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Team Leaders' & Team Members' Interviews about Reverse Mentoring for Team Effectiveness in Construction Projects

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Team Leaders' & Team Members' Interviews about Reverse Mentoring for Team Effectiveness in Construction Projects

by Konstantinos Karagiannis

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Preface

The finalization of the present research marks the end of my master's journey at Delft University of Technology, in the Netherlands. As a partial fulfillment of the Construction Management and Engineering program, I had the opportunity to explore a relatively new practice, reverse mentoring, within the project context in construction and explore its application and effect on the overall project team effectiveness.

I have to admit that my master journey and especially my graduation work helped me to realize even more the importance of the human factor in the successful completion of construction projects. Therefore, broadening my initial strict engineering perspective towards adopting a people-centric mentality will definitely be a great asset to my future career in the construction industry.

Here I feel the need to thank a few people that without their help the completion of the current study would not be possible. First, I would like to thank researcher Yan Liu for having the initial idea of the reverse mentoring topic. Of course, I would like to express my gratitude towards both members of my committee, Prof. Martijn Leijten who was always there for me from the first moment supporting me and guiding me through the whole thesis process as well as Prof. Paul Chan, who was always asking me critical questions trying in that way to make me change my engineering way of thinking towards adopting that one of a social science researcher. Also, I feel the need to thank the Greek and Dutch companies, GEK Terna, DENCO Structural P.C., ABT B.V., Count & Cooper and Royal HaskoningDHV, as well as their employees who were willing to participate in our research and share with us their experiences and viewpoints about the researched topic. Finally, I would like to thank my family and friends for their continuous support during my whole master's journey.

The present work is devoted to my father, the best person ever met, and to my mother, the person unfortunately I almost never had the chance to meet.

I hope that you will enjoy reading my report!

Konstantinos Karagiannis

Delft, March 2023

Executive Summary

1 Research Aim & Questions

The present study attempts to explore the concept of reverse mentoring at a project level within construction, perceiving it as that process who supports learning from someone subordinate to someone superior on the basis of a power difference relationship between a team member and a team leader. So far, the existing literature has emphasized on the concept's application within companies at a wide range of different sectors with the benefits being overwhelming for both reverse mentoring participants and the organization as a whole. However, they do not examine it within the project context. Not only does the present work, places reverse mentoring into that unexplored area, but focuses specifically on construction projects since their growing complexity and their entrance into the fourth industrial revolution, increase the need of project managers to shift their focus from the traditional project management tools and techniques that drive only productivity, towards new practices that target human development and team performance improvement. But to what extent can it be achieved by reverse mentoring? Therefore, the main goal of the current research is to both explore the model's applicability in construction projects and gain understanding of the possible model's contribution to the team members' and the team leaders' development and the overall project team effectiveness. Having that in mind, the main research question is formulated as follow:

Main Research Question: What is the added value (if any) of the reverse mentoring model to the overall project team effectiveness in construction projects & how (if possible) it can be achieved?

This research question is broken down into the next five sub-questions.

1. What is the possible link between reverse mentoring and construction project team effectiveness based on literature?
2. How can the reverse mentoring concept be conceptualized based on literature and therefore within organizations?
3. How can the reverse mentoring concept be conceptualized based on practitioners' stories and therefore within construction projects?
4. Why do we need (if it is needed) reverse mentoring, based on practitioners' view – What is the link with team effectiveness (If any)?
5. How could we lead (if possible) to a high-quality reverse mentoring relationship at project level, based on practitioners' opinions?

2 Methodology

A qualitative research approach with the use of fifteen semi-structured interviews with team leaders and team members of different construction project teams was adopted in order to achieve the target goal of this study. Specifically, an interactive research strategy was adopted enabling multiple circles between the different design

components, meaning the goals, the theoretical framework, the research question and sub-questions as well as the used methods and validity actions. In other words, if a change in one of the above-mentioned components occurred, then reconsideration and re modification of the other components would have to apply as well. Therefore, the present study started by tentatively defining the research goals and questions, while at the same time a thorough review on the reverse mentoring topic and on the construction project team effectiveness literature had already started. After tentatively defining the project goals, the research questions and the theoretical framework, we passed on the operational phase of our project by conducting the interviews and dealing with the validity threats. Here, it should be mentioned that as the research was progressing moving to the operational phase of our study, the first three tentatively established components had to be reconsidered and modified again. The final version of each component can be seen in the next figure.

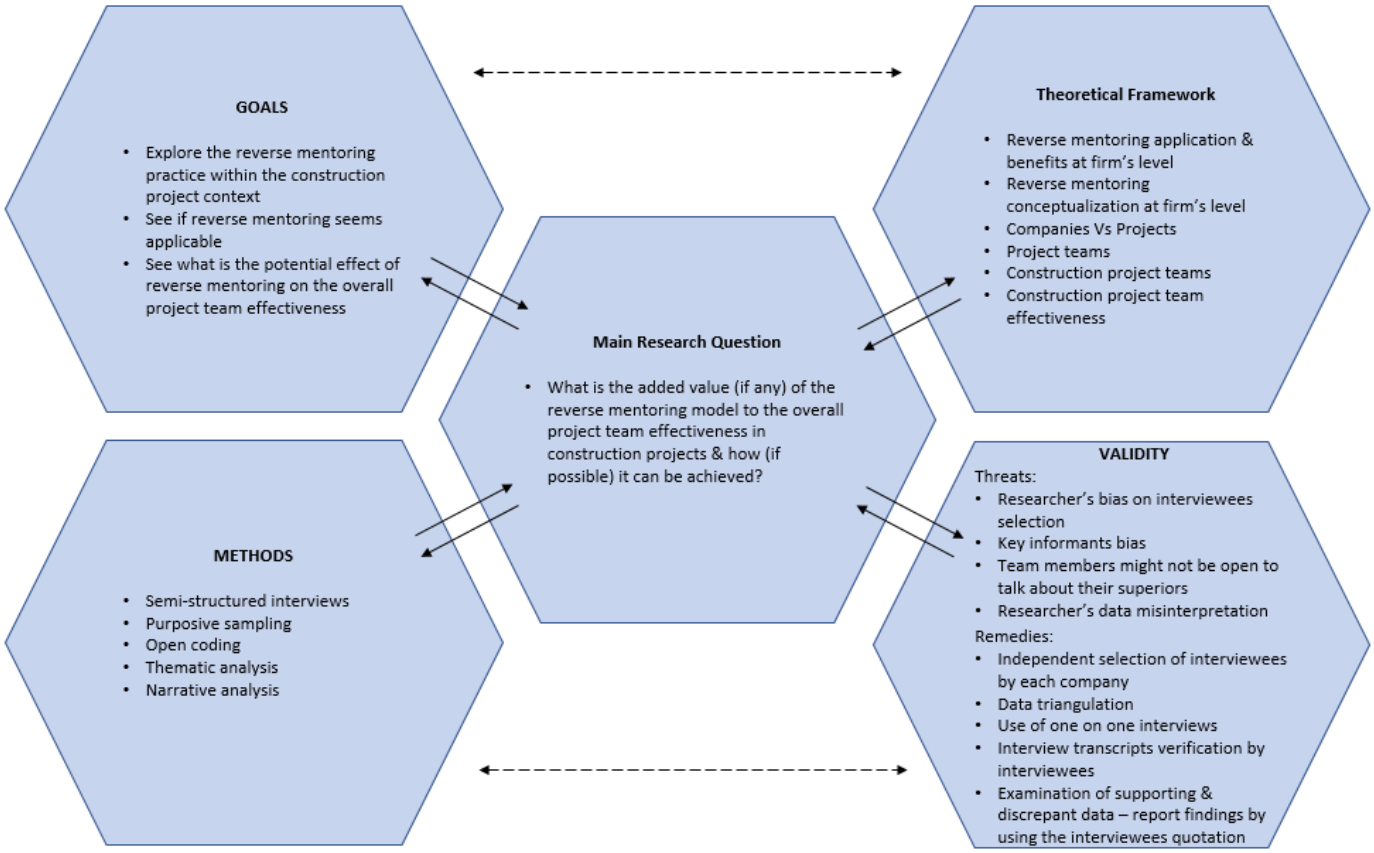

Figure I: Final design map of the present study

3 Results & Conclusions

First of all, and based on both academic and practitioners' literature, reverse mentoring can be perceived as a tool which exceeds by far its initial purpose of transferring solely technological knowledge from young to old employees but targets also to the address of modern workplace issues within companies, like on diversity and inclusion. This happens, since the model is disconnected with age, taking place also on the basis of either a position or a power difference relation between the participants. As far as the reverse mentoring relationship is concerned, although it starts as a one-way knowledge transfer from the subordinate to superior, it ends up as a reciprocal relationship, with both participants contributing to each other. In that way, the relationship deepens and the true benefits of the concept appear not only for the reverse mentoring dyads but for the whole organization as well. Thus, it can be easily understood why a tentative link is observed between the reverse mentoring concept, however at firm's level, and the recognized by literature, elements of highly effective construction project teams, requiring further exploration through the conducted interviews.

Therefore, after conducting fifteen semi-structured interviews with team leaders and team members, belonging to either Greek or Dutch companies and being actively involved in either building or infrastructure projects, it was concluded that reverse mentoring interactions do exist within that context, yet take place in an informal way. Specifically, a reverse mentoring relationship is formed on the basis of a spontaneous process where a serious problem has to be appeared first and afterwards either the team leader or the team member should take the initiative and enter into a reverse mentoring process. However, the purpose of the concept and the way the relationship develops matches with what has already been found in literature. Therefore, the most reverse mentoring interactions within the projects, which end up as a mutual exchange between the participants, seem to focus but not be limited to the challenges brought by the digital turn in construction, but extend to other critical issues within the projects, such as the leadership style of team leaders, making final decisions on technical solutions and corrective actions as well as how conflicts are managed.

Based on the interviewees' experiences and perceptions about reverse mentoring in construction projects, twelve different benefits were recognized for either team members or team leaders or for the whole project team.

Positively Affected Factors by Reverse Mentoring	
1. Conflict Solving	7. Commitment
2. Soft Skills	8. Team Composition
3. Quality Relationships	9. Project Goals
4. Communication	10. Leadership
5. Creativity & Innovation	11. Humility
6. Decision Making	12. Culture

Table I: Overall benefits of reverse mentoring in construction projects

As for the final link between reverse mentoring and project team effectiveness, it seems that the above benefits positively influence the nine out of fifteen, recognized by literature, elements of highly effective construction project teams.

Elements of Highly Effective Construction Project Teams	Final Link with Reverse Mentoring	Elements of High Effective Construction Project Teams	Final Link with Reverse Mentoring
Process Factors		Individual Factors	
1. Communication	✓	9. Soft Skills	✓
2. Decision Making	✓	10. Hard Skills	×
3. Conflict Solving	✓	Other Factors	
Team Factors		11. Goals & Objectives	✓
4. Leadership	✓	12. Clear Roles & Responsibility	×
5. Quality relationships	✓	13. Mutual Trust & Commitment/Shared Values	✓
6. Climate	×	14. Owner's Satisfaction	×
7. Composition (team skills, size & stability)	✓	15. Team members' satisfaction	×
8. Team learning	×		

Table II: Linkage between reverse mentoring & construction project team effectiveness

This result means that reverse mentoring may not make a huge difference in overall project team effectiveness that would require each project team to implement the idea, but at least it has a positive effect on the majority of team

effectiveness factors. Therefore, it may be up to each project team to decide which factors need improvement and thus determine whether or not a reverse mentoring practice should be adopted. However, our suggestion to experience the maximum benefits of the model is to somewhat formalize a process that takes into account the implementation suggestions presented in the following table.

Implementation Steps	Important Decisions & Actions
1. Sessions	a) Group sessions vs One on one sessions b) Promote a two-way interaction
2. Pairings	a) Team member's alternation in each session
3. Sessions Place	a) Everywhere but face to face
4. Participants' Commitment	a) Write down stuff – make a journal b) Establish measurements c) Be consistent d) Team leader should be really interested in the process e) Higher management involvement f) Daily reference to success reverse mentoring stories by the team leader
5. Training (for 1-1 sessions)	a) Important for one on one sessions b) Teach participants the proper way of giving feedback/conveying information
6. Trainer's Involvement (for group sessions)	a) Important for group sessions b) Teach participants the proper way of giving feedback c) Create an empathy culture between participants
7. Starting Point	a) After the team's formation, when people get to know each other
8. Ending Point	a) Keep track on your established measurements about the participants' motivation vs Until the end of the project team's mission
9. Frequency	a) Once per month – once per quarter vs Once per week – once per two weeks

Table III: Reverse mentoring implementation steps and their related decisions and actions

4 Recommendations for Further Research

- The conduct of an empirical study by applying reverse mentoring in practice within a project team, is highly recommended in order to test and expand the present study's findings.
- Reverse mentoring seems closely related to hierarchy within project teams. So, a tentative proposition which demands further research is that the more hierarchy within a project team, the bigger the need for implementing the model but the harder it would be.
- Reverse mentoring applicability seems to be related with the project's phase. Therefore, another tentative hypothesis that is worth further exploration, is that the reverse mentoring model is more realistic for engineers working in the field and therefore during the construction phase of projects.

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1 Introduction

This chapter is setting the scene of reverse mentoring research context, explaining the reason why the present study is needed. Afterwards the thesis aim is explicitly defined and translated into one main research question and five sub-questions that will be answered in the next chapters, while at the same time the thesis relevance for academics and practitioners is explained. Finally, it is presented a short introduction to each one of the following chapters, which are included in the current report.

1.1 Reverse Mentoring Background

In the recent years there is a growing interest in reverse mentoring practice, since many companies have implemented the model successfully, with their overwhelming communicated results being gradually validated by the last decade's academic literature (Chaudhuri, Park & Johnson 2021).

Reverse mentoring is a relatively new practice which first officially appeared in 1999 and started gaining popularity globally, both in the western but also in the eastern world after 2005 (Chaudhuri, Park & Johnson 2021). It was first perceived as the inverted process of traditional mentoring, with a young employee mentoring an older one on internet related issues. Specifically, the concept was formalized in 1999 by the former chief officer of General Electric, Jack Welch, implementing the model in his organization. However, it was first introduced in literature in 1998, when twenty-eight students, who were following a nutrition education course at the University of Delaware, Newark, were paired as mentors with professional dieticians but internet beginners. They performed a 2.5-hour workshop with the results being extremely positive in terms of the usefulness of the shared information and knowledge as well as the enthusiasm of both students and dieticians (Cotugna & Vickery 1998). Jack Welch, one year later, during a meeting with the CEO of GE's UK insurance company, heard for the first time the reverse mentoring idea. Afterwards, he flipped the organization's hierarchy upside-down, encouraging five hundred top leaders to receive education on internet use by young employees, under their thirties, who would act as mentors. All executive participants, including Jack Welch, were being reverse mentored at least three to four hours every week. After the concept's successful implementation at first place, the program was expanded, including approximately 3000 mentees of senior managers. Few years later Jack Welch admitted that reverse mentoring was the best idea ever heard, since its implementation led to a full exploitation of the internet's strengths at a business level (Welch & Byrne 2003, Welch 2003). Although the benefits of the model, after its successful practical implementation by Jack Welch, led practitioners, like Procter and Gamble, The Hartford's, GM Financial, Unilever, Dell etc. to embrace and execute the model, academics seemed more skeptical about the validity and the relevance of the intervention, possibly because of the lack of a theoretical framework and the difficulty to access real-time data, something which is substantiated by the fact that there are scarce research studies until 2005 (Chaudhuri, Park & Johnson 2021). At that time, Alvarez et al. 2005, again at the University of Delaware, organized a program in which they were being reversed mentored by graduate students, who were

computer literate, helping them to develop online courses for the first time ever. Since then and after the successful implementation of the concept both in educational setting by Alvarez and in business setting by Jack Welch, reverse mentoring has been expanded in several sectors within organizations until today, including banking (Taysir & Ulgen 2017), healthcare (Murphy & Adams 2005), information & communication technology (Chen 2014) and government (Gabriel et al. 2020). Many of the companies within those sectors used the model in a more innovative way in order to address modern organizational issues on diversity and inclusion with the final communicated results being extremely positive for both the reverse mentoring participants but for the whole organization's functionality as well.

