one of the main reasons why they have been promoted project managers. However, Charles argues that when moving towards a position in project management, engineers have to change their working approach:

> *"You think that you can continue doing the same things and get the same results, working as much as before, or even more. But then you realize that to get people achieving a certain result you cannot keep the same working approach as when you were working by yourself." (Charles, [7,12], energy)*

4.6.2. Evolution of project managers' self-confidence

One of the main changes experienced by the interviewees during their transition is the increase of their self-confidence. For example, Rachel considers self-confidence as being what has the most changed between the beginning of her career and now:

> *"Confidence in myself, I would say, clearly, and the network that I have built over the years, and then recognition, when you are known and recognized, you trust yourself more and you ask yourself less questions." (Rachel, [13,17], aeronautics)*

Louis has also gained confidence over the years. He suggests that experiences such as talking in front of two hundred people, have taught him a lot. Even though Louis trusts himself and his work, he does not forget to be humble when he is facing new challenges. To illustrate his saying, Louis quotes the famous Confucius:

> "*Experience is a lantern carried on the back, which only lights the path that has already been walked through." (Confucius)*

Eric has needed several years to feel self-confident and suggests that it has not always been easy for him:

> *"To take a simple example, I used to ask people for information with a weak and shivering voice. They were obviously totally ignoring me. Once, I told my mentor that I did not get the information, so he took me by the hand, and got the information by himself." (Eric, [13,17], energy)*

Being self-confident has never been natural for Eric. Indeed, he argues that even after twelve years as a project manager and even if things are quite better now, he still needs to develop his self-confidence:

> *"I have comfort zones, as there are certain kinds of projects and people that I am very comfortable with. However, from one day to another, everything can change. If I am given a project with people I do not know, and if just one person talks louder than me, then my confidence collapses, and I need to start everything again from the beginning. This has happened to me in 2017, so it is far from being finished, and it does not just happen by its own." (Eric, [13,17], energy)*

4.6.3. When project managers consider themselves as such

Rachel has started considering herself as a project manager when she started receiving recognition from her hierarchy and colleagues:

> *"When you are told that you are good at doing your job, then you realize." (Rachel, [13,17], aeronautics)*

For her part, Michelle has considered herself as a project manager as early as she got the job. She suggests that her previous experience as technical manager of very small technical teams has helped her a lot dealing with her project manager position.

Both Louis and Charles have considered themselves as a project manager after the termination of their first project they had managed from start to finish. In the same vein, George has considered himself as a project manager after his third project, which was bigger and more complex than the first two ones.

Eric has needed three years before being comfortable with his project manager position. According to him, his initial lack of confidence and non-vindictive nature are the main reasons why it has taken him three years. Moreover, Eric suggests that the process is not completely finished, as he is still not comfortable with some aspects of his position. Eric even argues that becoming a project manager is an *"never-ending journey"*.

William argues that engineering-backgrounded project managers achieve a major step of their transition when admitting their inability to control everything:

> *"I do not know if all engineers are the same, but I think that as engineers we like to understand what we are doing, in our well-defined scope. Nevertheless, at some point, it is necessary to let it go, we cannot control everything, it is physiologically impossible." (William, [7,12], energy)*

According to William, when project managers reach this step, when they admit their fallible nature, then they can consider themselves as project managers. For his part, William thinks that he has not reached this step yet.

In line with the above, Louis mentions that, only after a certain amount of time, he realized that he was just a small piece of its company and that his projects could continue without him. Louis describes his company as a *bulldozer* that tends to depersonalize people with its procedures and processes.

4.7. Managing leadership challenges

This part aims at describing some of the main challenges experienced by the interviewees when moving towards a project manager position.

4.7.1. Today's workplace complexity

Several interviewees mention the nature of today's business environment as being a real leadership challenge.

William suggests that today's workplace is more and more dynamic and complex, with people coming from different places. He also adds that some of these people are involved in the project only for a day while others will be working on it for several weeks or even years. According to William, static teams are increasingly rare. He also mentions that his company talks more and more about leadership because it is involved in an ever-increasing number of international projects, involving complex interrelations:

"Within this complexity, there is an increasing need of leaders." (William, [7,12], energy)

According to William, if a company wants to remain competitive in today's business environment, it has to offer complex products or services, and to adapt quickly to the demand. William suggests that when the level of complexity increases, so does the need for leadership. Consequently, leadership is crucial for today's organizations' success.

Similarly, Eric mentions that he is more and more working with international teams, where team members do not share the same language and culture. In such an international environment, Eric argues that communication skills are of great importance and help the project manager reinforcing his leader role.

Within an international team, George suggests that the project manager's communication and listening abilities, as well as his/her adaptability are crucial for the success of a project.

4.7.2. Organizational complexity

Anthony, Eric, Michelle and William emphasize the fact that organizational structure can represent a barrier to project managers' authority, and therefore to project managers' leadership. Indeed, all of them take the example of a matrix organizational structure where functional project managers do not have any hierarchical authority over the members of their team. However, and despite this lack of hierarchical authority, project managers have to mobilize their team members around the same objective and make them work together.

4.7.3. Assertiveness

Eric still lacks assertiveness when managing people whom he does not know or with whom he is not used to work. Eric even considers his assertiveness and exercise of authority as being his main areas of improvement:

"In some cases, I tend to not assert my authority and impose my opinion, even though I know I am right." (Eric, [13,17], energy)

However, Eric makes it clear that the above is not systematic. Indeed, he argues that it depends on the people he is working with.

4.7.4. Conflicts

Several interviewees have experienced problematic conflictual situations within the context of a project they were in charge of.

For example, Rachel experienced a problematic conflictual situation with one project team member she was hierarchically responsible for:

> *"[...] a difficult person, with completely unforeseeable and violent reactions, who created conflicts with other members of the project team." (Rachel, [13,17], aeronautics)*

Rachel describes herself as *"traumatized"* and describes the experience as *"very complicated and difficult"*. Moreover, she adds that the experience affected her personally, and that it was the first time she brought work-related issues back home. To deal with that person, Rachel attended a training program which purpose was to help project managers managing difficult people.

> *"I worked on myself, on my way of communicating, to adapt myself to that person, and this way to minimize conflicts, and in the event of a conflict to know how to shoulder it, how to react firmly, to not be affected personally, to break away from that." (Rachel, [13,17], aeronautics)*

At that time, she also felt the need to talk about the situation to other people from both her professional and personal environment, to seek help from them on how to apprehend that person. Because of that experience, Rachel considers that dealing with conflicts is the aspect of leadership she has struggled the most with.

Michelle also experienced a problematic conflictual situation with one team member. The situation was delicate because that person was actually the expert of the team. Michelle tried to resolve the conflict, but the expert was too much of a disruptive element, so she had to remove him from the team. Michelle emphasizes on the fact that being a woman is a real advantage when it comes to deal with conflicts:

"[...]conflicts are ubiquitous in project teams. When you are working with completely different people and personalities a certain sensitivity is needed, as well as the ability to resolve conflicts. In that case I must admit that being a woman is a real advantage. Women are less using their power relationship with their employees, sometimes I get the impression that I am talking to my children." (Michelle, [13,17], automotive)

4.8. Easing the transition

The objective of this part is to present what can, according to some interviewees, help easing engineers transition to project management.

4.8.1. Soft-skills oriented classes

Both William and George think that engineering education should introduce more soft skills-oriented classes.

William even argues that the class that has served him the most in his career is not hard skills-oriented at all, but an history of science class:

"It had absolutely nothing to do with hard skills such as calculation, but it was opening students up to new perspectives." (William, [7,12], energy)

However, both William and Rachel admit that soft skills-oriented classes are not very easy to teach.

4.8.2. Involvement of professionals

William also emphasizes the importance of involving professionals in engineering education programs. According to him, having professionals talking about their job and what they actually do, is very interesting for engineering students. Indeed, William argues that such kind of intervention enables engineering students to discover jobs they have not heard about before, and therefore to offer them new prospects:

"There are today lots of engineers who find themselves doing calculation or such kind of things, while they would have preferred to do something else." (William, [7,12], energy)

Moreover, William argues that involving professionals in engineering education programs helps engineering students becoming aware of the need to develop other skills than hard ones.

4.8.3. Personalized coaching

When asked about what could have helped him in his transition, Eric says that he would have liked to receive a personalized coaching in communication from the very beginning of his career as a project manager. A coaching which would have specifically focused on his main weaknesses.

5. Analysis and discussion

First of all, the empirical data introduced in the previous chapter will be analyzed using the theoretical framework developed in chapter *2. Literature*. Then, these findings will be discussed.

5.1. The choice of project management

5.1.1. Analysis

Among the eight interviewees, most of them consider their project manager position as a natural evolution of their career. Indeed, most of them suggest that they started as engineers and then over the years their responsibilities have increased until reaching the ones of a project manager. This is clearly consistent with *E3: A lack of recognition and opportunities in the technical career path make engineers move towards managerial positions.* Indeed, it shows that the natural career path for engineers is to move towards managerial positions.

However, other reasons for moving towards a project manager position have been mentioned by two interviewees. Indeed, both Eric and George have moved towards a project manager position as it was a less tough position in terms of working conditions than their former technical position. The choice of engineers to move towards managerial positions can then also be done by convenience.

My empirical data have therefore emphasized the lack of career opportunities available for engineers who want to grow as technical specialists as well as the fact that technical positions are sometimes tougher in terms of working conditions than managerial ones. These appears therefore as the main reasons why engineers move towards managerial positions.

5.1.2. Discussion

I feel that organizations should open new career paths for engineers who do not want to move towards managerial positions but who want to grow as technical specialists. A potential solution could be to consider the role of project manager as dual. In other words, two people will be

simultaneously project managers. One of them will be responsible for the leadership side of project, while the other one will be responsible for the technical side of the project.

Sotiriou and Wittmer's (2001) theory strengthens this idea. Indeed, Sotiriou and Wittmer (2001) consider that project management can be divided into a task side and a people side. Sotiriou and Wittmer (2001, p. 12) refer to the task side of project management as the side that includes *"the technical aspects of the project and the tools (software) and techniques (logic, diagrams, Gantt charts, statistics, etc.) for planning and controlling the project"*. Then, Sotiriou and Wittmer (2001, p. 12) refer to the people side of project management as project managers' handling of *"the skills to provide the motivating environment that will induce the project's personnel to work as a team to accomplish its objectives"*.

Bearing that in mind, engineers who do not want to move towards managerial positions but who want to grow as technical specialist, could be in charge of the task side of project management. While, engineers who are very comfortable with leadership, could be in charge of the people side of project management.

This pair of project managers could also be considered as a solution to the issue emphasized by Louis and Michelle in point *4.2.1. The good project manager*. Indeed, they both argue that it could be challenging for a project manager, who does not have any technical knowledge on the project field, to gain his/her team members' trust. Therefore, with one of the two project managers specialized in the project technical field, gaining the trust of the team members would be easier.

However, this configuration would probably create issues of authority among the two project managers.

5.2. Situational leadership

5.2.1. Analysis

The concept of situational leadership is not literally mentioned in any questions of my interviewing guide. However, when asked about what changes the most in their practices over

the years, three interviewees have described the concept of situational leadership. Indeed, Rachel says that depending on the project team member's personality, she needs to adapt some aspects of her project management:

> *"[...] there are people to whom you can delegate a lot of things, without any need of pushing them, while other people need to be closely surrounded. There are people who are very autonomous, so you can give them quite broad guidelines, and there are others you constantly need to be behind their back." (Rachel, [13,17], aeronautics)*

Similarly, both George and Louis have realized over the years that some people need more guidance and motivation than others to perform their assigned tasks. As mentioned in chapter *2. Literature*, situational leadership is based on the amount of support and direction a leader should provide depending on the subordinate's personality. This is exactly what is described by George, Louis and Rachel.

However, Rachel adds two aspects that are not covered by the theory of situational leadership. Indeed, she suggests therefore that she adapts her way of communicating to the person she is working with as well as the frequency to which she shows consideration to her team members. The importance of recognizing team members for their work and contribution to the project has also been emphasized by Louis.

Bearing the above in mind, it seems that my empirical data are consistent with *L1: Project managers must adapt their leadership style depending on the team member's personality.*

5.2.2. Discussion

All these three project managers have realized the importance of situational leadership over the years. Furthermore, situational leadership, as opposed to other schools of leadership which considered that leaders are born and not made, believes that leadership can be learnt. Therefore, if engineering students could be introduced to this theory as early as possible in their education, and put it into practice through simulation exercises for example, it would be a huger time-saver. Indeed, when starting as a project manager they would already know that they have to adapt their leadership style depending on the team member.

5.3. Developing soft skills

5.3.1. Analysis

Most of the interviewees argue that leadership cannot be learnt. Rachel even argues that training courses aiming at developing project managers' soft skills are useless when those do not have any innate interpersonal qualities. Consequently, my empirical data are not consistent with *L2: Project managers can learn leadership by developing their soft skills.*

One may suggest that these interviewees think so because they are personally very comfortable with the leadership side of project management. This is actually true for both Michelle and Rachel who have not faced many difficulties dealing with the leadership side of project management. However, when it comes to Eric, this is not true at all. Indeed, it has been showed throughout chapter *4. Empirical data* that Eric's transition from technical specialist to project manager has been and is still very difficult.

5.3.2. Discussion

I personally do not share the opinion of these interviewees. On the contrary, I share Kumar and Hsiao's (2007, p. 18) idea that *"leadership could be born out"* when proper education and training are provided.