Therefore, what is important to be clearly understood is that reverse mentoring at first, was a simple practice for transferring internet related competences from young technology savvy employees to older digital illiterate seniors. As new technological advancements appeared over the years, the reverse mentoring purpose expanded into new technologies and innovations like the mobile and the social media usage. However, recent studies perceive reverse mentoring as a more complex practice with its pairings being structured not only on the basis of the age difference between the employees (old-young) but also based on their power difference (manager-employee) or their position difference (senior-junior) within their organization (Cismaru & Lunius 2019). As for the related reverse mentoring outcomes, they exceed a lot the traditional function of mentors transferring solely technological knowledge to mentees, by reaching a mutual mentoring outcome, enabling reverse mentoring participants to exchange "not only high tech, but also high touch skills, not only tangible but also intangible returns" (Cismaru & Lunius 2019). Therefore, reverse mentoring in the present research is defined in accordance to Lawrence's definition, as the process which supports learning from someone subordinate who has greater knowledge on career or psychological level on the basis of either the age, power or position difference to his superior, reaching finally a mutual exchange between both participants.

As we are going to see below the two functions of reverse mentoring, career and psychological function, do exist also in traditional mentoring. So, how does reverse mentoring differ from traditional mentoring?

Traditional mentoring is an either formal or informal relationship which is formed by an older person who acts as a mentor to a younger one by sharing his knowledge, skills and experiences in order to help the former to grow and achieve his/her career and life successes (Lawrence 2017). Also mentoring should not be confused with the term coaching, since it is not a short-term relationship but a deeper one, which is not always visible from someone who is outside of the mentoring relationship (Kulesza & Smith 2013). According to Kram 1983 coaching is just an element of the mentoring's career function. Specifically, mentoring consists of the career and the psychological function. Within the former function, the elements of coaching, sponsorship, challenging assignments, exposure and visibility are included, while the latter involves role modeling, counseling and friendship. If a role reversal takes place, then based on Murphy 2012 and Chen 2013 & 2014 the reverse mentoring not only follows the Kram's theory but expands it including new attributes, like affirmation and encouragement, new viewpoints and ideas, skill development, the opportunity to get a better understanding of another generation and therefore improve work relations, communication and emotional intelligence. Such benefits work two ways between the reverse mentoring participants, reaching finally as already has been mentioned a mutual relationship.

1.2 Research Problem & Gap

As it has already been presented, the fact that the benefits of the reverse mentoring implementation within organizations are overwhelming, reaching a win-win-win situation between both reverse mentoring participants and the organization as a whole, have raised the academics' and practitioners' interest worldwide over this relatively new practice. However, the reverse mentoring concept has never been explored within the project context, and especially within construction projects which are going to be done in the present work. What prompted us to explore the reverse mentoring practice within that context is the fact that construction projects have become more dynamic and technology driven over the past years, demanding a shift in the required project skills from focusing only on technical expertise to more social and collaborative skills (Bakker & Kleijn 2018). Specifically, Bakker & Kleijn emphasize on the need of project managers to shift their focus from the traditional project management tools and techniques, towards

human development and team performance improvement. Therefore, it is suggested that project managers should strive to adopt tools and practices, which will not only drive productivity, but focus more on "socialization, engagement, trust, collective learning and bottom up intelligence" of project teams (Bakker & Kleijn 2018, p. 273). That shift of project managers' focus is also substantiated by the world economic forum report, which states that the main challenge of shaping the future of construction, is not really a technological one, but rather a social and organizational issue, since people are those who have to build up the required skills to foster collaboration and address the technological challenges.

1.3 Research Aim & Questions

Therefore, in the present work, the reverse mentoring model is perceived as a new promising practice which could possibly lead future project managers to release the full potential of their project teams. Therefore, the reverse mentoring model is explored within the project context in construction.

The research aim of the current study is twofold. On the one hand, to explore the model's applicability in construction projects and on the other hand to gain understanding of the possible model's contribution to the team members' and the team leaders' development and the overall project team effectiveness.

Therefore, the main research question is formed as follow:

Main Research Question: What is the added value (if any) of the reverse mentoring model to the overall project team effectiveness in construction projects & how (if possible) it can be achieved?

By structuring such a research question, the possible added value of the reverse mentoring practice at construction project context has to be explored first. Therefore, we lead to the attempt of answering the first sub question, which has its roots in literature and targets towards finding the link between reverse mentoring practice and construction project team effectiveness.

Sub-question 1: What is the possible link between reverse mentoring and construction project team effectiveness based on literature?

However, in order to establish the link between reverse mentoring and project team effectiveness of the first sub-question we have to test it and therefore we have formed three additional sub questions. Specifically, the following questions attempt to explore the way the reverse mentoring model is perceived in literature and experienced in practice within the construction projects, while at the same time, they try to test the findings of the first defined sub-question and explore for further contributions of the model.

Sub-question 2: How can the reverse mentoring concept be conceptualized based on literature and therefore within organizations?

Sub-question 3: How can the reverse mentoring concept be conceptualized based on practitioners' stories and therefore within construction projects?

Sub-question 4: Why do we need (if it is needed) reverse mentoring, based on practitioners' view – What is the link with team effectiveness (If any)?

So far, the structured sub questions aim to answer the first part of the main research question. Thus, the last sub-question, which can be seen below, is the one that brings us again to the second part of the main research question, contributing to the possible practical implementation of the model at project context.

Sub-question 5: How could we lead (if possible) to a high-quality reverse mentoring relationship at project level, based on practitioners' opinions?

Summing up, the main research question has been broken down into the following set of sub-questions:

1. What is the possible link between reverse mentoring and construction project team effectiveness based on literature?
2. How can the reverse mentoring concept be conceptualized based on literature and therefore within organizations?
3. How can the reverse mentoring concept be conceptualized based on practitioners' stories and therefore within construction projects?
4. Why do we need (if it is needed) reverse mentoring, based on practitioners' view – What is the link with team effectiveness (If any)?
5. How could we lead (if possible) to a high-quality reverse mentoring relationship at project level, based on practitioners' opinions?

1.4 Research Relevance

The present study attempts to expand the reverse mentoring practice into a new research field, that one of projects in construction domain and explore its implications there, by making a link also with team effectiveness. Therefore, the present work is going to develop new knowledge about reverse mentoring's potential application and benefits within the project context. Regarding the academic world, we hope that this study is going to motivate and convince more social science researchers to shift their focus and commit themselves to exploration research of reverse mentoring in construction projects, by testing and expanding the present study's findings. As far as the practitioners of construction projects are concerned, it is believed that the recommended reverse mentoring practice with the identified way of implementing it, deserves at a great extent the project teams' attention, since it can possibly contribute towards releasing their full potential.

1.5 Thesis Outline

In this paragraph, a short overview of the current report's chapters is presented.

Chapter 1: Introduction
As it has already been indicated, in chapter one the research context is set, with the related research aim and questions being defined, acting as a guideline for the development of the present work.

Chapter 2: Literature Review
A thorough review of the related academic and practitioners' literature about reverse mentoring has been conducted, presenting the identified concept's implementation steps within firms as well as its communicated benefits for both reverse mentoring participants and the whole organization. Chapter two closes with the model's conceptualization within companies, answering the sub-question two.

Chapter 3: Theory
This chapter attempts to explain specific terms and concepts which are further used as a base for examining the interview findings in chapter six. Therefore, it starts by contradicting a disciplinary society against a project society, in order to understand the differences between companies and projects, while it furthers zoom in on project teams and

construction project teams respectively. Finally, the main project team effectiveness factors are identified based on academic literature and a tentative link with the reverse mentoring model is made, on the basis of the chapter's two presented reverse mentoring benefits, answering the first sub-question.

Chapter 4: Methodology
In this chapter the adopted qualitative research approach with the use of semi-structured interviews for the present study is indicated first, with the main focus being in the rest chapter, on the used methods for answering the research sub-questions and therefore our main research question as well as on the actions taken for ensuring the study's validity.

Chapter 5: Results and Discussion
Chapter five, attempts to present the interview findings of the conducted interviews. After every findings' presented paragraph, a discussion section follows, where the related results are interpreted and tested against the existing literature. It should also be mentioned that in this chapter, sub-questions 3, 4 & 5 are answered on the basis of the interviewees' stories and point of views about reverse mentoring in construction projects.

Chapter 6: Conclusions & Recommendations
In the final chapter of the current report, the conclusions of the current research are presented together with the most surprising findings of the reverse mentoring practice in construction projects. Finally, the limitations of the present work are indicated along with the recommendations for further research.

2 Literature Review

In this chapter, the review of reverse mentoring academic's and practitioners' literature is going to be presented with the emphasis being on the concept's purpose, implementation and benefits within companies. It starts with indicating the reasons why reverse mentoring programs have been implemented over the past years and continues by recognizing the key success implementation steps for applying it. Subsequently, the communicated benefits, by literature and practice, are pointed out, while it ends with conceptualizing the reverse mentoring concept at firm's level.

2.1 Reverse Mentoring

The reverse mentoring model, which is the inverted process of traditional mentoring, started as that process during which a young employee mentors an older colleague at senior level, with the former acting as a mentee (Murphy, 2012). However, over the years that definition expanded taking also into account pairings which are formed on the basis of the participants' power difference (manager-employee) or position difference (senior-junior) within the companies (Lawrence 2017). As it can be easily understood by the definition shift over the years and since its first implementation by Jack Welch, reverse mentoring has been used for different purposes (Chaudhuri et al. 2021). In the beginning, the concept mainly targeted on transferring technological knowledge to older employees in order to bridge their technological divide with the younger ones by focusing solely on the internet and email usage (Alvarez et al. 2005). Even today, many reverse mentoring studies have been conducted for the same purpose but their focus shifted on social media and new digital applications use, which affect the modern organizations' practices. Another traditional objective of the reverse mentoring application, refers to the expertise advancement and management of younger employees within organizations (Chen 2013, Chen 2014). However recently, reverse mentoring has been used in a more creative and innovative manner towards addressing crucial workplace problems on diversity and inclusion. For instance, some studies perceived the model as a learning tool to increase the awareness of top management about the underrepresented groups' experiences and attitudes, so that they could discard any prejudiced views of each other (Raza & Onyesoh 2020, Madison 2019).

Following the same rationale, most modern organizations decided to launch a reverse mentoring program after considering a series of challenges every business is facing in today's world. Such challenges include, the address of unconscious bias towards establishing a more harmonious workplace, the establishment of equality, diversity and inclusion in the modern workplace, the business adaptation to new technology and the changing demographics as well as the transfer of knowledge, experiences and skills from the experienced employees to the younger generation (ACE).

2.1.1 Application Steps based on Academic Literature & Practice

In order to reach the initially defined purposes and experience the most benefits out of the reverse mentoring program, it should be organized first an effective application process. For that purpose, the following presented success implementation steps at a business level, came from both the academic literature, reviewing the work of Chaudhuri 2019, which is believed to be maybe the most comprehensive study focusing on that topic, and also from the empirical findings based on the widely accepted successful reverse mentoring paradigms of the Hartford and Procter & Gamble cases as well as the only one found practical implementation of the model in the construction domain by ACE.

2.1.1.1 Academic Literature

Without being evident from literature on whether or not the reverse mentoring program is suitable for every organization, Chaudhuri 2019, after her continuous debate with companies about the reverse mentoring practice and her research on the art and science of reverse mentoring implementation, acknowledged ten fundamental principles for its successful implementation. According to Chaudhuri 2019, organizations should:

1. Align the reverse mentoring purpose with the business strategic goals.
2. Create a shared and non-threatening culture, meaning that the program is more possible to achieve great success in organizations which adopt a risk taking culture that drives creativity and innovation, encourage openness in terms of knowledge creation and learning within company, while at the same time, they are willing to communicate to the outside world the positive concept's result, towards establishing a shared vision.
3. Ensure leadership engagement, so that the program becomes more credible.
4. Select reverse mentors and mentees, through a volunteering process for mentees (they should acknowledge their weaknesses and be vulnerable to new learning), and a stricter selection process for mentors (they should be trustworthy and have adequate technical and social skills).
5. Ensure training and support for mentors and mentees, with mentors' training focusing on strengthening interpersonal skills, while mentors on overcoming personal egos and become good listeners.
6. Succeed a perfect match, having always in mind that the most chances of a successful dyad lie on complimentary participants' personalities with similar backgrounds. Furthermore, it is suggested to select mentors and mentees with different hierarchical positions while they should be also coming from separate lines of business.
7. Start small, meaning that the wisest option is to experience a pilot program with a small number of participants, in order to avoid the firm's culture shock.
8. Organize a reverse mentoring program, with its formal duration being approximately one year, and the meetings' frequently being closely related to the program's purpose. However, most programs adopt a frequency strategy of one meeting per month for the first 6 months and then one meeting per two months until the program's termination.
9. Cultivate trust, confidentiality and transparency, since mentees in order to undergo an intimidating process, by making themselves vulnerable to younger mentors, need to feel safe and sound.
10. Find and communicate successful reverse mentoring stories, in order to become more positive/prone towards the reverse mentoring practice.

2.1.1.2 Practice

Most of the above-mentioned factors that lead to a successful implementation are also encountered in practice. Specifically, we present maybe two of the most cited practical applications in the literature, The Hartford's and the Procter & Gamble's cases, as well as the ACE's reverse mentoring program which was conducted from construction and engineering organizations.

2.1.1.2.1 The Hartford Case

The Hartford is one of the largest property and casualty insurance companies in the US. Due to the widespread use of the internet, customers changed their habits in the way they were informed about insurance and financial products, so Hartford had to catch up with this reality and shift its interest in social media and emerging technology use. According to the Hartford case, organizations should:

1. Set a clear timeline for the structured program
2. Set clear program's goals from the outset
3. Ensure the firm's commitment - the Hartford's commitment ensured by linking the reverse mentoring's goals to the company's overall goals.
4. Place high emphasis on mentors' selection – the Hartford program sought for a trustworthy candidate with interesting personality and strong technical & communication skills.
5. Assure that mentors are very well informed about the mentees' goals in each session but also at the end of the program.
6. Form pairs based on both participants' common interests or hobbies to encourage discussions beyond the project's goals and clear hierarchical distance to avoid conflict.
7. Assign a coach for each pair – at the Hartford's case, a coach from the HR department was assigned to support each pair by guiding mentees to be open to new knowledge and mentors to respect and understand mentors' learning peculiarities, while open digital platforms were created to enable and keep track to the reverse mentoring program.
8. Define the meetings' frequency – meetings at the Hartford's program were taking place for half-hour to one-hour every three to four weeks at the seniors' offices.

2.1.1.2.2 Procter & Gamble (P&G) Case

P&G is a company which produces a wide variety of branded consumer goods, like beauty and grooming supplies, different types of detergents as well as household and care items. One of the most well-known reverse mentoring applications, is the P&G's mentoring-up program, which targeted the retention of women at junior and middle management level, since till then there was not any female representation at senior level. Moreover, P&G ran another successful program, the biotechnology reverse mentoring program, which had as a goal to educate top managers about the biotechnology consequences on the business.

Therefore, based on the success implementation of P&G's reverse mentoring programs, organizations should:

1. Set a clear purpose and objectives (what you want to achieve at the end of the program), helping towards achieving a compelling business case and high participants' engagement.
2. Ensure the top organization's commitment, so that the program is taken seriously by everyone.
3. Achieve a good match, with both participants having a stake in the matching process.
4. Offer training to pairs before starting their sessions, in order to increase the chances of beginning and maintaining meaningful relationships.
5. Create a supportive environment, in order to ensure adequate space and time for the dyads to perform – P&Gs' programs lasted approximately one year, while the meetings' frequency was once every one to two months in a convenient environment for both.
6. Offer ongoing support to each pair during the whole program.

2.1.1.2.3 ACE Case

ACE is a consultancy and engineering association which targets to improve industry awareness of the future leaders in the natural and built environment. The focus of the conducted pilot reverse mentoring program was on bridging the technological gap between junior and senior employees. Specifically, the reverse mentoring program paired 22 people from seven companies, including Arcadis, BWB, Peter Brett Associates, Max Fordham, Tony Gee and Partners and WSP, with each company being responsible for creating the pairs. While the program was in its mid-way, it attracted the interest of three more companies, Arup, AECOM and Ramboll, which had developed their own programs, contributing to further sessions.

Based on ACE's reverse mentoring program, organizations should:

1. Train participants before the program's launch, so that unconscious bias is addressed and dealt with as soon as possible.
2. Set the ground rules of the whole process from the outset. A contract or memorandum creation helps to clearly define the mentors and mentees' roles and agree on the program's timeline – ACE's program lasted 9 months.
3. Ensure company's support.
4. Select participants through a self-volunteered process, but the mentors' selection should be done according to mentees' needs.
5. Create a trusting environment which encourages participants' commitment.
6. Pair participants with similar personalities but from different work teams that do not work together on a daily basis.
7. Organize at least one session every two months, including also ad-hoc catch ups, but away from day to day distraction places (e.g. coffee shops).
8. Check the program's progress regularly and see if participants want further support.

2.1.1.3 Application Steps of Reverse Mentoring Model

Summing up the above findings of the reverse mentoring application steps based on the academic literature and practice, 9 different steps are identified which can be seen in the next table.

Implementation Steps	Academic Literature	Practice		
	Chaudhuri 2019	The Hartford's	Procter & Gamble	ACE
1. Participants' commitment	Ensure leadership engagement - Find & communicate success reverse mentoring stories, align goals with the organization's strategic goals	Clear goals and timeline from the outset & link purpose with company's overall goals	Clear goals and objectives & ensure top organization's commitment	Set the ground rules of the whole process from the outset & ensure company's support
2. Organization's Environment	Create a shared, non-threatening culture, cultivate trust, confidentiality and transparency	-	Create a supportive environment, in order to ensure adequate space and time for the dyads to perform	Create a trusting environment which encourages participants' commitment
3. Sessions' Place	-	The meetings will take place at mentees offices	The meetings will be conducted in a convenient place for both	The meetings will be held away from distraction places (e.g. coffee shops)
4. Pilot Program	Always start small, by launching a pilot program with a few participants	-	-	-
5. Selection process	Should be volunteering and stricter for mentors	High emphasis on mentors' selection on the basis of trustworthiness, strong technical & communication skills	-	Select participants through a self-volunteered process, but the mentors' selection should be done according to mentees' needs
6. Perfect match	Complimentary participants' personalities with similar backgrounds, meaning different hierarchical positions from separate lines of business	Form pairs based on both participants' common interests or hobbies	Both participants should have a stake in the matching process	Pair participants with similar personalities but from different work teams that do not work together on a daily basis
7. Duration	one-year duration	Half-hour to one-hour meetings	one-year duration	-
8. Frequency	one meeting per month or one per two months	one meeting every three to four weeks	one meeting per month or one per two months	At least one session every two months
9. Training	Ensure training support for mentor-mentees & assure that mentors are very well informed about what are the mentees goals for each session but also for the whole program	Assign a coach for each pair	Offer training to pairs before starting their sessions & ongoing support during the whole program	Train participants before starting the reverse mentoring program & during the program check if pairs need further support

Table 2.1: Application steps of the reverse mentoring model at organization level

2.1.2 Concept's Benefits based on Academic Literature & Practice at Organizational Level

As it was previously mentioned, the most widely researched topic, from the reverse mentoring's formalization until today, is the concept's use for mining the technological gap between younger and older employees. However, many recent studies like that one of Browne 2021, tend to break down that cultivated image of young employees transferring solely their knowledge to "teach old dogs new technology tricks", mentioning characteristically that such perception for reverse mentoring's potential is "self-limiting, over simplistic and denies organizations more valuable insights" (Browne 2021). Therefore, he proposes to perceive reverse mentoring as a tool, which at first level it may serve that over simplistic goal of knowledge transferring from mentors to mentees, but as the relationship deepens, it is possible to lead to a win-win situation between both participants and the organization as a whole (Browne 2021). The same attitude also is held by Chen 2013, who mentions that it is a tool which offers many benefits similar to traditional mentoring but its subtle difference in turning the hierarchy on its head, makes the results even more impressive. Therefore, it is imperative to explore the academic and the practitioners' literature and find the reverse mentoring outcomes at a firm level, not only for mentors and mentees but for the organization as well.

2.1.2.1 Academic literature

Starting first with the mentors' benefits, it is visible that the reverse mentoring process positively affects their personal development at many different levels. Not only do they experience more career opportunities via their increased visibility within their organization and their developed networking (Gugercin 2017), but they also acquire important hard and soft skills, necessary for today's organizational practice. Specifically, they have the opportunity to see how their mentees are dealing with a new problem, resulting in their own development of problem-solving skills (Gugercin 2017). Moreover, being formally in the role of mentor, makes them feel more confident about their own capabilities (Kulseza & Smith 2013, Browne 2021), helping them to practice important leadership skills, like teaching (Murphy 2012). In terms of soft developed skills, the whole exchange process pushes mentors to learn how to listen, empathize and communicate effectively with their mentees (Gabriel et al. 2020). Finally, at a mental level, the fact that the organizations value their less experienced employees, by creating space for their voices to be heard, increases employees' job satisfaction and personal fulfillment (Chaudhurl & Ghosh 2012).

Moving on the mentees' side, it can be supported that the concept's benefits are more limited compared to mentors' positive results. Of course, the most widely mentioned benefit across literature, since most of the current studies explore pairs in technology transfer from young to old employees, is the acquisition of technical technology skills (Murphy 2012, Gabriel et al. 2020, Chen 2014). At broader terms, mentees can also gain in depth understanding of younger groups of employees, helping them both by shaping their interventions as leaders, during the organization's daily life, in order to increase the latter's motivation (Kulseza & Smith 2013) and by upgrading their communication skills across different generations (Murphy 2012).

Finally, at an organizational level, it can be supported that the results can contribute to the overall organization's functionality. Many studies revealed the concept's contribution to the employees' engagement (Chaudhurl & Ghosh 2012, Murphy 2012) as well as the mentors' commitment to their job and their organization (Murphy 2012, Hechl 2017, Chaudhurl & Ghosh 2012). According to Chaudhurl & Ghosh 2012, this further leads organizations to experience lower rates of employees' turnovers, avoiding unnecessary costs. Another recognized benefit of the reverse mentoring application at a firm level, is the created open and safe environment for exchanging knowledge and experiences, which facilitates trust building between participants (Kulseza & Smith 2013) while it promotes creativity and innovation (Browne 2021). Also, the pairs which perform within such a blame free environment tend to gain better understanding of each other, avoiding in that way unnecessary conflicts and discarding possible pre embedded biased views and stereotypes (Kulseza & Smith 2013).

The main findings based on the academic literature review at organizational level can be seen in the next table.

Mentors' Benefits	Mentees' Benefits	Organization's Benefits
Acquire leadership skills *(like teaching & mentoring skills)* (Murphy 2012, Gabriel et al. 2020, Chen 2014, Harrison 2017, Kulseza & Smith 2013, Gugercin 2017, Khattak et al. 2021)	Upgrade their knowledge & their technical skills *(mainly their tech related skills)* (Murphy 2012, Gabriel et al. 2020, Chen 2014, Harrison 2017, Kulseza & Smith 2013, Taysir & Ulgen 2017, Khattak et al. 2021, Gugercin 2017)	Enhance the mentors' engagement & commitment (Murphy 2012, Chaudhurl & Ghosh 2012, Hechl 2017, Billups 2016, Browne 2021)
Gain insight into the organizational structure (Murphy 2012)	Increase their understanding of different generations (Murphy 2012, Kulseza & Smith 2013, Gugercin 2017)	Enhance mentees' engagement (Chaudhurl & Ghosh 2012)
Gain better understanding of their own job role (Murphy 2012)	Learn to communicate better across different generations (Murphy 2012)	Reduces employees/mentees turnover (Chaudhurl & Ghosh 2012, Browne 2021)
Acquire soft skills *(like listening and communicating effectively & giving feedback)* (Murphy 2012, Gabriel et al. 2020)		Intergenerational technology gaps are addressed and bridged (Murphy 2012)
Personal fulfillment & satisfaction (Chaudhurl & Ghosh 2012, Billups 2016)		Creates an open & safe environment, facilitating trust building, knowledge sharing, creativity & innovation (Murphy 2012, Raza & Onyeson 2020, Kulseza & Smith 2013, Browne 2021)
Acquire problem solving skills (Gabriel et al. 2020, Gugercin 2017)		Increase awareness of underrepresented groups within organization (Raza & Onyeson 2020)
Increase their self-confidence (Kulseza & Smith 2013, Browne 2021)		Break down biased views/stereotypes between employees (Raza & Onyeson 2020, Kulseza & Smith 2013)
Increase visibility & develop networking connections (Gugercin 2017)		Creates a positive work climate (Billups 2016)
		Reduces generational conflict between employees (Kulseza & Smith 2013, Gugercin 2017)
		Promotes greater interaction between group members (Kulseza & Smith 2013)
		Better understanding of the organization's culture (Gadomska-Lila 2020)

Table 2.2: Academia's perspective for concept's benefits at an organization level

2.1.2.2 Practice

The above literature findings at business level are substantiated also from the companies' empirical findings after applying a reverse mentoring program (see table 2.3). The table was structured based on secondary sources, like official companies' websites, companies' reports and presented interviews from participants on the web. The recognized results are coming from the programs conducted by General Electric (GE), GM Financial, Procter and Gamble (P&G), the Hartford and ACE.

Mentors' Benefits	Mentees' Benefits	Organizations' Benefits
Formed quality relationships with colleagues (GM Financial, Procter & Gamble, the Hartfod)	Helped them deal with everyday challenges at work (GE, GM Financial, Procter & Gamble)	Increased employees' engagement (Procter & Gamble, the Hartford, ACE)
Understood how business is working (GM Financial, Procter & Gamble)	Understood mentor's perspective (GM Financial, Procter & Gamble)	Developed creative & innovative ideas (Procter & Gamble, the Hartford)
Developed leadership skills (Procter & Gamble)	Upskilling of program's focus (GE, Procter & Gamble, the Hartford, ACE)	Changed the business way of dealing with challenges (Procter & Gamble, the Hartford)
Led to personal career development (GE, the Hartford)	Valued mentor's importance (GE, the Hartford)	Created open lines of communication between team members (GM Financial)
Developed communication skills (ACE)		Initial biased views for the other group of employees changed (ACE)

Table 2.3: Practitioners' perspective for concept's benefits at an organization level

2.1.3 Concept's Benefits at Educational Level

As a final remark, maybe it is also interesting to shed some light on the concept's results at an educational level, as they come with some new insights. Although most of the conducted studies at educational settings emphasize again on the traditional purpose of the reverse mentoring application (Boysen 2016, Leedahl et al. 2019), others tried to explore its role into a completely different context. Recent studies by Peterson and Ramsay 2020 who perceived the model as a reciprocal tool, found that the dynamic exchange of knowledge, experiences, advice and guidance between the department leaders and the minority ethnic communities' students, increase the former's understanding towards students and help the latter to improve their goal attainment. As for the research of Clarke et al. 2019, they present reverse mentoring not only as an appropriate tool for incorporating new technologies into the health educational environment, but also for improving the workplace culture and the effectiveness of multidisciplinary working teams, which demand a high degree of collaboration. The reverse mentoring model is not perceived as a process which follows the traditional rule of pairing, matching the younger mentor with the older mentee, but as a dynamic content driven process of mutually exchanging information and knowledge, especially between different members within the multidisciplinary team in order to gain knowledge about the others' members professions.

2.2 Conceptualization of Reverse Mentoring based on Literature (Answering Sub-question 2)

First of all, it should be highlighted again, that none of the previous studies has explored the model at project context. Therefore, the concept's conceptualization can be solely performed based on the findings at firms' level.

Following the Kulseza & Smith 2013 rational, who mention that "knowledge is best measured by experience rather than years", since learning makes someone knowledgeable and not the time on itself, the reverse mentoring model can be disconnected with age and also considered on the basis of either the position difference or the power difference of the participants (Lawrence 2017). Therefore, the used terminology in figure 2.1 for someone who takes the role of mentor is "subordinate" and that one of mentee is "superior". Also, by following the previously presented findings, which perceive reverse mentoring as a reciprocal dyadic exchange tool, acting far beyond its traditionally described goal, it is believed that the concept can be considered as an exchange or reciprocal tool between the reverse mentoring participants. If we would like to further describe the concept based on well-established theories, then according to reverse mentoring literature the concept can be seen as a social exchange tool, by taking into account the utilitarian perspective of Blau 1964, on social exchange theory (SET), at a dyadic level, considering the exchange quality between a leader and a follower (Leader – Member Exchange Theory, LMX) with the exception of role reversal.

According to Social Exchange Theory, people connect with each other through an exchange process in order to maximize benefits and minimize costs (Makhubele & Kekwaletswe 2017). The inventor of SET, Blau 1964, argues that human relationships are developed and maintained, based on participants' cost benefit analysis. In terms of benefits, participants account for those things that hold value for them in the relationship while costs can be perceived as the unwanted/negative things of the exchange process. Therefore, each participant undergoes a continuous process of adding the benefits and subtracting the costs, in order to decide whether or not it is worth starting, maintaining or terminating a relationship. Of course, the calculations do not take place explicitly, but it is an implicit process on the basis of personal obligation, gratitude and trust, promoting reciprocal exchanges between participants (Blau, 1964). Following that rationale both superiors and subordinates undergo a cost benefit process for participating in the reverse mentoring interaction and therefore maintaining it, having as a goal a high quality LMX relationship.