Most of these interviewees are the same as the ones, who over the years, have realized that importance of situational leadership. But, situational leadership, as opposed to other schools of leadership which considered that leaders are born and not made, believes that leadership can be learnt. Therefore, their argument is not consistent with their practices.

Furthermore, I suggest that most of the interviewees who believe in the innate nature of leadership do so because they have not realized the existence of other means of developing soft skills. Indeed, they have developed their soft skills on-the-job and have consequently difficulties considering another way of doing it.

5.4. French engineering education programs

5.4.1. Analysis

Opinions about French engineering education programs are quite balanced among the interviewees. Indeed, both George and Michelle argue that when it comes to technical skills, ECM's broad-based scientific education has been a real advantage. For example, Michelle argues that her basic knowledge in several technical areas has helped her a lot with quickly understanding the general problematic of projects and getting a proper grasp of the technical related issues. Furthermore, according to Michelle, technical knowledge helps a project manager to establish himself/herself as the leader of the project and to gain his/her team members' trust. However, William is, for his part, much more critical towards French engineering education programs. Indeed, according to him, French engineering education programs fail to prepare their students to the exercise of leadership.

What has stricken me the most after going through my empirical chapter, is that there is unanimity among the interviewees on the fact that a lack of technical skills is less significant than a lack of soft skills for project managers' success. However, only one interviewee, William, highlights the inconsistency that exists between French engineering education programs and the actual requirements of a project manager position. Indeed, all the interviewees suggest that the engineering education they followed was mainly focused on the development of technical knowledge and overlooked the development of other skills such as soft skills. Nevertheless, only William suggests that French engineering education programs should involve more courses and situational workshops aiming at developing students' soft skills.

Therefore, as only one interviewee calls French engineering education programs into question, I would say that my empirical data are not consistent with *E1: Engineering education programs fail to prepare students to the challenges of today's business environment.*

5.4.2. Discussion

I think that the main reason why most of the interviewees do not call into question French engineering programs is because they have developed their soft skills on-the-job. Kumar and

Hsiao (2007, p. 19) refer to this practice as *"learning the soft skills the hard way"*. Consequently, they have difficulties considering another way of doing it.

5.5. Learning processes

5.5.1. Analysis

All the interviewees have learnt the meaning of their position on-the-job. When engaged in a learning on-the-job process, project managers are both passive and active.

Indeed, several interviewees emphasize the importance of learning from watching others. Then, from the amount of informal knowledge gathered while watching other people, project managers shape their own personality and project management style. Learning from watching appears therefore as an informal learning process that allow non-experienced project managers to learn the tricks of the trade. William emphasizes the importance for newly promoted project managers to work with as much different project managers and project teams as possible. According to him, witnessing different styles of project management makes it possible for newly-promoted project managers to do their *"shopping"* and decide afterwards what they want to keep or not.

However, in order to learn, newly promoted project managers need to put what they have witnessed into practice. That's the reason why most interviewees, when starting as project managers, have directly been made responsible of a project. The process of learning on the job does not seem very risky for the organization. Indeed, most of the time newly project managers are put under the responsibility of a mentor who checks the project's indicators and takes the necessary measures to put the project right on tracks if necessary. However, learning on the job may be to some extent harsh for the newly promoted project manager. Indeed, this has been seen in point *4.6.2. Evolution of project manager's self-confidence* through Eric's personal experience.

My empirical data are therefore consistent with *E2: Engineering-backgrounded project managers develop their soft skills through experiential learning.*

Moreover, George emphasizes the fact that experienced project managers can play the role of mentors. In such a context, he suggests that open-mindedness and will to share knowledge are very important. He indeed considers knowledge sharing as being the very objective of mentorship and therefore tries to remain open to improve the skills of the people who work with him. This can therefore be associated to *L3: Project managers must challenge their team members intellectually to make them grow*.

5.5.2. Discussion

Becoming a project manager is about interaction. Both literature and empirical data chapters have showed that project managers engage in experiential learning. They learn from others and because of others. However, engineers' need for self-control has been emphasized in point *2.4.3. Technical professionals*. Therefore, I think that it may be difficult for engineers to admit that their learning depends on others. This is according to me, one of the main reasons why becoming a project manager is challenging for French engineers, they have to accept the huge impact the others have on their becoming process.

Furthermore, experiential learning being the main learning process in which newly project managers engage themselves, I think that the methods used to teach soft skills-oriented courses to engineering students should imitate this learning process and therefore engage students in both passive and active learning.

5.6. Changes

As seen in chapter *4. Empirical data*, the interviewees experience three main types of changes when engaging themselves in the process of becoming a project manager.

5.6.1. Changing one's mind

First of all, the accumulation of experiences over the years changes project managers' perception of things. For example, Louis suggests that experience has changed his opinion on the importance of planning. The previous point *5.1.1. Situational leadership* has also introduced

some of these changes of mind experienced by project managers. Indeed, George, Louis and Rachel have over the years realized that they need to change their leadership style to the person they are working with.

Therefore, my empirical data are consistent with *B2: Experience over time, and the accumulation of information which comes along it, change project manager's way of seeing things.*

5.6.2. Changing one's working approach

Then, a major step of the process appears to be when engineering-backgrounded project managers stop working as engineers, and start working as project managers. Indeed, both Charles and William emphasize the tendency of engineers to be over-achievers and to want to control everything. However, both of them argue that when becoming project managers, engineers have to change their working approach. The main reasons being that it is not physiologically possible to control every single aspect of a project and because working with people differs from working alone.

Therefore, my empirical data are consistent with *TC3: When moving towards a project manager position, engineers must change their working approach.*

5.6.3. Changing one's self

When it comes to their inner selves, one of the main changes experienced by the interviewees affects their self-confidence. Indeed, several interviewees have gained confidence over the years. Therefore, my empirical data is consistent with *B3: Becoming a project manager induces an erosion of the project manager's individuality and the creation of a new one.*

However, because the process of becoming affects engineers' inner-selves, it can therefore be very intrusive. Indeed, several interviewees have been personally affected by their work. For example, Rachel has been affected personally by a conflictual situation involving one of her team members. She even argues that it was the first time she brought work-related issues back

home and that she felt the need to talk about the situation to people from her personal environment, to seek help from them.

5.6.4. Discussion

The analysis has showed that engineering-backgrounded project managers achieve a major step of their becoming process when they recognize their fallible nature. In other words, when they recognize that they cannot control every single aspect of a project. Moreover, both the literature and empirical chapters have emphasized the need for project managers to rely on the expertise of other people when they are in charge of projects that are completely outside of their technical skills set. This can indeed be seen in Kumar and Hsiao's (2007) list of eleven dimensions of an engineering leader. Furthermore, in point *2.3.2. Experiential learning* of the literature chapter it has been mentioned that a lot of knowledge is gained by newly promoted project managers either when they do not manage to reproduce what that have seen or when they see other people doing things wrong. Therefore, failure appears as a major component of the experiential learning process in which engineers engage themselves when moving towards a project manager position. However, the concept of failure is counter nature to engineers who

Furthermore, the intrusive nature of the process of becoming a project manager has not been mentioned in chapter *2. Literature*. However, Crosbie (2005, p. 50) suggests that informal support, that helps individuals implementing new skills, can *"be found outside of the professional environment, at home or in other personal pursuits"*. This justifies why Rachel felt the need of seeking help from her personal entourage. I feel that the intrusive nature of the process of becoming is one of the reason why it is challenging for engineers.