Leader Member Exchange Theory, explores the exchange quality between a leader and a follower within organizations. The point of departure for LMX, is that the leader of a team forms different types of relations with each one of the team members. Particularly, it recognizes two types of relationships. A low-quality relationship, which is formed according to the contract specifications and the job description as well as a high-quality relationship, which extends beyond the contract agreement and involves a deeper relation based on mutual exchange of resources and support (reciprocal influence), trust and respect, something which is also desirable in the formed reverse mentoring relationship.

Finally, the next figure presents the way the reverse mentoring model can be conceptualized at a firm's level, based on the recent literature findings on this topic and by making use of some well-known existing theories.

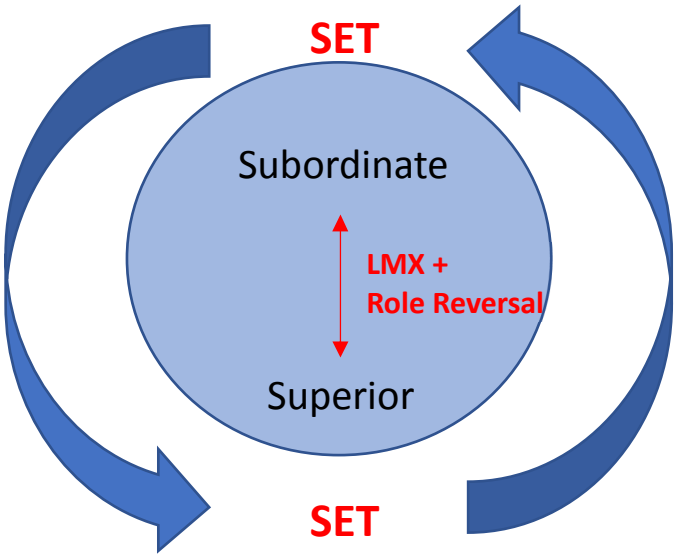

Figure 2.1: Reverse mentoring conceptualization based on literature

3 Theory

In this chapter a series of concepts and terms are going to be defined at first. Thus, the companies' characteristics are juxtaposed with those of projects, with the latter being further zoomed in on team level in construction. Then, an attempt is being done to examine the implementation steps of reverse mentoring under the recognized characteristics of companies based on Jensen et al. 's 2016 research, while at the same time the construction project team effectiveness factors are being identified based on literature and therefore a tentative link with reverse mentoring is being established.

3.1 Companies Vs Projects

In this paragraph we are going to highlight the main differences between companies and projects, based on the Jensen et al. 's 2016 research, where the disciplinary society within which the companies are included, is compared with the existing society within projects. In general, an ideal disciplinary society is characterized as a stable environment where you can control processes and results beforehand while an ideal project society is a dynamic environment, where pre codification is not possible. According to Jensen et al., the comparison between those two opposite societies can be conducted on the basis of what we do (activity), where we do it (space), when we do it (time) and with whom (relations) in each society.

Starting with the activities that take place in each one of those societies, it is observed that in a disciplinary society what we do is preplanned by defining first the space, the time and the needed people for that activity. This can be understood by considering the activity of dancing, which is learned at a specific dance school, after finding if needed a dancing partner for specific types of dances like waltz and following the specific classes time frame and content, predefined by the dance teacher. Therefore, in a disciplinary society, space, time and relations define the activity, while the latter is a repetitive and a preplanned action. On the contrary, within projects, the activity is taking the lead, defining the space, the time and the relations. For instance, the dance floor can open everywhere, if people first start dancing, while when the activity will finish, the formed space, time and relations will cease to exist. Therefore, the activity is taking a central role in projects while it can be characterized as emerging, unique and temporary. This is also why the term "experience" has a different meaning for a project society, since it goes along with the number of different activities you have been involved in, in different contexts and not with the number of times someone did the same activity.

By taking into account the same dancing example that Jensen et al. use in their research, we can distinguish the difference of the space importance in each society. Within a disciplinary society, the space defines the activity, like what the dance school does for learning dancing, while within projects it happens the opposite, if we think again of the dancing activity that can take place everywhere after someone starts dancing. So, at a project society, the space is

a flexible place where an emergent activity is possible to take place and therefore, the emphasis shifts from the space to the actual activity.

In terms of time, it is evident that the difference lies in the temporary structure of the project society compared to the disciplinary one. Thus, the activity in disciplinary organizations is often repetitive in a constant flow, while in projects, is one-off due to its temporariness. So, when you finish with one project then you move on to the next activity, and therefore to the next project. The temporary structure of projects also, plays an important role to the developed relations in it and they are characterized as connections rather than fixed relationships which are formed on the basis of the predefined space and time at permanent organizations.

The next table summarizes the differences between a disciplinary and a project society, and therefore between companies and projects.

Comparison basis	Disciplinary Society	Project Society
Relationship between activity, space, time & relations	"Space, time and relations define activity"	"Activity becomes the order and opens up time, space and relations"
Activity	"Activity is mostly repetitive and organized through predictions"	"Activity is emerging, unique, temporary and organized through projections into the future"
Space	"Space shapes activity: One space is related to one activity"	"Activity shapes spaces. Spaces are designed for maximum flexibility aimed to create the probability for an activity
Time	"Activity is "permanent" based on repetition in a constant flow"	Activity is temporary; hence there is time in and between projects"
Relations	"Relations exist in a fixed hierarchy bounded by time and space"	"Activity is relational, thus connecting is more important than relying on fixed relationships"

Table 3.1: Main differences between a disciplinary society and a project society (Jensen et al. 2016)

3.2 Project Teams

Before focusing on project teams, it might be wise to define the term "team", since it is a widely used word by everyone and it might mean different things to different people. Therefore, it is necessary to draw upon literature and establish a common understanding of the team term. Team is more than a group of people who help each other and work together. According to Paulus 2000, the group is part of a team, since it can be perceived as two or more people who form relationships and influence each other by their daily interactions, while teams are groups of people who work together within an organization towards a shared purpose. A more comprehensive definition was given by Katzenbach & Smith 2003, defining the term "team" as "a small number of people with complementary skills, who are committed to a common purpose, performance goals and approach for which they hold themselves mutually accountable".

However, that definition fits many different types of teams. Parker 2003, acknowledged three different types of teams, the classic functional teams, the self-directed teams and the cross functional teams. The classic functional team follows a pyramid organizational structure, where its members are directly reporting to their boss. This kind of clear hierarchy structure seems suitable to stable industries with predictable markets. On the other hand, in self-directed teams there is a horizontal structure, since their members are fully responsible for getting their job done and managing themselves in terms of dealing with the everyday arising challenges. Such kinds of teams seem suitable for startup companies which adopt a participative management style. As for the cross functional team, it is a multidisciplinary team, in which team members are coming from different firm's departments, since their knowledge and skills combination is considered necessary for achieving their common goal. Cross functional teams seem suitable for companies which act within a dynamic environment towards satisfying the market's fast changing demands. Parker 2003, further classified

teams as permanent and temporary. With permanent teams we mean those teams which are formed within the ongoing organizational structure, such as the functional department teams, while with temporary teams, we refer to short term teams which are built to study, analyze or solve a specific business problem. Thus, project teams belong to the latter category.

Specifically, Tyssen et al. 2013, identified four characteristics of project teams. First, their temporary structure can be easily understood by looking at the project team's development process. According to their research, project teams are going through a three phase process, starting with the conception phase, where the goals and the resource planning is set by the manager and the team members, followed by the organizing phase where the team norms and values are set, while at the same time the members' roles towards the performed tasks are defined. Finally, the accomplishment phase takes place, where the team members work together for successfully completing the project. A second recognized feature of project teams by Tyssen et al. 2013, is their unique outcome. Every project is different from any other previously conducted one, while the approaches used towards the project's success will also differ respectively. The involved uncertainty can be dealt with, by the creation of a creative environment so that the team will be able to come up with new practices for pursuing their shared goal. Another project team characteristic is the fact that the leader of the project team often lacks authority towards team members, increasing the difficulty of establishing the needed working culture. Also, team members are representatives of their organization and therefore, they tend to rely more on their functional supervisor, since he/she is responsible for their future rewards. Finally, the heterogeneity of team members constitutes another feature of a project team. Often project teams are built of individuals with complementary skills, which come from different departments of the firm. Having also in mind that several employees can enter and leave the project team during the course of time while others can participate at the same time in other projects, makes its functionality more challenging.

All these project team characteristics go along with the respective challenges of the following table.

Project Teams Characteristics	Possible Challenges
Temporariness	Difficult to establish team norms/values and positive relations, like trust
Unique outcome	High degree of the involved uncertainty and risk, calls for creativity
Leader's limited authority	Leaders may lack authority towards team members. The latter may be obliged more on their functional department supervisor
Members Heterogeneity	Multidisciplinary coordination and communication may be difficult
Team members variability	Difficult to maintain group cohesiveness and team members commitment

Table 3.2: Project team characteristics and challenges (Tyssen et al. 2013)

3.2.1 Construction Project Teams

In general, the construction industry can be characterized as a dynamic and fragmented industry, since different specialist companies need to collaborate with each other during the different phases of a project, under specific time frame, towards the project's success. Undoubtedly, the construction projects, regardless of their size, cannot be completed by a single company, since either it cannot bear all the involved risk alone or does not have all the required know-how and staff required to complete the project. Therefore, construction teams are structured by individuals from different types of organizations, such as engineering and architecture companies, contractors, subcontractors, etc. In that way, the representatives of each company come together and form the project team, within which they have to perform very different but closely related roles. In other words, the origin of team members within a

construction project team is the main difference compared to other industries' project teams, since it is impossible for team members to belong to the same company. The following figure indicates the members' composition of a typical construction project team (Ong 2008).

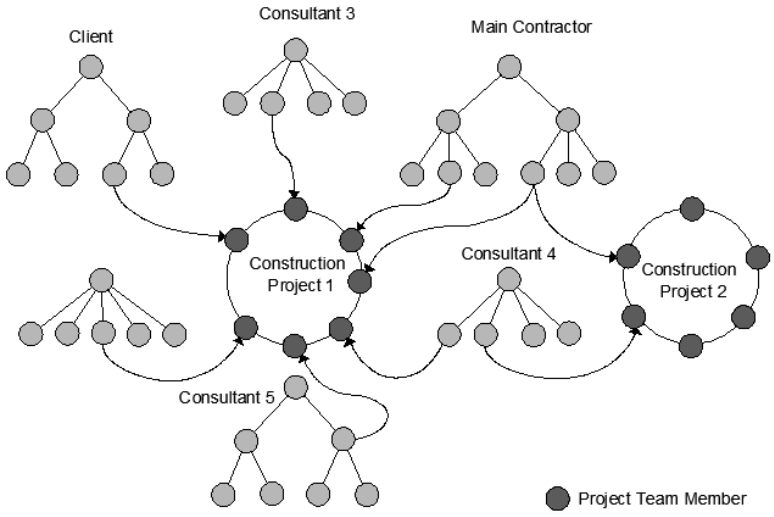

Figure 3.1: A typical construction project team composition (Ong 2008)

Therefore, the construction project teams can be classified as temporary, cross functional teams, which include the project teams' characteristics of the table 3.2, but with an additional distinct feature. Not only do their team members hold multidisciplinary professions but they are coming from different specialized sub-teams of different companies. This is the main feature that makes project teams in the construction domain unique compared to project teams from other industries, like manufacturing.

3.3 Reverse Mentoring Implementation: Construction Projects Vs Companies

As it has already been highlighted in chapter 2, there is not any research on reverse mentoring within the project context, so it is not feasible to use the existing literature for comparing the concept's implementation between construction projects and companies. However, it would be useful to highlight why some differences of the concept's implementation within construction projects seem unavoidable compared to the recognized implementation factors of reverse mentoring within companies, if we examine them on the basis of Jensen et al. 's point of view. So, based on tables 3.1 and 2.1, the following table has been structured.

Companies Implementation Steps based on Academic Literature & Practice (Table 2.1)	**Decisions & Actions** based on Academic Literature & Practice (Table 2.1)	**Comparison Basis between Companies & Projects** based on Jensen et al. 's research (Table 3.1)
1. Participants' commitment	a) Clear goals & timeline, b) Ensure top organization's support by aligning program's goals with company's strategic goals c) Ensure top organization's support by finding and communicating success stories within organization	**Figurative Space** is predefined
2. Organization's Environment	a) Create a nonthreatening & supportive environment	**Figurative Space** is predefined
3. Sessions' Place	a) Mostly at mentees' offices, but always away from distraction places	**Actual Space** is predefined
4. Pilot Program	a) Start small – low number of participants	**Relations** are predefined
5. Selection process	a) High emphasis on mentor's selection b) Volunteering process	**Relations** are predefined
6. Pairings – Matching process	a) Complimentary participants from different departments	**Relations** are predefined
7. Duration	a) Clear timeline from the outset b) Program duration: mostly one year	**Time** is predefined
8. Frequency	a) Sessions frequency: mostly one per month or one per two months	**Time** is predefined
9. Training	a) Training takes place beforehand but if needed during the whole process as well	**Figurative Space** is predefined

Table 3.3: Combining the companies implementation steps recognized on literature with the comparison factors between companies and projects of Jensen et al. 's research

The first thing that can be observed from the above table, is that the predetermined space, relations and time define the activity of reverse mentoring, in accordance with the first of the main characteristics of a disciplinary society and therefore a company (see table 3.1). Specifically, it can be observed that in order to run a reverse mentoring program within firms, it is advisable first to create the needed space, both figuratively by ensuring the organization's acceptance and thus the participants' participation and training as well as literally by defining the place of the sessions. Also, you need to determine the relations between the participants by finding them and pairing them as well as the exact timeline of the whole process. By emphasizing more on the time perspective of Jensen et al. 's research, it can be seen that the reverse mentoring activity should take place in a constant flow and in constant time intervals, while the relationships between the participants should be predefined and fixed during the whole process.

Therefore, it is confirmed that the above reverse mentoring implementation steps follow the recognized by literature characteristics of a disciplinary society and might not match with the needed steps at a project level. So, it would be interesting to understand how these factors possibly need to be differentiated and to what extent so that a reverse mentoring process could be fitted within a completely different environment, that one of construction projects.

3.4 Team Effectiveness in Construction Projects

In general, a team can be characterized as successful if their team members exceed performance and enhance effectiveness. But what exactly team performance and effectiveness are? Many initial definitions of team effectiveness include performance as a key element for succeeding it, but they do not explicitly highlight the difference. Team performance can be considered as the occurring situation within a team or the execution and the result of a specific action (Henderson & Walkinshaw 2002). It is closely related with the way teamwork and the task related activities are completed. In other words, performance can be viewed as a contributing factor to team effectiveness which in turn is associated with the extent the project goals and objectives have been achieved (Henderson & Walkinshaw 2002).