5.7. Challenges

Several interviewees emphasize the fact that organizational structure can represent a barrier to project managers' authority, and therefore to project managers' leadership. Indeed, all of them take the example of a matrix organizational structure where functional project managers do not have any hierarchical authority over the members of their team. However, and despite this lack of hierarchical authority, project managers have to mobilize their team members around the

same objective and make them work together. My empirical data are therefore consistent with *TC2: Organizational complexity makes it difficult for project managers to exercise leadership.*

Moreover, several interviewees have faced difficulties dealing with leadership-oriented challenges such as conflicts, assertiveness, exercise of authority. Therefore, my empirical data are consistent with *TC1: Influence, motivation, conflicts, communications, and finally teamwork and cooperation are the most challenging areas for project managers.*

5.8. A never-ending process

5.8.1. Analysis

Regardless of experience, none of the interviewees has reached a complete mastery of the project manager job. Indeed, all of them keep discovering and learning new things, improving their skills, but also making mistakes. Moreover, Eric even suggests that becoming a project manager is an *"never-ending journey"*. Therefore, my empirical data are consistent with *B1: Becoming a project manager is an unstable and never-ending process.*

5.8.2. Discussion

The nature of what is experienced by a French engineer when moving towards a project manager position is where my findings differ the most from Hill's (2003). Indeed, Hill (2003) refers to the experience of becoming a manager as a transition. However, a transition is, in its very definition, a passage from one state to another. Therefore, when using the term transition, Hill (2003) suggests a starting point, characterized by an initial state, but also a point of arrival, characterized by a final state. However, at the same time, Hill (2003, p. xv) argues that managers *"must prepare themselves for a lifetime of learning and personal reinvention"*. Here is where Hill (2003) is confusing. The term transition implies a limited-in-time and stable nature, while the terms lifetime and reinvention imply a never-ending and unstable one. Then, is the experience of becoming a project manager limited in time or endless? Stable or unstable?

After analysis of my empirical data, I have come to the conclusion that French engineering backgrounded project managers do not ever reach a state of complete mastery of their job, even

after years as project managers. They remain in between, as they keep discovering and learning new things, changing, developing their skills but also making mistakes and learning from them. In that respect, I suggest that becoming a project manager is a never-ending and unstable experience. Becoming a project manager is not a transition, but an endless succession of transitions. Project managers keep changing their state and therefore reinventing themselves.

My finding is strengthen by Carlsen's (2006) conceptualization of becoming as a process. Indeed, Carlsen (2006, p. 133) argues that *"primacy is given to movement, flux, emergence, and process over that of end-states, entities, stability, and discrete periods"*. Therefore, becoming a project manager is a process, inherently endless and unstable. One participant to my research study has referred to his process of becoming a project manager as a never-ending journey. Some would say that, such as transition, the term journey can refer to a passage from one place to another, however here the term journey is used as a synonym of adventure. And yes, this participant is right, becoming a project manager is a real adventure full of obstacles and challenges in which French engineers engage themselves without really knowing where it will get them. This finding is strengthen by Ramazani and Jergeas (2015) who also refer to the process of becoming a project manager as a journey. Therefore, the process experienced by French engineers when moving towards a project manager position is a never-ending journey in which they must engage without any expectation of completely mastering one day the job.

Moreover, Hill (2003) argues that there are few shortcuts to the process of becoming a manager. The first issue to be discussed here, is whether or not shortcuts can be considered in the context of a never-ending process. I would tend to say no. However, as seen through the empirical chapter, this never-ending journey includes distinct steps of awareness that project managers reach over the years. Among these steps of awareness are for example:

- When engineering-backgrounded project managers realize that a lack of technical skills on their part has less influence of the project's success than a lack of soft skills.
- When engineering-backgrounded project managers realize they have to adapt their leadership style to each project team member.
- When engineering-backgrounded project managers realize they cannot control every single aspect of projects and admit their fallible nature.
- When engineering-backgrounded project managers realize they have to change their working approach.

To come back to Hill (2003), I suggest that the concept of shortcuts cannot be used within the context of a never-ending process. However, I think that some of the previously mentioned steps of awareness can be reached sooner. Indeed, if engineering education programs manage to make engineering students realize certain things before even starting working, then time would be gained. My finding is strengthened by Farr and Brazil (2009, p. 8) who argue that *"the earlier the development process is started, the more time is available to grow into a leadership role […] To succeed, young engineers must more quickly grow into this role. Everyone wins when young engineers develop leadership skills early in their careers"*.

5.9. Easing the process

Not a lot of interviewees have managed to think about potential solutions that could have helped them in their transition from technical specialists. Therefore, I cannot really tell if my empirical data are consistent with the propositions of the theoretical framework.

5.9.1. Engineering education programs' reform

Both William and George think that engineering education should introduce more soft skills-oriented classes. However, both William and Rachel admit that soft skills-oriented classes are not very easy to teach. William also emphasizes the importance of involving professionals in engineering education programs. According to him, having professionals talking about their job and what they actually do, is very interesting for engineering students. Indeed, William argues that such kind of intervention helps engineering students becoming aware of the need to develop other skills than hard ones.

William's opinion is then to some extent consistent with *ET1: A modified teaching approach is required to teach soft skills to engineering students and engineering education programs should involve more industry professionals to bring awareness among the students about today's industry expectations.*

5.9.2. Coaching

Eric is the only interviewee who has mentioned coaching as something that could have helped him developing his soft skills. Therefore, Eric's opinion is consistent with *ET2: Coaching is a potential solution to newly promoted project managers' lack of soft skills.*

5.9.3. Selection of project managers

William adds that his company attaches great importance to candidates' attitude towards other people. Indeed, he suggests that when selecting new project managers his company focuses on the candidates' curiosity, ability to communicate with other people and learn from them, inclination to solve problems and inclination for the job itself. Several other interviewees have also emphasized the importance for project managers to be curious and to have a real inclination for the job. Therefore, my empirical data is consistent with the first part of *ET3: Project managers' selection processes must look beyond engineers' technical skills and provide a realistic preview of the job to potential candidates.*

5.9.4. Discussion

These solutions should be tested to assess their ability to make French engineers' process of becoming project managers easier.