Specifically, in construction domain, according to Azmy's 2012 work, construction project team's effectiveness refers to "the ability of the team to clearly define, agree and understand projects' common goals and their roles and responsibilities to accomplish assigned tasks and deliver a completed and well-built project compliant with the highest quality, as well as effectively embrace owner's expectations during the entire project through the use of effective communication strategies" (Azmy 2012). This definition includes a series of important factors recognized in this work that play a significant role towards team effectiveness, such as team leadership, team goals and objectives, team communication and relationships, team roles and responsibilities as well as the owner's satisfaction. Specifically, the team leaders are responsible for guiding team members to achieve the project objectives and thus succeed the owner's satisfaction by reinforcing everyone to perform according to their strengths and ensuring their full commitment (team leadership). As for the team goals, they should be clearly defined and agreed by everyone so that they can provide purpose, focus and direction to the whole team (team goals and objectives). Also, team members' roles and responsibilities should be clearly defined as soon as possible during the team's development process, avoiding possible role conflicts during the construction process (team roles and responsibilities). In terms of soft factors like team members' communication skills, they play an equally important role since they facilitate the process towards establishing the team norms and values as well as gaining a better understanding of the other team members' personalities (team communication). In that way, personal trust relationships between team members can be formed (team relationships), promoting team learning in terms of gaining understanding of each other's strengths and weaknesses. In other words, high quality team relationships ensure trust and respect between employees' roles within the construction process, something necessary for the overall team's effectiveness.

The formation of good quality relationships between team members is perceived of highest importance for teams to reach their full potential also in Ong's 2008 study. He specifically mentions that the cultivation of a friendly team climate, so that people feel positive about their team, contributes positively to relationships' formation and thus to team's effectiveness. If this is not the case, the team runs the risk of experiencing undesired outcomes, like conflicts between their team members.

Another study about the elements affecting the construction project team effectiveness, came from Alharbi 2022. He focused his research on building projects, finding that the project team effectiveness is affected by several factors. The findings were grouped as elements which are related with the team structure, the team composition and the team process. In the first category, the clarity of team's goals and roles as well as the leader's role were identified, in line with the Azmy's previously presented work, but Alharbi also included as important separate elements towards team effectiveness the establishment of norms and trust between team members. In the team composition category, he included the significance of team members to hold the necessary hard skills for the conducted work, the size of the team as well as its stability, in terms of members commitment towards working together for achieving their shared goals. Regarding the team process factors, communication between team members, which might take the form of informal meetings, information sharing and feedback sessions, is perceived of highest importance. Also, other team process factors that are included, are the way the decision-making process is performed and if anyone feels comfortable about it, the way the conflict resolution takes place and the importance of creating a supportive climate between team members. The findings of those three studies are presented in the following table.

Authors **Elements of Highly Effective Construction Project Teams**	Ong (2008)	Azmy (2012)	Alharbi (2022)
Process Factors			
1. Communication		✓	✓
2. Decision Making			✓
3. Conflict Solving			✓
Team Factors			
4. Leadership		✓	✓
5. Quality relationships	✓	✓	
6. Climate	✓		✓
7. Composition (team skills, size & stability)			✓
8. Team learning	✓		
Individual Factors			
9. Soft Skills		✓	✓
10. Hard Skills			✓
Other Factors			
11. Goals & Objectives		✓	✓
12. Clear Roles & Responsibility		✓	✓
13. Mutual Trust & Commitment/Shared Values		✓	✓
14. Owner's Satisfaction		✓	
15. Team members' satisfaction	✓		

Table 3.4: Elements of effective construction project teams found in literature

3.5 Tentative Link between Reverse Mentoring & Team Effectiveness in Construction Projects (Answering Sub-question 1)

Based on literature findings, it could be supported that there is a visible but tentative link between the reverse mentoring outcomes (see tables 2.2 & 2.3) for companies, and the team effectiveness factors (see table 3.4) recognized in literature for construction projects.

If we consider first the reverse mentoring's results on participants level, we can see that they are very likely to form quality relationships with each other and with their colleagues as well, developing at the same time soft and hard skills, which are necessary according to the team effectiveness literature.

At an organizational level, the successful application of the reverse mentoring model, offers several benefits which match with a series of team effectiveness factors. According to reverse mentoring literature and practice, conflicts are greatly reduced since the superiors can gain a better understanding of their subordinates and the other way around, with the subordinates also having the chance to understand the organizational culture and are more likely to act according to the firm's values and norms. Moreover, by making use of a reverse mentoring program, an open space for everyone's voices to be heard is created, reinforcing the development of a positive and amicable organizational climate. Last but not least, the reverse mentoring model can also lead to the increase of participants' commitment and engagement to their organization while it is a way to reduce employees' turnovers, which could prove very costly for the company.

Therefore, a tentative linkage between reverse mentoring and construction project team effectiveness based on the existing literature, is indicated in the following table.

Elements of Highly Effective Construction Project Teams	Reverse Mentoring Benefits based on Literature (Firm's Level)	Elements of Highly Effective Construction Project Teams	Reverse Mentoring Benefits based on Literature (Firm's Level)
Process Factors		Individual Factors	
1. Communication	✓	9. Soft Skills	✓
2. Decision Making		10. Hard Skills	✓
3. Conflict Solving	✓	Other Factors	
Team Factors		11. Goals & Objectives	
4. Leadership		12. Clear Roles & Responsibility	✓
5. Quality relationships	✓	13. Mutual Trust & Commitment/Shared Values	✓
6. Climate	✓	14. Owner's Satisfaction	
7. Composition (team skills, size & stability)		15. Team members' satisfaction	✓
8. Team learning			

Table 3.5: Tentative linkage between reverse mentoring & construction project team effectiveness based on literature

As for the detailed description of how reverse mentoring can possibly influence the above recognized construction project team effectiveness factors based on tables 2.2 & 2.3, is presented in the next page.

Possible Positively Influenced Construction Project Team Effectiveness Elements by Reverse Mentoring	Reverse Mentoring Application		
	Mentors' Benefits	**Mentees' Benefits**	**Organization's Benefits**
1. Communication	-	Learn to communicate better across different generations	Creates open lines of communication between team members
2. Conflict Solving	-	-	Break down biased views / stereotypes between employees
	-	-	Reduces generational conflict between employees
3. Soft Skills	Acquire leadership skills (like teaching & mentoring)		-
	Acquire communication skills	-	-
4. Hard Skills	-	Upgrade your knowledge & your technical skills of program's focus	-
5. Quality Relationships	Form quality relationships with your colleagues	-	-
6. Climate	-	-	Creates a positive work climate
7. Clear roles & Responsibility	Gain better understanding of your own job role	-	-
8. Mutual trust / Commitment / Shared values	-	-	Enhances mentors' engagement & commitment
	-	-	Enhances mentees' engagement
	-	-	Creates an open & safe environment, facilitating trust building, knowledge sharing, creativity & innovation
	-	-	Employees have a better understanding of the organization's culture
9. Team members satisfaction	Personal fulfillment & satisfaction	-	-

Table 3.6: How reverse mentoring can possibly affect some of the main construction project team effectiveness factors based on literature

Of course, it should be mentioned here, that the identified link between reverse mentoring and construction project team effectiveness, may not hold true, if we think of the differences between a disciplinary and a project society (Jensen et al. 2016) and therefore the specific characteristics that go along with the project teams in construction domain (Tyssen et al. 2013). This is also why the link is characterized as tentative. However, the fact that many studies consider the reverse mentoring model as a Leader Member Exchange tool, which is a form of leadership that can have a role in project context (Tyssen et al. 2013), with role reversal (Murphy 2012), it makes us optimistic that the model might be applicable at project settings and that at least some of the above outcomes would also hold true for project teams within construction.

4 Methodology

Chapter 4 starts with presenting the overall research strategy followed for answering our main research question. However, the main focus of this chapter is on the methods and validity components of our research design, trying to present the reasons why specific data gathering and analysis methods were used and what actions were taken in order to prevent or minimize possible validity threats during the operational phase of our project, making our final findings believable.

4.1 Qualitative Research Design

Based on previous studies and the researcher's best knowledge, reverse mentoring has never been examined within the project context. However, as it has already been described in previous chapters, there are reasons to believe that its possible application within construction projects can contribute positively to the overall project team effectiveness. Therefore, according to Stebbins 2001, when a process, activity or situation has received little scientific attention, then exploration and thus qualitative research is the most suitable methodological approach, in order to capture possible new ideas for the researched topic. However, this requires an overall strategy which promotes flexibility and open mindedness towards the examined data (Stebbins 2001). This is the reason why the performed strategy for the present qualitative research was based on Maxwell's suggestion of adopting an interactive process, enabling multiple circles between the different components of the study, meaning the project goals, the theoretical framework, the research questions, the methods as well as the study's validity (see figure 4.1). As it is explained in his book, linear models are not suitable, since they attempt to predefine from the study's outset all the above-mentioned components. Adversely, qualitative studies demand reconsideration and continuous modification of their components in response to new learning or to possible components' changes. That also applies to the research questions component, since they are not fixed from the study's initiation, but can be significantly modified and informed during the course of the project. Therefore, an interconnection and interaction between the different components of the study should exist, meaning that the activities of data collection and analysis, theory development and modification, research questions' formation and reconsideration, validity threats address and management should take place simultaneously with the one informing the others.

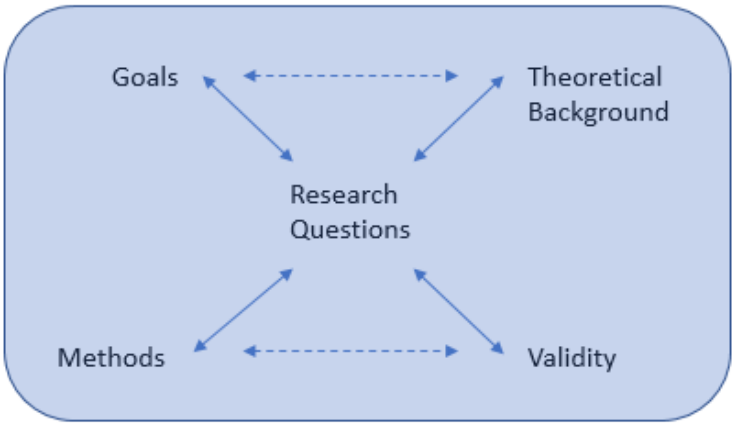

Figure 4.1: Qualitative research design of the present study based on Maxwell's suggestion

The upper triangular of the above figure, which includes the goals, the theoretical framework and the research questions, was tentatively structured in the beginning of the present study, with the latter component, the research questions, acting as the link to the bottom, more operational, triangular. However, it is worth noting that as the research was progressing moving to the operational phase of our study, the upper triangular had to be reconsidered and modified again. The final version of it has already been described in chapters 1, 2 and 3. In this chapter, our focus is shifted on the bottom triangular and specifically, on the applied methods for answering the research questions and the actions taken for dealing with the possible validity threats.

4.1.1 Methods for Data Gathering

The applied data gathering methods for answering the research sub questions 3, 4 & 5 are going to be presented in this section. The data were gathered by performing interviews, with observation not being possible, since the present study was not conducted in collaboration with a construction company that could possibly give access to the daily routine of construction project teams. Adversely, interviews gave us the opportunity to collect possible reverse mentoring experiences from the team leaders and the team members perspective. However, in order to gather the appropriate data for analysis we had to take important decisions not only about the interview process but for the sampling method and strategy as well. The reasons behind each decision as well as the way they were implemented in practice are going to be described in the next paragraphs.

4.1.1.1 Semi-structured Interviews

Semi-structured interviews were used as a method for collecting the interviewees' life experiences and viewpoints about reverse mentoring. They usually have a sequence of themes to be covered and some suggested questions while at the same time they enable the interviewer to be open to changes regarding the questions' sequence and formation, in order to follow up the stories told by the interviewees (Stebbins 2001, Brinkmann & Kvale 2018). Therefore, the flexibility that semi-structured interviews offer was the key reason for being used in the present study, since they gave to the researcher the opportunity to adopt a more spontaneous procedure, based on his active listening and thus his follow up questions, for capturing new insights of reverse mentoring within the project context, while at the same time the already suggested topics for discussion offered some valuable guidance in focusing on topics of greatest interest.

Specifically, fifteen face to face semi-structured interviews were conducted with project team leaders (e.g. construction managers, design managers etc.) and members (e.g. structural engineers, MEP engineers, geotechnical engineers etc.), in order to gain insight into the exploration of reverse mentoring practice in construction projects. Three of them were held in person and the rest online using Microsoft Teams, with both alternatives enabling us to observe the face expressions and the body language of interviewees during their answers, contributing positively to

the data interpretation (Verschuren et al., 2010). Regarding the interview questions of the semi-structured interview guide, they tried to be easy and understandable, without making use of academic language and jargon. It was attempted to adopt a roundabout interview process approach, as Brinkmann & Kvale 2018 mention in their book, where the interviewer tries to pose indirect questions and reveals the purpose of his study only at the end of the interview. The semi-structured interview guide for both project team leaders and project team members is presented in Appendices A and B respectively.

4.1.1.2 Selection Requirements of Possible Interviewees

As it is going to be explained below, the participants of the present study had to comply with four different selection requirements. The fact that the current study attempts to examine the reverse mentoring concept within the project context in construction, prompted us to select participants who were at that time actively involved in either building or infrastructure projects. Reminding here also that the present work examines reverse mentoring on the basis of a power difference relationship between the employees in construction projects, led us to our second requirement, demanding to be interviewed both team leaders and team members of construction project teams, without having any specific consideration about the participants' age (young-old) and position (senior-medior-junior). Thus, a team member could be older than the team leader or a team member could either hold a junior or medior or senior position. Another major selection requirement for participants was related to companies' and projects' variety. As Maxwell's research explains, in interview studies there is always the risk of "key informants bias", meaning that the interviewees' views may not be the typical ones of the examined group. In order to deal with that validity threat, which is going to be described also in paragraph 4.1.3, we applied variety in terms of finding project team leaders and members who belonged to different well-established design and construction companies and worked on different building or infrastructure projects. Our final requirement is related to the companies' origin. It was demanded that approximately half of the interviewees to come from companies located in Greece and half of them from the Netherlands. The reason behind this decision was twofold. First, because of the fact that the study was not funded and run within the tight timeframe of a Master's program, it was expected that the researcher would save significant time by exploiting his connections with companies from his home country in order to find a considerable number of interviewees. Secondly, it was also believed that it would be very interesting to explore if there are any worth noting differences between the reverse mentoring findings of construction project teams in Greece and those in the Netherlands, since those two countries are two completely opposite cultural societies according to Hofstede et al. 's research.