However, Pulko and Parikh (2003) suggest that the soft skills culture is not yet well embedded in engineering programs. To illustrate Pulko and Parikh's (2003) argument, my personal example can be taken. Indeed, when looking at Table 1.3.3 in the introduction chapter, it can be seen that my engineering school has been trying to develop its student's soft skills through courses such as *Management, Project Management* or even *Human and Social Sciences*. However, a proof that the soft skills culture is not yet well embedded in engineering programs is that when I took these classes I did not realize they were aiming at developing my soft skills. So, the most important thing to do is to make engineering students realize as soon as possible that today's dynamic and complex business environment requires excellent soft skills. I think that the use of new teaching methods as well as the involvement of more industry professionals can help engineering students realizing the crucial importance of soft skills in today's today's dynamic and complex business environment.

When it comes to coaching, my findings are strengthened by theory. Indeed, Suikki et al. (2006), Ramazani and Jergeas (2015) as well as Thompson and Cox (2017) all agree on the positive influence of coaching on the development of newly-promoted project managers' soft skills. However, theory does not emphasize on the importance for the coach to be open-minded and willing to share his/her knowledge.

6. Conclusion

The objective here is to give a clear answer to my research question, but also to introduce potential topics for further research. In that respect, the first two points will summarize my findings as well as their practical implications. Finally, the last point will introduce topics that I consider of interest for further research.

6.1. Answer to the research question

The primary objective of this master's thesis was to answer the following research question: *How and why is French engineers' transition from technical specialists to project managers challenging?*

First of all, the process of becoming a project manager is challenging for French engineers because most of the time this process is driven by the wrong motivations. Indeed, the lack of career opportunities available for engineers who want to grow as technical specialists as well as the fact that technical positions are sometimes tougher in terms of working conditions than managerial ones, make engineers move towards managerial positions. However, when engineers move towards a managerial position for one of these reasons, their skills may not match the actual requirements of the position. The process of becoming may therefore be challenging. Moreover, the inconsistency between French engineering education programs and the actual requirements of a project manager position is one of the main reasons why the process is challenging. Indeed, French engineering education programs mainly focus on the development of their students' hard skills, at the expense of soft skills which are actually crucial for project managers' success. The process of becoming a project manager also induces changes of diverse nature. Indeed, when engaging into this process, French engineers experience changes that affect their beliefs, working approach and inner-selves, making it therefore challenging. The never-ending nature of the process also explains to some extent the challenges experienced by engineers when becoming project managers. Then, the influence of others as well as the role played by failure on French engineering-backgrounded project managers' can also explained the challenging nature of the process. Indeed, project management is about people, and therefore people have a major impact on project managers. Indeed, it has been showed that the main learning process engaged when learning what it means to be a project

manager is experiential learning. This learning process consists of learning from watching other people. Moreover, it has been mentioned that a lot of knowledge is gained by newly promoted project managers either when they do not manage to reproduce what that have seen or when they see other people doing things wrong. Therefore, failure appears as a major component of the experiential learning process in which engineers engage themselves when moving towards a project manager position. However, the concept of failure is counter nature to engineers, especially to French engineers. The nature of the learning process in which project managers engage also explain why the becoming process is challenging for French engineers.

The above have summarized how and why the process is challenging. However, one part of the answer is also to provide solutions that could help French engineers easing their process of becoming a project manager.

First of all, organizations should open new career paths for engineers who do not want to move towards managerial positions but who want to grow as technical specialists. Then, the most important thing to do is to make engineering students realize as soon as possible that today's dynamic and complex business environment not only requires high-qualified technical specialists, but actual leaders. Consequently, students must not settle for only developing their hard skills, they also have to focus on the development of their soft skills. The French engineering establishments' mission is then to support their students in the development of their soft skills by planting the seed of leadership as soon as possible. However, this cannot be done using traditional lecturing methods characterized by one-way communication. A modified teaching approach is required. This modified approach should place particular emphasis on the involvement of engineering students and on the application of learning, through simulation exercises for example. Furthermore, engineering education programs should include more interventions of industry professionals to bring awareness among students about today's industry expectations. Considerable efforts have already been made by French engineering schools in this sense. However, I feel that these efforts have not yet managed to make students aware of the crucial importance of soft skills. Coaching also appears as a potential solution for developing newly promoted project managers' soft skills. Finally, a better selection of project managers is also a potential solution. Indeed, it the best engineers are not always the best candidates for a project manager position. Selection processes should therefore look beyond engineers' technical skills and provide a realistic preview of the job to potential candidates so

their expectations match the reality. These solutions should be tested to assess their ability to make French engineers' process of becoming project managers easier.

6.2. Practical implications

The potential solutions that could help French engineers easing their process of becoming a project manager have several practical implications.

Indeed, it has previously been said that a modified teaching approach should be used to teach soft skills to engineering students. This teaching approach should place particular emphasis on the involvement of engineering students and on the application of learning, through simulation exercises for example. This has therefore a practical implication on the size of the class to which the lecture is taught. Indeed, if the class includes a large number of students, then it would be impossible for the teacher to involve each of them. Therefore, soft skills-oriented courses should be taught to a small group of students. This is technically possible in the context of most French engineering schools as all the students from the same year are usually divided into small groups of about twenty members for tutorial classes. So, these groups could also be used for soft-skills oriented courses.

Then, it has been mentioned that engineering education programs should include more industry professionals to bring awareness among students about today's industry expectations. In order to bring awareness, the technical professional must himself/herself be aware. Therefore, senior industry professionals, who accept to talk freely about their success and failures, should be preferred for interventions directed to engineering students.

6.3. Further research

This third part aims at introducing topics that I consider of interest for further research.

6.3.1. Certifications and MBAs

Both topics of project management certifications and MBAs have been mentioned by several interviewees.

Among the eight participants, only one possesses a project management certification. Indeed, Charles is certified PMP, which is the most famous PMI certification. Michelle, for her part, considers experience as being superior to project management certifications. Therefore, it could be interesting to conduct a research study on the influence of project management certifications on French project managers. This research study could take its inspiration from Joseph and Marnewick's (2018) study of the influence of project management certifications on South African IT project performance.

Regarding MBAs, Anthony, George and William have at one point of their career thought about doing one. According to William, an MBA can to some extent boost a career, but it is not the only factor involved. For his part, Louis argues that an MBA can act as a good springboard for moving towards executive positions. However, according to louis, project managers who make the decision to follow an MBA, look for a career change. Therefore, it could be interesting to study the value of an MBA for French project managers. Slack's (1999) article could be a potential starting point for this research study.

6.3.2. Cross-sectional research design

Using qualitative data within the framework of a cross-sectional research design is not very common. Indeed, none of the articles using qualitative data that I have read to write my literature chapter was using such a design. Most of them were actually using a case study research design. Furthermore, even Bryman (2012) argues that a cross-sectional research design is usually used with quantitative data. However, I have managed to answer my research question and to find interesting results. It could be therefore interesting for other students to try such a design for the study of other topics involving qualitative data.