Specifically, Hofstede et al. 2005 define culture as the totality of one's life experiences, that come from the social environment someone grew up in the past years of his life and determine patterns like thinking, feeling and acting. Therefore, in order to understand both team leaders and team members, it would be crucial first to understand the national societies they are part of. Specifically, Hofstede et al.'s research, categorizes national societies on the basis of four different cultural dimensions, those of "power distance (from small to large), collectivism versus individualism, femininity versus masculinity, and uncertainty avoidance (from weak to strong)" (Hofstede et al. 2005, page 31). What is interesting to highlight here, is that Greece's and the Netherlands' scores on each cultural dimension are completely opposite. For instance, the Netherlands scores low in power distance index (PDI=38), meaning that subordinates are not too much dependent on their bosses while they can easily approach and contradict them, high in individualism index (IDV=80), meaning that employees strive for independence from their organization, low in masculinity index (MAS=14), meaning that both men and women are more concerned with their life quality instead of the men's priority towards material success observed in masculine societies and low in uncertainty avoidance index (UAI=53), meaning that Dutch people can easily deal with possible ambiguous or unknown situations. Adversely, Greece is a completely opposite culturally society compared to the Netherlands, scoring high in power distance index (PDI=60), low in individualism index (IDV=35), relatively high in masculinity index (MAS=57) and high in uncertainty avoidance index (UAI=112).

In the next table, the above-mentioned selection requirements of possible interviewees, are summed up.

Selection Requirements	Reason
1. Interviewees should be actively involved in construction projects.	Reverse mentoring concept is examined within the construction project context.
2. Approximately, half of the interviewees should be team leaders (Project Managers/Project Leads) and half of them should be team members (Engineers).	We aim to capture a complete picture of reverse mentoring on the basis of the power difference between the members of the project team.
3. From the same project select at least one team leader and one team member and at maximum two team leaders and two team members.	Apply variety in terms of finding interviewees who participate in different construction projects, in order to avoid key informants bias.
4. Approximately, half of the overall interviewees should come from well-established construction companies located in the Netherlands and half of them, from respective companies located in Greece.	- We aim to save as much time as possible in the selection process by taking advantage of the researcher's connections with Greek companies. - It is interesting to explore reverse mentoring within construction project teams of two opposite cultural countries according to Hofstede's research.

Table 4.1: Interviewees' selection requirements & why

4.1.1.3 Sampling Method & Strategy

Having established the appropriate selection requirements, the next step was to apply purposive sampling for finding the needed participants. Although, purposive sampling does not capture representativeness, it enables you to find people who are able to provide you with the appropriate information since they are either experts in their field or privileged witnesses to an event (Maxwell 2012), while you can stop finding new participants if the last conducted interviews have not added new ideas to the existing data (Stebbins 2001). Therefore, in the present work, the project team leaders can be perceived as experts in their field while both team leaders and members can be seen as privileged witnesses of the actual situation within projects, helping us to capture an as complete as possible picture of the reverse mentoring practice in construction projects. Another advantage of adopting purposive sampling for finding the needed interviewees, was to capture heterogeneity of the examined population, by ensuring the interviewees' representation from both the construction but also the design phase of projects as well as the women's representation as both team leaders and team members.

Specifically, the purposive sampling strategy was applied by sending first emails to well-known construction companies, located in the Netherlands, like BAM, Heijmans etc., including the reason for contact, the master thesis' purpose, the interviewees' selection requirements, the interview process and duration (1-hr interviews) as well as the offered payment (50 euros per interview) in line with Maxwell's suggestion, in order to increase possible participants motivation for accepting our invitation. However, this impersonal strategy did not work well, leading us to the attempt of taking a greater action. Since the covid-19 restrictions were over in June 2022, with the companies' offices being open again, the researcher approached in person many different companies in the Netherlands and Greece, making known his desires orally. Although it was a stressful, effort and time-consuming process, it finally paid off by finding fifteen participants. That process was taking place in parallel with the conduct of the actual interviews, stopping in fifteen participants, since the last two interviews contributed little new knowledge to our analysis (Stebbins 2001, Brinkmann & Kvale 2018). It is also worth mentioning that the vast majority of the interviewees did not accept the offered payment, but instead they happily volunteered to devote 1-hr of their time to have a discussion with us and therefore share their own experiences and thoughts about reverse mentoring in construction projects.

4.1.1.3.1 Interviewees Description

In the present study, the total number of participants who participated in our research as interviewees were fifteen. Looking at tables 4.2 & 4.3, it can be easily understood that seven of those were team leaders and the rest team members, while they were all actively involved in either an ongoing large building project (e.g. 5-Star Hotel & Restaurant Project in Athens) or an ongoing large infrastructure project (e.g. Oosterweel Project in Belgium). In general, the fifteen interviewees correspond to six different construction projects, while two of them are women (TL3 & TM1). It should also be mentioned that it has been used the term "design" manager or engineer for interviewees who participate in the design phase of projects and "construction" manager or engineer for those who participate in the projects' construction phase. However, two participants, TL2 and TM3, are getting involved in both projects' phases, since they are acting as high performing teams' trainers, attempting to increase effectiveness of either a design or a construction project team.

Focusing specifically on the team leaders' table, it can be observed that three participants belong to Dutch construction companies while four participants to respective Greek ones. In terms of their role within their project team, three of them are design managers, three construction managers and one high performing teams' trainer.

Team Leaders	Role	Years of Experience	Company	Construction Project
TL1	Design Manager	25	Royal Haskoning DHV	Oosterweel Project in Antwerp, Belgium
TL2	High Performing Teams Trainer	26	Count & Cooper	Vinex Project in Rotterdam, the Netherlands
TL3	Design Manager	26	ABT	Theater & Library Project in Utrecht, the Netherlands
TL4	Construction Manager	24	GEK TERNA	5-Star Hotel & Restaurant Project in Glyfada, Athens
TL5	Construction Manager	18	GEK TERNA	Integrated Casino Resort Project in Limassol, Cyprus
TL6	Construction Manager	31	GEK TERNA	5-Star Hotel & Restaurant Project in Glyfada, Athens
TL7	Design Manager	25	DENCO Structural P.C.	Subway Construction in Athens

Table 4.2: Characteristics of team leaders' interviewees

More or less, the same characteristics apply for the eight team members' participants, since half of them are coming from Dutch construction companies and the rest from Greek ones, while four of them are design engineers, three construction engineers and one of them is a high performing teams' consultant.

Team Members	Role	Years of Experience	Company	Construction Project
TM1	Design Engineer	4.5	Royal Haskoning DHV	Oosterweel Project in Antwerp, Belgium
TM2	Design Engineer	5	Royal Haskoning DHV	Oosterweel Project in Antwerp, Belgium
TM3	High Performing Teams Consultant	5	Count & Cooper	Vinex Project in Rotterdam, the Netherlands
TM4	Design Engineer	3	ABT	Theater & Library Project in Utrecht, the Netherlands
TM5	Construction Engineer	20	GEK TERNA	Integrated Casino Resort Project in Limassol, Cyprus
TM6	Construction Engineer	28	GEK TERNA	5-Star Hotel & Restaurant Project in Glyfada, Athens
TM7	Construction Engineer	16	GEK TERNA	Integrated Casino Resort Project in Limassol, Cyprus
TM8	Design Engineer	4	DENCO Structural P.C.	Subway Construction in Athens

Table 4.3: Characteristics of team members' interviewees

It is worth noting here that when reporting the interview results in the next chapter, the interviewees' quotes are rendered in orange for the Dutch participants and in blue for the Greek counterparts, while all are referred to as men for readers' convenience.

4.1.2 Methods for Data Analysis

In general, the data analysis started before all the conducted interviews were completed, but not after the first performed interview. Ideally, after the completion of the first interview, the analysis should have started in line with Maxwell's advice on collecting data and analyzing them simultaneously. However, this was not possible, since in the beginning of the interviews process, many of them were conducted within a short time period, while at the same time we were continuously searching for new interviewees. Just to give an overview, within nine days, from 13/07/2022 to 22/07/2022, six interviews were performed with three of them being held online and the rest in person, requiring a 4-hrs travel by car from the researcher's village in Greece, Xirolivado of Amfilochia, to the project's construction site in Glyfada, Athens. Considering also the fact that the transcription process of each interview was taking approximately eight hours, the overall effort for conducting the interviews and transcribing them was too much, preventing the researcher from immediately starting a detailed interview analysis. During that period, the applied strategy for being informed of possible new reverse mentoring insights in construction projects and interesting points of participants that could lead to the exploration of new eras during the subsequent interviews, was to keep notes immediately after the interviews' completion as well as during their transcription process.

The actual data analysis process started after the completion of the 11th interview. It was performed by making use solely of Microsoft Word. With the first look at our main research question the researcher's feeling was that it was calling for adopting categorizing strategies for data analysis, in order to find the similarities and differences of interviewees' thoughts about the possible positive effect of reverse mentoring on team effectiveness during construction projects and how such a process could be implemented successfully. Therefore, during the first phase of data analysis, the most common categorizing strategy across literature, coding, was used (Maxwell 2012). Specifically, the researcher started reading and open coding each interview line by line. Although, it had already been identified through literature the basic steps of reverse mentoring at firm's level (see table 2.1) as well as the possible link between reverse mentoring at firm's level and construction project team effectiveness (see tables 3.5 & 3.6), it was attempted to inductively code the data, in order to capture also new insights. After line by line coding was finished, it was attempted to make the codes as consistent as possible across the whole text, meaning that the codes which were describing the same thing with different words, were assigned finally with the same code. The final step involved the categorization process of the developed codes into themes. It was that time where the researcher was consulting in parallel the related literature and theory with the developed codes, in order to place the latter into themes. It is worth noting that during this process, if it was realized that a code or a theme had already been identified in literature with a different name, the final code or theme was assigned with the name found in literature.

While the researcher was proceeding with that 3-step categorizing analysis across the interviews' transcripts, at some point it was realized that the data were much more complex and richer than the over simplistic matrices that had already been developed, ignoring the actual relationships of the explored things. In order to deal with that problem, and after realizing that within the interview transcripts there were many detailed reverse mentoring stories of the interviewees' experiences, the researcher passed into the second phase of data analysis, shifting his focus on analyzing those narratives as a whole. This is what Maxwell 2012 calls as a connecting strategy for data analysis. That enabled us to understand the data in context, looking for relationships between the different parts of the transcripts in order to connect statements and events into a coherent whole. Therefore, during the second phase of the analysis the researcher tried to create narrative summaries of the interviewees' informal experiences with reverse mentoring practice in construction projects. Those narratives seek to capture the reverse mentoring experiences of the interviewees, including both their antecedents, meaning what led to a successful reverse mentoring relationship or to a failed one, and their consequences, meaning what were the communicated results on a personal and project team level. The term "summaries" is used, since although there have been included extensive quotes from the data, the researcher often involved a reorganization of the data in order to achieve a concise and coherent narrative about the reverse mentoring stories heard (see Chapter 5, paragraphs 5.1.1.1-5.1.1.4).

In the final phase of the analysis, the results of the categorizing and connecting strategies had to be integrated. By holding the constructed narrative stories of reverse mentoring against the developed matrices, enabled us to gain a deeper understanding of the data, making for instance the distinction between experience-based and perception-based benefits of reverse mentoring in construction projects (see Appendix C or Chapter 5, paragraphs 5.1.1.6 & 5.2.2), or forming relationships between the actions and behaviors of participants during the reverse mentoring process and the concept's end result (see chapter 5, paragraph 5.1.2). All in all, it can be supported that the analysis of the interview transcripts ended up as an iterative process, going back and forth into the interviews transcripts and moving from categorizing to connecting strategies and the other way around. This is graphically represented in the next figure.

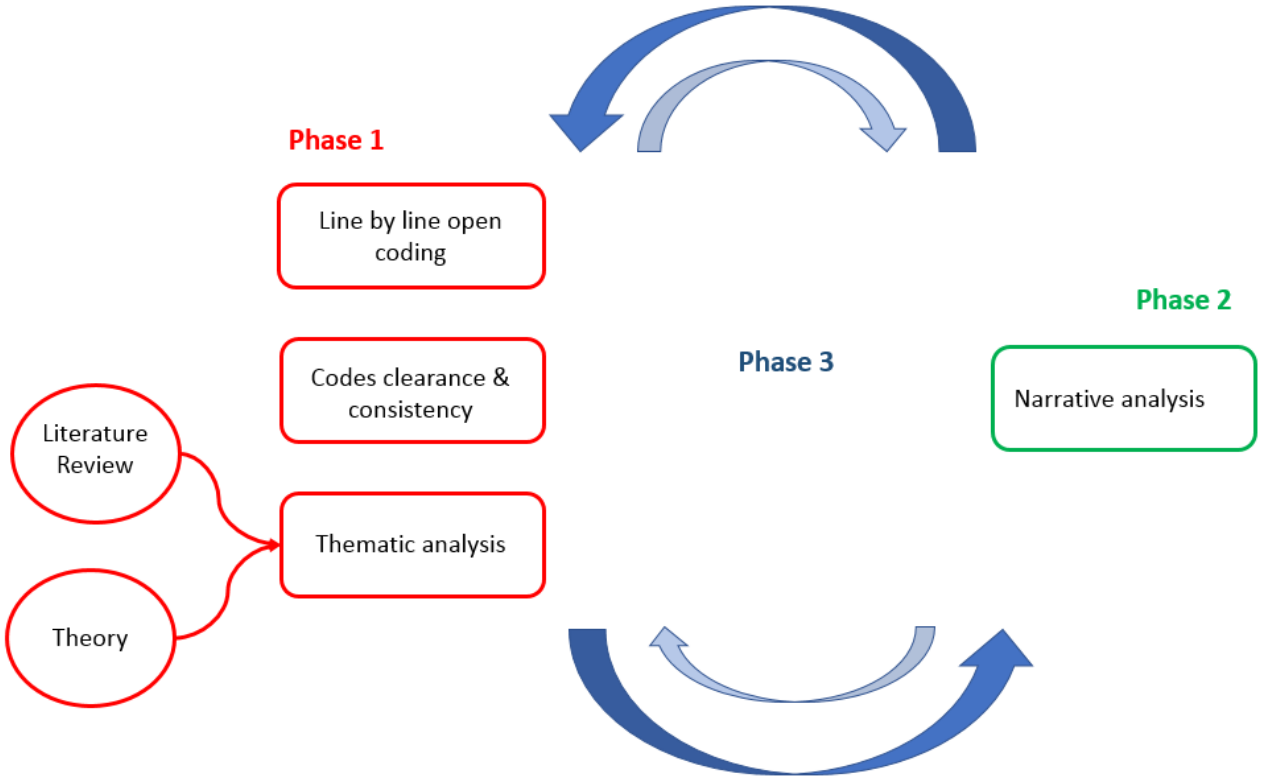

Figure 4.2: Sequence of methods used for data analysis in the present study

4.1.3 Dealing with Possible Validity Threats

With the term validity it is meant the credibility of any description, explanation, interpretation or conclusion (Maxwell 2012). Qualitative studies do not attempt to capture generalizability, since most of them, including the present one, are based on a small number of participants by making use of purposive sampling for selecting them. However, it is important to emphasize on the way it was attempted to minimize possible validity threats during the operational part of our study and therefore, the reasons why it is believed that the findings are useful and believable.

As it can be easily understood from the previous paragraphs of the current chapter, the key instrument for conducting the present study, as most of the qualitative studies, is the researcher, involving to every part of the project and thus being responsible for finding the appropriate participants, on the basis of the before mentioned requirements, performing the interviews as well as interpreting and analyzing the data. Therefore, the researcher's bias over the final results might be unavoidable, but it is useful to make aware of how the researcher's profile and actions influenced them.

Starting with the selection process of the interviewees, there was a visible threat of selecting participants that the researcher of the study, had already established a close relationship with them as friends, making the selection process easier but the actual interview process riskier, either by increasing the chance of interviews' importance misinterpretation between the interviewer and the interviewee (Maxwell 2012) or by increasing the interviewer's influence over the interviewees. Adversely, the interviewees selection was made by each company separately and independently on the basis of the selection requirements that were communicated to them beforehand. Therefore, the relationship between the researcher, and each interviewee can be described as a professional partnership for capturing the former's experiences and points of views. At this point, it should be also mentioned that the data triangulation strategy was applied, in order to reduce systematic bias from the interviewees' perspective, the so-called "key informants bias". Therefore, the analyzed data, collected at different times by interviewing people who matched

the selection requirements but belonged to different well-established companies in the Netherlands and Greece and participated in either the design or the construction phase of different ongoing construction projects.

As far as the actual interview process is concerned, the fact that the researcher had not any previous experience with qualitative research and the conduct of interviews, since he is holding an engineering background, increased the risk of acting during the interview process as an engineer, asking direct questions and waiting for direct answers. This could have a negative impact, resulting in a very structured interview process with comparable but poor data (Brinkmann & Kvale 2018). In order to deal with this threat, the researcher's supervisors were continuously urging him, to act during the interviews as a traveler whose goal is to follow the journey of the interviewee and thus all the twist and turns and all the surprising events in general, offering richer data (Brinkmann & Kvale 2018). Although it was difficult for him in the beginning to deliver his role sufficiently, tending sometimes to act as a miner, while the interviews were progressing it is believed that he reached a sufficient level. This is substantiated by the fact that some interviewees enjoyed their interviews, recognizing his active listening and his traveler interview approach, while the end result of the detailed interview transcripts, offered rich data for answering our research questions and finding new insights of reverse mentoring compared to the existing literature. Here it should be highlighted that one on one interviews were qualified, since it was believed that not only would they be better manageable by a researcher who is not experienced with conducting interviews, but they could also offer a safer environment, especially for team members, to express themselves freely without their leader's presence.

During the data analysis, there was a chance of misinterpreting the interviewees' words. In order to deal with this threat a series of actions were taken. First of all, the data analysis of each interview started after the interview transcripts were verified by the respective participants, ensuring the transcripts' correctness. Moreover, it is worth noting that every time it was realized, during the data analysis process, that the researcher acted more like an engineer than a social science researcher during the interviews, asking direct, leading questions to the interviewees, then, the corresponding answers were excluded from the overall analysis. Another applied strategy, which contributed to the credible interpretation of the data was to continuously examine both supporting and discrepant data, compared to the existing literature. Therefore, in chapter 5, the results and discussion chapter, the discrepant findings are reported and highlighted as well, allowing readers to evaluate them and draw their own conclusions. For instance, in paragraph 5.2, which describes the implementation steps of reverse mentoring in construction projects according to the interviewees' perceptions, all the identified actions and decisions on each step are presented, no matter if the one might reject the other and therefore are left upon the reader's judgment. What is further done in order to enable the readers to draw their own conclusions, is to provide the reason behind each opinion put forward by the interviewees and also denote the times each opinion appeared during the interviews, so that the reader knows its strength. A detailed table about the recognized possible validity threats as well as the respective remedies are presented below.

Project's Operational Phase	Possible Validity Threats	Remedies
Selection Process	1. Researcher's bias over the interviewees' selection	- The interviewees selection was made by each company separately on the basis of the previously presented selection requirements
	2. Key informants bias	- Data triangulation
Actual Interviews	3. Researcher's background & inexperience might lead to poor data	- A semi-structured interview guide was used – The researcher tried to adopt, as much as possible, the traveler's interview approach
	4. Team members might be more hesitant to talk about their experiences with their team leaders	- One on one interviews were used

Data Analysis	5. Data misinterpretation	- Interview transcripts were verified by the participants - Interviewees' answers that came from direct leading questions, were excluded from the analysis - Continuous examination of both supporting & discrepant data - The results of the data analysis process were reported by making use as much as possible the interviewees words

Table 4.4: Dealing with possible validity threats during the operational phase of the project

4.2 Key Take-aways of Previous Chapters

In order to tackle our main research question, a qualitative study was conducted, by adopting an interactive approach according to Maxwell's suggestion which enables multiple circles between the five interdependent components of the study (see figure 4.3). Before moving on to the results' chapter, it is worth reminding the key content of each component presented in the previous chapters, by indicating the final design map of the present work.

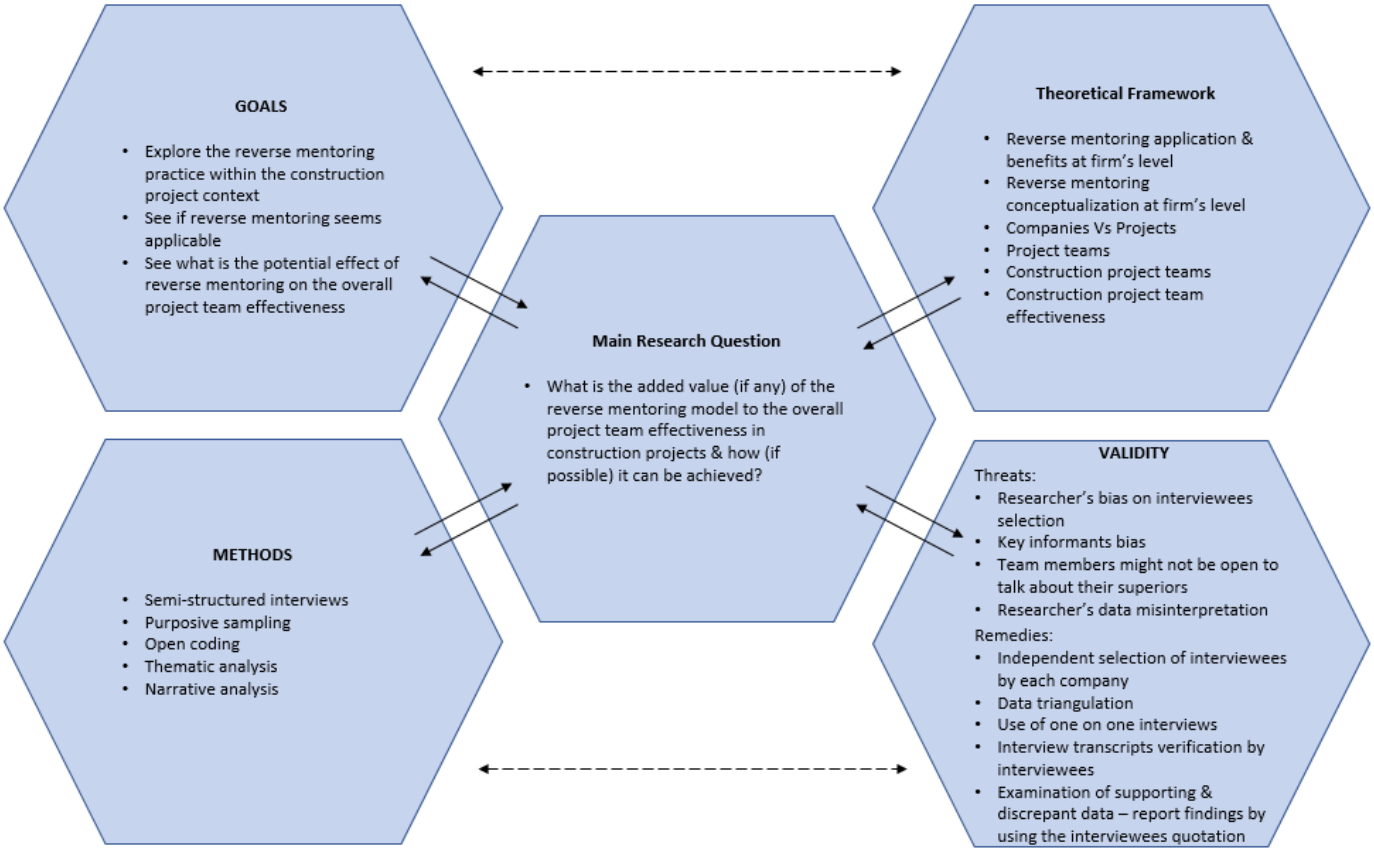

Figure 4.3: Final design map of the present study

5 Results & Discussion

In this chapter we are going to present the results of the conducted interviews and their juxtaposition to the previously presented literature findings during the discussion parts. At first, the informal reverse mentoring interactions within construction projects are described, along with their identified benefits and their related enablers that lead to a successful interaction. Then, the possible way of formalizing the concept in construction projects is described according to the interviewees point of view, while finally the link between reverse mentoring benefits and construction project team effectiveness is established.

Here, it should also be mentioned explicitly that during the structure of this chapter we were very careful of not including the interviewees' thoughts and experiences, regarding the below presented issues in each paragraph, that took place at a firm's level. For instance, the TL3 shared his experience about a mentoring program that ran within his company and resulted sometimes in the reverse process with the younger employees eventually learning the most experienced employees and therefore gaining visibility within the organization. Explicitly he mentioned that *"we thought that mentoring is also for the young people to help the experienced people, but finally it contributed much more than it was expected to the experienced ones, teaching them that they have to take young people with them and not act alone."* Therefore, such kinds of experiences have not been taken into account in the next sections, since they are not within the context of construction projects.

5.1 Informal Reverse Mentoring Interactions in Construction Projects

In this paragraph the informal interactions of the participants with reverse mentoring are presented. The term "informal interactions" has been used since, as it was expected, reverse mentoring has never been implemented within a construction project team formally. The only recognized formal processes are those of team meetings, *"meaning the meetings that take place between the team or the different teams of the project led by a leader"*, trying to keep track on "*the progress of the tasks assigned to the team members*" (TL5). Usually, those *"meetings are held on a daily basis depending on the topic of the project, in which usually 2-5 people participate, depending on the people involved from my team. Once a week there is also a more general meeting in which more people participate, both juniors and seniors"* (TL6). More or less, same processes with the same purposes are held by team leaders from the Netherlands, like the weekly stand, which is a weekly half an hour to one-hour team meeting with the team leader having the opportunity to ask three questions, every team member; *"what have you done the last week, what are you going to do the next week, and who do you need in order to do the planned actions for the next week?"* (TL1). Although such kinds of processes are far away from reverse mentoring, informal reverse mentoring interactions do exist. Specifically, in the next parts of the current section, the success stories of informal reverse mentoring interactions are going to be presented with their related communicated results. By taking also into account those success stories but the failed attempts as well, the informal reverse mentoring interaction enablers will be presented. These enablers have a twofold meaning since they can be translated into barriers if the opposite action or behavior appears.

5.1.1 Success Stories

From the total fifteen interviews conducted with team leaders and team members, who participate in different building and infrastructure projects in the Netherlands and Greece, twelve different successful informal reverse mentoring interactions were identified. All the interactions were taken place between a team member (either an engineer or even a skilled technician) and a team leader while the substance of the interactions majority is related to technology-based creativity & innovation with the technology being used as a mean for doing things differently and therefore reaching a faster result on technical problems or facilitating the everyday working life on procedural issues. The second most frequently appeared topic of reverse mentoring interactions is related to conflict management between the team leader and the team members as well as the decision-making of a proposed technical solution, while the latter concerns the adaption of a different leadership style by the team leader.

The substance of the informal reverse mentoring interactions as well as the times that each one of them appeared in the interviews and by whom is presented in the next table.

Substance of Successful Informal Reverse Mentoring Interactions	How Many Times Appeared	Who Mentioned What
1. Technology-based Creativity & Innovation	(4)	TM2, TM3, TM8
2. Conflict Management	(3)	TL1, TM1, TM3
3. Decision Making on Corrective Actions & Technical Solutions	(3)	TL4, TL5
4. Leadership Style Alternation	(2)	TL1, TL2

Table 5.1: Successful revere mentoring interactions presented in the interviews

The detailed interviewees' success stories of informal reverse mentoring interactions within construction projects are indicated below and grouped according to their substance.

5.1.1.1 Technology-based Creativity & Innovation

As it has already been mentioned, the digital turn reverse mentoring interactions are related to either the adoption of smarter technical solutions or the adoption of more effective procedural stuff. For example, the TM2 admits that *"I am a guy who does not like doing things inefficiently. So, when I was doing my design work on my previous project, I was thinking; ok this can be done smarter and faster. Thus, I did some automation with python, but the guy who was my supervisor back then, he was not really a fan of it. Since he didn't really like it, he told me; I do not think you should do that. But I was kind of stubborn, so I did it anyway."* He further explains how he approached his superior in order to convince him about his idea; *"he was skeptical, so I needed to think of something in order to take him along with me and how things went. So, I made it in a way to make it easy for him to follow and check the results. In other words, I wanted him to be comfortable with the results, so that he knew that everything was fine. Therefore, I really took him along in the process, showing him for example that the result from the program I wrote matches with the actual result that the calculations gave. I really took him by the hand to show him that it is something he can trust."* As for the final result he continues saying that; *"eventually, he was really happy with the results. I think that I changed his mind about it. So, I think he is kind of open to doing things automated and doing it with the script. At the beginning he was really skeptical, but later on he came to me and asked me for a different problem if I could maybe write a little script for him so that we can do it faster."* A very similar experience was also communicated by the TM8. As he explains, it was very time and effort consuming without any success to transfer the data manually from the one software to the other in

order to conduct the needed dynamic analysis, so he tried to do it automatically, although his manager did not agree with that. Specifically, he shares that *"I tried to see what the problem was and then I sat down and made some MATLAB code, making my own procedure, so that through MATLAB the loads could be read from the second program. I understood that the problem was on how the program reads the load on each linear element. I can say that for some period of time, because my manager was gone, I worked more comfortably and freely, advancing this process a lot, as she didn't have the opportunity to stop me. And I say this because the moment she came back, she said to me, "whatever you're doing stop now! We have these issues in the project, so you have to do these things." So, I stopped messing around and we did the procedure she suggested, with the masses I explained to you earlier. Of course, we reached a dead end, because in the end we had two models that we tried to theoretically make the same manually, but pressing the analysis button for the same data we had different reactions to the elements. So different moment reactions, different axial reactions etc. And then another guy jumped in and said? "isn't there some way to transfer loads from one program to the other?" That's when I said that this particular thing is something I've been trying for the whole previous period and I almost have it ready. And then my manager agreed that it might be worth seeing what I've done. So, after two weeks of trying with no results and bad attitudes towards me, we saw that my tool works well with negligible deviations."* What he also feels about his created tool, is that, not only did it have a real impact on that specific project but also to the future ones, since he characteristically mentions that *"the tool I made for them freed their hands, since they then used it in all the next projects."*

The same interviewee shared another informal reverse mentoring interaction, related to the adoption of procedural stuff by the team leader and therefore by the whole project team. As he explains *"within the company we have tools which are in excel. One of them was given to me during a project we did, so I modified it in terms of the input and the output. So, I inspired my leader and he changed his tool too, as did the whole team working on this project as well. So, I can only think of such little things, like ideas that might make everyday life a little bit easier and help the supervisors to make them do something different."* A similar story about procedural issues but with the focus on team leader's work structure is coming from TM3. As he explains he advised his team leader *"on how to structure his work, on how to deal with balance, since he was getting a lot of questions from people who weren't stuck in his agenda, so I told him how to do agenda management, google calendar management so that he doesn't get overtasked."*

5.1.1.2 Conflict Management

Informal reverse mentoring interactions are also taking place based on conflict management advice by the team members to team leaders with both recognizing it. The TM1 describes a situation where *"the design manager, the superior, told someone about some design issues, related to the water level which was supposed to change but it might not be supposed to change, but he did not tell the whole team and finally it became like a mess. Because it was like a secret but it was not really a secret and in the end everyone knew of course. But then the person who I was supervising came to me asking me what the hell was going on. I tried to calm him down, telling him, do not worry, it might change but we have not tried it officially, so it is just going to continue the way we do. So, I was trying to put out the fire which was not even there. Then I went to my supervisor, telling him that this is not the way it should go, you should be open in your communication and just be really clear. Therefore, he should have said to the whole team that there might be some changes but now they do not affect the design and just continue the way you are doing it. Otherwise you have people on edge. And he took that very well. He already admitted himself that he made some mistakes and even apologized for putting more work on my shoulders because he did not do his job right. However, the most important thing is that we never experienced such a situation again."* Almost the same experience comes into play by TM3, who refers to his superior saying that *"he didn't understand sometimes why conflict happened around him and I explained that to him. So, this happens because of the way you are communicating things."* The TM3 therefore admits that not only did the interaction benefit his superior to deal with conflicts but himself as well; *"he became far more effective in meetings. Also, he gave that back to me, so we had long beach walks together and elaborated hours about situations and what could be. So, it helped us both I would say. One of my skills I improved was not being very rigid and taking more time, letting first others speak and understanding others."* About more or less the same issues but from the opposite perspective, that team leaders' side, we have the TL1's experience. In his current project there was initially a problem with the former project manager, since the project was off track and therefore, he was called to replace him.