6.3.3. Identity

When dealing about the concept of a new individual, I have scratched the surface of another concept which is identity. Actually, I have made the choice of not going deeper into this concept

as it is very large and complex. However, some scholars that I have quoted in my literature chapter have dealt with this concept. Indeed, Carlsen (2006) suggests an organizational identity while Hill (2003) talks about a professional identity. Further research could therefore study more deeply the role of identity in the process of becoming.

6.3.4. Non-French project managers

My research study focuses on French engineering-backgrounded project managers. However, half of the interviewees have worked abroad, and some of them have mentioned certain differences they have observed between French and non-French project managers. For example, Louis emphasizes the difference exiting between British and French project managers. According to him, British project managers tend to be more contract and finance oriented, while French project managers tend to be very operational. Moreover, Louis argues that in the US, people do not care about the education background when it comes to selecting project managers.

Moreover, it has been mentioned by George in point *4.2.3. Project management tools, methods and processes* that one of the main objectives of his company is to spread a uniform message across all its centers worldwide and create therefore a *"common language"*.
Therefore, further research could focus on the influence of national culture, professional culture and organizational culture on project managers' practices and behaviors.

6.3.5. The influence of gender

On one hand, in chapter *4. Empirical data*, the two female project managers that I have interviewed have, more than any of the other interviewees, emphasized on the challenges they have faced when dealing with conflicts. Indeed, both of them have experienced problematic conflictual situations within the context of a project they were in charge of. One of them, argues that being a woman is a real advantage when it comes to deal with conflicts.

On the other hand, in chapter *2. Literature* I have introduced a theory which suggests that male engineering students tend to be over-confident about both their hard and soft skills, and refuse to act on the advice of their teachers.

The purpose here was in any case to study the differences that might exist between female and male project managers, therefore no gender-related questions can be found in the interviewing guide. However, a possible topic for further research could be to study the influence of gender on project managers' learning and exercise of leadership.

Bibliography

Aarseth, W. K., Rolstadås, A. and Klev, R. (2016) *Project Leadership Challenges. Their nature and how they are managed. Fagbokforlaget, Trondheim, Norway.*: Fagbokforlaget.

Andersen, E. S. (2006) 'Toward a project management theory for renewal projects.(Author abstract)', *Project Management Journal,* 37(4), pp. 15.

Atkinson, R. (1999) 'Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria', *International Journal of Project Management,* 17(6), pp. 337-342.

Bass, B. M. (1985) *Leadership and performance beyond expectations.* Collier Macmillan.

Bass, B. M. (1990a) *Bass & Stogdill's handbook of leadership : theory, research, and managerial applications.* 3rd ed. edn. New York: Free Press.

Bass, B. M. (1990b) 'From transactional to transformational leadership: Learning to share the vision', *Organizational Dynamics,* 18(3), pp. 19-31.

Bellinger, R. (2002) 'PRODUCT DEVELOPMENT STUNTED', *Electronic Engineering Times,* (1238), pp. 46-48.

Bennis, W. (2009) *On becoming a leader.* Basic Books.

Berg, M. E. and Karlsen, J. T. (2007) 'Mental models in project management coaching', *Engineering Management Journal,* 19(3), pp. 3-13.

Bouffartigue, P. and Gadéa, C. (1997) 'Les ingénieurs français: Spécificités nationales et dynamiques récentes d'un groupe professionnel', *Revue française de sociologie*, pp. 301-326.

Bryman, A. (2012) *Social research methods.* 4th edn. Oxford ; New York: Oxford University Press.

Burgoyne, J. G. and Hodgson, V. E. (1983) 'Natural learning and managerial action: A phenomenological study in the field setting', *Journal of management studies,* 20(3), pp. 387-399.

Burns, J. M. (1978) *Leadership.* New York: Harper & Row publishers.

Carlsen, A. (2006) 'Organizational becoming as dialogic imagination of practice: The case of the indomitable Gauls', *Organization Science,* 17(1), pp. 132-149.

Cicmil, S. and Hodgson, D. (2006) 'New possibilities for project management theory', *Project Management Journal,* 37(3).

Creswell, J. W. and Miller, D. L. (2000) 'Determining validity in qualitative inquiry', *Theory into practice,* 39(3), pp. 124-130.

Crosbie, R. (2005) 'Learning the soft skills of leadership', *Industrial and commercial training,* 37(1), pp. 45-51.

Davis, K. (1981) *Human behaviour at work.* N. Y. McGraw-Hill.

El-Sabaa, S. (2001) 'The skills and career path of an effective project manager', *International journal of project management,* 19(1), pp. 1-7.

Farr, J. V. and Brazil, D. M. (2009) 'Leadership skills development for engineers', *Engineering Management Journal,* 21(1), pp. 3-8.

French, J. R., Raven, B. and Cartwright, D. (1959) 'The bases of social power', *Classics of organization theory,* 7, pp. 311-320.

Gane, C. (2001) 'Process management: integrating project management and development', *New directions in project management*, pp. 67-82.

Gehring, D. (2007) 'APPLYING TRAITS THEORY OF LEADERSHIP TO PROJECT MANAGEMENT', *Project Management Journal,* 38(1), pp. 44-54.

Gillard, S. (2009) 'Soft skills and technical expertise of effective project managers', *Issues in informing science & information technology,* 6.

Guba, E. G. and Lincoln, Y. S. (1982) 'Epistemological and methodological bases of naturalistic inquiry', *ECTJ,* 30(4), pp. 233-252.
Hersey, P. and Blanchard, K. H. (1969) 'Life Cycle Theory of Leadership', *Training and Development Journal,* 23

Hersey, P., Blanchard, K. H. and Natemeyer, W. E. (1979) 'SITUATIONAL LEADERSHIP, PERCEPTION, AND THE IMPACT OF POWER', *Group & Organization Studies,* 4, pp. 418-428.
Hill, L. A. (2003) *Becoming a manager : how new managers master the challenges of leadership.* 2nd edn. Boston, Mass.: Harvard Business School Press.
Hodgson, D., Paton, S. and Cicmil, S. (2011) 'Great expectations and hard times: The paradoxical experience of the engineer as project manager', *International Journal of Project Management,* 29(4), pp. 374-382.
Institute, P. M. (2013) *A guide to the project management body of knowledge (PMBOK guide)*: Project Management Institute.
Johnson, D. and Sargeant, A. (1998) 'Motives for transition: an exploratory study of engineering managers', *Human Resource Management Journal,* 8(3), pp. 41-53.
Joseph, N. and Marnewick, C. (2018) 'Investing in project management certification: Do organisations get their money's worth?', *Information Technology and Management,* 19(1), pp. 51-74.
Kolb, D. 1984. Experiential learning as the science of learning and development. Englewood Cliffs, NJ: Prentice Hall.
Kombarakaran, F. A., Yang, J. A., Baker, M. N. and Fernandes, P. B. (2008) 'Executive coaching: it works!', *Consulting Psychology Journal: Practice and Research,* 60(1), pp. 78.
Koskela, L. and Howell, G. 'The underlying theory of project management is obsolete'. *Proceedings of the PMI Research Conference*: PMI, 293-302.
Kotnour, T. (2000) 'Organizational learning practices in the project management environment', *International Journal of Quality & Reliability Management,* 17(4/5), pp. 393-406.
Kotter, J. P. (2008) *Force for change: How leadership differs from management.* Simon and Schuster.
Kumar, S. 'Industry participation in a capstone design course'. *Proceedings of ICEE*.
Kumar, S. and Hsiao, J. K. (2007) 'Engineers learn "soft skills the hard way": Planting a seed of leadership in engineering classes', *Leadership and Management in Engineering,* 7(1), pp. 18-23.
Lewis, J. P. (2001) *Project planning, scheduling, and control : a hands-on guide to bringing projects in on time and on budget.* 3rd ed. edn. New York: McGraw-Hill.
Maylor, H. (2001) 'Beyond the Gantt chart:: Project management moving on', *European Management Journal,* 19(1), pp. 92-100.
Müller, R. and Turner, R. (2010) 'Leadership competency profiles of successful project managers', *International Journal of Project Management,* 28(5), pp. 437.
Nealy, C. (2005) 'Integrating Soft Skills Through Active Learning in the Management Classroom', *Journal of College teaching and Learning,* 2(4).
Nixon, P., Harrington, M. and Parker, D. (2012) 'Leadership performance is significant to project success or failure: a critical analysis', *International Journal of Productivity and Performance Management,* 61(2), pp. 204-216.
Northouse, P. G. (2018) *Leadership: Theory and practice.* Sage publications.

Nyhan, B. (1998) 'Competence development as a key organisational strategy-experiences of European companies', *Industrial and commercial training,* 30(7), pp. 267-273.
Paton, S., Hodgson, D. and Cicmil, S. (2010) 'Who am I and what am I doing here? Becoming and being a project manager', *Journal of Management Development,* 29(2), pp. 157-166.
Poster, C. (1996) 'Being and becoming: Rhetorical ontology in early Greek thought', *Philosophy & rhetoric*, pp. 1-14.
Pulko, S. H. and Parikh, S. (2003) 'Teaching 'soft'skills to engineers', *International Journal of Electrical Engineering Education,* 40(4), pp. 243-254.
Ramazani, J. and Jergeas, G. (2015) 'Project managers and the journey from good to great: The benefits of investment in project management training and education', *International Journal of Project Management,* 33(1), pp. 41-52.
Rao, M. (2014) 'Enhancing employability in engineering and management students through soft skills', *Industrial and Commercial Training,* 46(1), pp. 42-48.
Roberts, K. (1994) 'The transition into management by scientists and engineers: a misallocation or efficient use of human resources?', *Human Resource Management,* 33(4), pp. 561-579.
Rosenbaum, B. L. (1991) 'Leading today's technical professional', *Training & Development,* 45(10), pp. 55-63.
Rynes, S. L., Tolbert, P. S. and Strausser, P. G. (1988) 'Aspirations to manage: A comparison of engineering students and working engineers', *Journal of vocational behavior,* 32(2), pp. 239-253.
Shenhar, A. J. (2004) 'Strategic Project Leadership® Toward a strategic approach to project management', *R&d Management,* 34(5), pp. 569-578.
Slack, J. (1999) 'The value of an MBA for engineers', *Engineering Management Journal,* 9(5), pp. 231-234.
Sotiriou, D. and Wittmer, D. (2001) 'Influence methods of project managers: Perceptions of team members and project managers', *Project Management Journal,* 32(3), pp. 12-20.
Stogdill, R. M. (1974) *Handbook of leadership: A survey of theory and research.* New York, NY, US: Free Press.
Strohmeier, S. (1992) 'Development of interpersonal skills for senior project managers', *International Journal of Project Management,* 10(1), pp. 45.
Suikki, R., Tromstedt, R. and Haapasalo, H. (2006) 'Project management competence development framework in turbulent business environment', *Technovation,* 26(5-6), pp. 723-738.
Thite, M. (1997) 'Managerial skills in technical professionals—an exploration of IT project leadership', *The Place of Information Technology in Management and Business Education*: Springer, pp. 191-198.
Thompson, S. and Cox, E. (2017) 'How Coaching is Used and Understood by Project Managers in Organizations', *Project Management Journal,* 48(5), pp. 64-77.
Thornberry, N. E. (1987) 'Training the engineer as Project Manager', *Training and Development Journal,* 41(10), pp. 60-62.
Walker, D. and Dart, C. J. (2011) 'Frontinus—A project manager from the Roman Empire era', *Project management journal,* 42(5), pp. 4-16.
Williams, T. (2005) 'Assessing and moving on from the dominant project management discourse in the light of project overruns', *IEEE Transactions on engineering management,* 52(4), pp. 497-508.
Špundak, M. (2014) 'Mixed agile/traditional project management methodology–reality or illusion?', *Procedia-Social and Behavioral Sciences,* 119, pp. 939-948.

APPENDIX

A-1: E-mail sent to project managers (French version)

Bonjour,

Étudiante à l'École Centrale Marseille, j'ai obtenu votre contact via Centrale Marseille Alumni.

Je suis actuellement en double diplôme en Norvège, où je fais un master en management de projet.

Dans le cadre de ma thèse de master, je souhaiterais interviewer plusieurs managers de projet travaillant dans le domaine de l'ingénierie afin d'étudier l'influence de l'expérience sur leurs compétences de leadership.

J'aimerais ainsi vous interviewer afin de bénéficier de votre expérience personnelle en tant que manager de projet.

En ce qui concerne l'interview, il serait semi-directif, ne durerait qu'une trentaine de minutes et pourrait être effectuer par téléphone ou via Skype/Facetime.

En espérant que vous répondrez favorablement à ma demande, je reste à votre entière disposition pour toute information complémentaire.

Cordialement,

Marie Daden

A-2: E-mail sent to project managers (English version)

Hello,

I am a student at École Centrale Marseille, and I got your contact information via Centrale Marseille Alumni.

I am currently doing a double degree in project management in Norway and within the context of my master's thesis, I would like to interview several project managers to study the influence of experience on their leadership skills.

I would therefore like to interview yourself and learn from your own experience as a project manager.

Regarding the interview, it would be semi-structured, would last about thirty minutes and could be conducted by phone or via Skype/Facetime.

I hope you will answer positively to my request. For further information, do not hesitate to contact me.

Best regards,

Marie Daden

A-3: Semi-structured interviewing guide (French version)

Formation et parcours professionnel :

1) Combien d'années d'expérience avez-vous en tant que manager de projet ?

2) Dans quel(s) domaine(s) d'activité avez-vous travaillez ?

3) Comment et pourquoi êtes-vous devenu manager de projet ?

4) Durant vos études, avez-vous suivi des cours de management de projet ?

- Oui : Ces cours vous ont-ils été utiles ? Pourquoi ? À quel moment de votre carrière et dans quelle situation ?
- Non : Auriez-vous aimez en suivre ?

Manager de projet :

5) De combien de personnes se composaient votre plus petite ainsi que votre plus grande équipe projet ? Quelle est la principale différence lorsque vous managez une petite et une grande équipe ?

6) Qu'est ce qui selon vous caractérise un bon manager de projet ?

Découverte du métier de manager de projet :

7) Qui ou qu'est-ce qui vous a aidé, au début de votre carrière de manager de projet, à comprendre votre rôle et vos responsabilités ?

- Mentor (patron, supérieur, autre(s) manager(s) de projet, etc.)
- Modèle (manager(s) de projet plus expérimentés)
- Livres, etc.

Évolution personnelle :

8) Au début de votre carrière de manager de projet, utilisiez-vous des guides de bonnes pratiques (PMI, PMBOK), afin de guider vos actions et vos décisions ?

9) Qu'est-ce qui a changé aujourd'hui ? Est-ce que vous vous basez davantage sur votre intuition ?

10) À partir de quel moment vous ne vous êtes plus senti novice ?

Leadership :

11) Par rapport à ce que vous venez de dire, quelles sont selon vous les principales différences entre un manager de projet non-expérimenté et un manager de projet expérimenté ?

12) Comment décrieriez-vous la notion de leadership dans le cadre d'un projet ?

Défis, passés et présents :

13) Quels sont les aspects du leadership qui vous ont posés ou vous posent le plus de problème ? Avez-vous, durant votre carrière, eu des difficultés à communiquer avec les acteurs d'un projet et / ou les membres de votre équipe ? À motiver votre équipe ? À gérer les conflits ?

14) Avez-vous surmonté ces difficultés ? Comment ?

Développement des compétences :

15) Avez-vous cherché à développer votre aptitude à communiquer, gérer des conflits, motiver une équipe, etc. via des ateliers, des formations, des exercices, des livres ?

- Oui : à quel moment de votre carrière ? pensez-vous que ces formations ont eu une influence sur vos compétences de leadership ? (Tout de suite après, ou après un certain lapse de temps ?) Étiez-vous en groupe ? Est-ce l'entreprise qui vous l'a demandé ?
- Non : pensez-vous que ce type de formations aurait pu vous être utile ? À quel moment de votre carrière ?

16) Est-ce que vous parlez de leadership avec des personnes de votre entreprise ?

- Patron (aligner les objectifs du projet avec ceux de l'entreprise)
- Autres managers de projet
- Supérieur

Faciliter la transition :

17) Qu’est ce qui selon vous, vous aurait permis de vous développer plus rapidement ?

A-4: Semi-structured interviewing guide (English version)

Education and professional background:

1) How long have you been project manager?

2) In which field of activities have you and are you currently working?

3) Why and how did you become project manager?

4) During your studies, have you follow any project management-oriented courses?

- Yes: what do you think about them? Have they been useful? If yes, why and when in your career?
- No: would you have liked to be taught project management-oriented courses?

Project manager:

5) How many people do you manage (smallest and biggest teams)? What are the main differences when managing a big and a small team?

6) How do you define a good project manager?

Discovering the role and responsibilities of a project manager:

7) Who and/or what did help you at the beginning of your project manager career realizing the scope of your role and responsibilities?

- Mentorship
- Role model
- Books, guides, etc.

Personal evolution:

8) When you started as a project manager, did you tend to follow standardized project management methods and processes (PMI, PMBOK) to guide your actions and decisions?

9) What has changed the most today? Do you rely more on your intuition?

10) When have you started considering yourself as a project manager?

Leadership:

11) According to you, what are the main differences between an experienced project manager and a non-experienced one?

12) How do you define leadership within the context of a project?

Past and present challenges:

13) What are the aspects of leadership that you consider as being the most challenging?

14) Have you overcome these challenges? How?

Developing skills:

15) Have you tried to develop your abilities to communicate, deal with conflicts, motivate a team, etc. through training courses, workshops, simulation exercises?

- Yes: when in your career? What has been the influence of these on your leadership skills?
- No: do you think that these could have been helpful for you? When in your career?

16) With whom in your company do you speak about leadership?

Easing the transition:

17) In your opinion, what could have helped you in your transition from engineer to project manager?

A-5: Participants' characteristics

Interviewees	Gender	Engineering specialization	Year of engineering graduation	Other degree(s)	Field of activity	Current location	Former position(s)	Current position	Size of projects	Years as a project manager
Anthony	M	Mechanical engineering	2004	MSc in Entrepreneurship (EM-Lyon, France)	Energy	Norway (Oslo)	Sales manager (2005-2007), Business manager (2007-2010), Project manager (2011-2017)	Digital delivery manager (since 2017)	Between 2 and 25 people	6, ∈ group [0,6]
Charles	M	Marine engineering	2003		Energy	USA (Houston)	Hydrodynamics engineer (2003-2005), Hydrodynamics lead engineer (2006-2008)	Engineering project manager (since 2008)	Between 30 and 150 people	10, ∈ group [7,12]
Eric	M	Electronic engineering	1999		Energy	France	Commissioning engineer (1999-2004), Exportation project manager (2004-2015)	Senior project manager (since 2015)	Between 2 and 50 people	14, ∈ group [13,17]
George	M	Marine engineering	1998	MSc in Marine Technology (Cranfield, UK)	Energy	Brazil (Rio de Janeiro)	Project engineer (1998-2004), Project manager (2004-2014)	Division director (since 2015)	Between 4 and 180 people	10, ∈ group [7,12]
Louis	M	Marine engineering	1995		Energy	Norway (Stavenger)	Scientific volunteer (1995-1997), Naval architect (1997-1998), Marine and structure engineer (1998-2000)	Project manager (since 2000)	Between $44M and $300M	18, ∈ group [18,∞]
William	M	Marine engineering	2001		Energy	France	Trainee engineer (2001), Installation engineer (2002-2005), Lead engineer (2005-2007), Work package manager (2008-2012)	Tender project manager (since 2012)	Between 30 and 35 people	10, ∈ group [7,12]
Michelle	F	Industrial design	2000		Automotive	France	Electronic engineer (2000-2003), Hardware team leader (2003-2005), Hardware project leader (2005-2009)	Senior project manager (since 2009)	Between 5 and 30 people	13, ∈ group [13,17]
Rachel	F	Acoustic engineering	2000	MSc in Business Administration (IAE Aix-en-Provence, France)	Aeronautics	France	Project Management Officer (2003-2011), Project management business partner (2011-2017)	Customer team leader (since 2017)	Between 4 and 10 people	15, ∈ group [13,17]