As he says during the first days, he understood that there was a lot of distrust and conflicts within his team. So, one of the things that helped him deal with that situation was the one on one interaction with his team members; *"I started talking to all the team members because I've heard some things and of course I had to do some discussions because on a personal level, there was a lot of disruption, mostly between the former project manager and the team members. There were conflicts since things didn't go as they were expected and then things escalated on a personal level. So, I started to have one on one sessions, with all the team members separately. So, I would like them to tell me what they were thinking and I chose that way of doing it because I think that people tend to talk more if they are one on one. I was also telling them; trust me, you can share with me whatever you want, since everything discussed here will stay between you and me. If you don't want to make known what you are going to say outside, be sure that it will not happen, so tell me what is bothering you and maybe I can help you to avoid something or even make it better. So, this is what was happening in the beginning and I should assure people that I could help them with their concerns. I think that it really helped to get everybody in the right direction."* However, that interaction did not help him only to put everyone in the right direction but it also helped him to learn how to manage conflicts. He explicitly adds that *"If someone is sort of attacking you, don't go into the counter attack, but sort of catch the attack and bend a little backwards and then move forward. I mean not literally but with words and the actions you do. That's what I have learnt from them. That is what always helps you in your communication."*

5.1.1.3 Decision Making on Corrective Actions & Technical Solutions

What is observed here is that sometimes, although some decisions have already been made by the project managers about a technical solution or the planning of works, during the implementation phase if the team members experience any malfunction or think of a better technical solution, they might take the initiative to approach their superior and share their advice. So, the TL4 shares a typical day for him on the construction site, saying that *"I might be out in construction and find something and say we're going to do it this way, someone else has suggested a different way that is easier and more correct, so I adopt it. I will of course first make sure that the proposed solution does not create any other problems and thereafter adopt the other's point of view."* Two similar but more extensive success stories of reverse mentoring interactions on that topic are also coming from the TL5. In his first one he shares that he made an initial *"decision for the team to work on a roof terrace and perform some difficult MEP construction works. There were some difficulties because around 20 people had to work on the roof terrace while the civil engineering part had not advanced. In particular, it had not materialized to such an extent that it would have allowed me to move forward and be productive in the part of my own responsibility. Specifically, the problem was identified by the subordinates. Later the feedback came from a specific subordinate, telling me that here we have to change the work plan and made a specific proposal. After it was confirmed by me that something was going wrong, in terms of productivity, in other words we were not making the most of the man-power we had there, we changed our practice and the sequence of works in this particular case, so that we could make full use of our man-power somewhere else until this place comes up to the appropriate level, regarding the necessary building work that had to be implemented first, so that we can work again."* He admits that it was a crucial decision for the project, since he says that *"this may seem like something simple to you, but it was something extremely important because it involved a great effort of many people for this specific part of the work, requiring many man-hours. So, it was an important decision that I made based on the feedback that was given to me from below."* The second success story concerns the implementation of the delivered BIM shop drawings to the construction team, in a fast track, over 300 million, project. He specifically mentions that *"I gave the BIM plans to the construction team, so that they could implement them in the construction of the project. Then I received a feedback in the sense of; "yes, I don't have classes because BIM helped me on this, but no optimization has been done in the routing, because we end up making longer distances, bigger networks, since imagine that a pipe was running and we made it a circle to go to a point, because those who made the plans had no understanding of engineering, since they were draftsmen. As a result, I cannot take advantage of BIM as a tool, both for the identification of classes and for the optimization of service routes". Therefore, what I did, after receiving this feedback, is to proceed with a corrective action, adding engineers to the design team to support them and thus, improve the BIM modeling, in terms of enhancing the engineering perspective within the shop drawings."* While he continues saying that what he eventually understood is that *"BIM is necessary in complicated construction projects, in terms of the design of the application study, but with a clear presence of engineer people in the design team."*

5.1.1.4 Leadership Style Alternation

There are informal reverse mentoring interactions focusing on the leaders' necessity to apply different styles of leadership according to the project team's needs. For instance, the TL1 mentions that, when *"I started as a project manager in a team, I started reading things I was already in charge of, but a team member came to me and said; "You have to do something because at this moment you are not visible as a project manager. You have to be sort of visible as a leader." I am not that style of project manager who is going to say; "Let's go, we have to do this!" But sometimes people need to know who is in the lead, and what kind of person you are. So, he came to me and he is someone who I really trust, since when he gives feedback, he overthinks that before and he doesn't say something vague or something ridiculous. So, I really valued that and I took action to get the team together, introduce them and explain to them how I am working. So, it really helped me."* The same substance is identified in the TL2's informal reverse mentoring interaction, although it had as a starting point a misconception of the team leader's behavior by the team member; *"When I asked a lot of questions, one of my team members said; "You are asking so many questions, so I am feeling you do not trust me". Ok, I did not know that. So, I said; "No, I was just interested in you as a person and also your performance". And I asked him also; "Why does it feel so bad for you?" Then he shared a personal story about himself, telling me that he had a conflict with his parents where one of them said; "I don't trust you".* So, the team leader then understood that his team member was very sensitive to not being trusted and continued the interaction by saying; *""This is so good that you shared that with me, I really didn't know. And what are more things that you think I should do better?" And then he said; "Yeah, you are very flexible, but sometimes you can be more critical." He said something like; "You always understand but you don't have to", so you can say to me, "we just have to do it and I am not going to explain it anymore. Then, I am going to adapt, I need that! You have to give some push back, not always being the understanding people manager." Actually, in our meetings I tried to prove that and I checked it with him later. "What do you think, did I improve in this area?" He said; "Yeah, yeah. You are really doing it in a very good way. You are listening when you need to listen." From his perspective of course. And in other moments he also said; "Yeah, you can also give me know, or say solve it yourself or you can refer me to somebody else, and say contact him or her and solve it together or come up with a proposal." Normally, I wouldn't do that. I was so helpful that I wouldn't act in that way."*

5.1.1.5 Interpretation & Discussion (Answering Sub-question 3)

Taking into account the above informal reverse mentoring interactions that led to a positive result within projects and therefore the table 5.1 which summarizes them, it can be seen that the purpose of the most interactions have as a base the digital turn in construction. This result matches with the most used reverse mentoring topic across literature, which is technology (Alvarez et al. 2005). However, there is one big difference. Based on literature, reverse mentoring within companies, can be used as a tool for superiors to be taught by their subordinates, about the new technological advancements in their field (Murphy 2012). Whereas within projects, it seems to be useful as a tool for promoting creativity and innovation through new technology, since team members have the opportunity to present their technology-based ideas for doing things differently or smarter, and therefore team leaders make use of them and implement them, on the project. Therefore, at project level it does not seem useful for superiors to learn using new technology but be aware of its strengths and therefore implement the subordinates' ideas and applications.

However, just like in literature, reverse mentoring interactions exceed the technology context (Browne 2021). Based on literature and practice, many companies used the concept for addressing modern workplace issues on diversity and inclusion (Raza & Onyesoh 2020), here many informal reverse mentoring interactions targeted the respective problems that every project should deal with, like better decision making, conflicts reduction and leadership alternation according the team's needs.

Before we move on to the next parts of this section, it is worth noting that based on the interviewees' experiences, a reverse mentoring interaction and therefore a relationship ends up as a two-way street but is structured on the basis of a spontaneous process, where a problem has to be appeared first and then, either the team leader should take the initiative to approach his subordinates and ask for advice, like the TM1's example who organized one on one sessions

with all his team members etc., or most frequently the team members have to take the initiative to speak up and approach their superior, giving him their perspective, as we have seen to all of the rest examples.

5.1.1.6 Experience-based Benefits

The term "experience-based benefits" is used since they are coming from the previous presented informal reverse mentoring experiences of the interviewees. The next table indicates the positively influenced factors after taking place a successful informal reverse mentoring interaction.

Experience-based Benefits	How Many Times Appeared	Who Mentioned What
1. Creativity & Innovation	(6)	TM2, TM3, TM8
2. Conflict Solving	(3)	TL1, TM1, TM3
3. Soft Skills	(3)	TL1, TM1, TM3
4. Quality Relationships	(2)	TL2, TM3
5. Commitment	(2)	TM2, TM3
6. Decision Making	(3)	TL4, TL5
7. Leadership	(2)	TL1, TL2
8. Humility	(2)	TL1, TL2

Table 5.2: Experience-based benefits of informal reverse mentoring interactions within projects

As it can be seen from the table, there are eight different recognized factors that were positively influenced by the informal reverse mentoring interactions within projects. A detailed description on how these factors are affected as well as at what level (participants' level or team's level) is presented below on the basis of the interviewees' words:

- **Creativity & Innovation**

  Based on the digital turn informal reverse mentoring interactions, some benefits for both the team leaders and the whole project team's functionality are identified. First of all, the two experiences of TM2 and TM8 show that they helped team leaders to increase their understanding and take advantage of the new technologies' usage. This is evident by the team member's perception that; *"I think that I changed his mind about it. So, I think he is kind of open to doing things automated and doing it with the script. At the beginning he was really skeptical, but later on he came to me and asked me for a different problem if I could maybe write a little script for him so that we can do it faster."* The latter sentence also shows that the informal interaction was the reason for incorporating more the digital way of working into the project's work. The same can be concluded with the TM8's words as well; *"the tool in MATLAB I made for them freed their hands, since they then used it in all the next projects."*

  Moreover, the TM8 communicated how he contributed towards benefiting his team leader on procedural issues, alternating one of the used excel tools within a project, inspiring his team leader to do the same, with the TM3 adding that he helped his team leader by *"telling him how to do agenda management, calendar management so that he doesn't get overtasked."*

- **Conflict Solving and Soft skills**

  The TL1, after replacing the former project manager in his current project, organized, as it was described before, one on one sessions with all his team members in order to deal with their concerns since there was a lot of distrust and personal conflicts within the project team. What he admits that learnt from that process is

how to handle conflicts since he says that *"If someone is sort of attacking you, don't go into the counter attack, but sort of catch the attack and bend a little backwards and then move forward. I mean not literally but with words and the actions you do. That's what I have learnt from them (meaning their team members)."* And continues by saying; *"that is an important lesson that I almost use on a daily basis. There are always conflicts of interests, a lot of people in the project do not want exactly the same as you want, but you always have to keep your common goal in mind so that you can achieve a successful project. That is what always helps you in your communication, even if you have a conflict or something like a "preliminary conflict."* The way the things are communicated by the team leader is also what the team members think as a reason behind the conflict creation, if we emphasize on the TM1's and TM3's conflict management advice to their superiors. Specifically, the TM1 communicated to his superior that *"you should be open in your communication and just be really clear"* with the TM3 saying *"this (meaning the created conflict) happens because of the way you are communicating things"*, while both recognize the situation improvement after their informal interaction with their superiors as the former says that *"we never experienced such a situation again"*, and the latter admits that his superior *"became far more effective in meetings."* So, it can be seen that both interactions not only did they help the team leaders to better handle conflicts but also to improve their communication skills, with the TM3, recognizing that his team leader *"also gave that back to me. One of my skills I improved was not being very rigid and taking more time, letting first others speak and understanding others."*

- **Quality Relationships**

Taking into account two communicated informal reverse mentoring interactions, one from TL2 and one from TM3, it can be seen that the interaction has a positive influence on the team leader's – team member's relationship either explicitly or in terms of getting to know each other better on a personal level. The latter is evident in the TL2's experience who mentions that during the interaction process, his subordinate *"shared a personal story about himself, telling me that he had a conflict with his parents where one of them said; "I don't trust you".* Therefore, the TL2 acknowledged his team members' sensitivity of not being trusted, since he continues by saying; *"This is so good that you shared that with me, I really didn't know."* A more explicit acknowledgment that such kinds of interactions strengthen the relationship between the team member and the team leader comes from TM3's experience, who mentions that *"it builds the relationship between me and the team leader, and also between me and other superior people who asked me for advice and I gave something back."* Something which is even more evident by the fact that the TM3 says that together with his superior *"had long beach walks and elaborated hours about situations and what could be."* If a strong relationship between two people does not exist, this is not possible to happen.

- **Commitment**

TM3 talks about his feelings when his team leader asked for his advice; *"That gives a lot of gratitude and gratefulness. It starts with feeling very honored, if someone asks for your advice, and then it gives you satisfaction if he uses it and it's very nice. So, this is how I felt."* More or less the same feeling comes from TM2 when his senior Geotech and the design lead included him into the process of finding a technical solution on an unexpected demanding problem, making him feel more important and involved in the project. Specifically, he shares that; *"on my previous project where I did the foundation. We had micro piles and there was a little bit of a struggle with some demands from the people who gave us the assignment. At the end of that day, me, the senior Geotech and the design lead went to an office, sat together and we started drawing on the white board, thinking of solutions to really tackle the problem. That's really something that I liked a lot, it is something like a highlight. It was a really nice moment to just sit together with all these smart and experienced people to just tackle a problem, which we were really struggling with. It was a nice moment"*

- **Decision Making**

As we have already seen, two Greek team leaders shared their experiences, regarding the adoption of a better technical solution in construction sites or the need to proceed with corrective actions. Especially, TL4, admits that he adopted the proposed solution by a craftsman while he was on site; *"I could learn things from a construction craftsman that I may not have encountered, may not have known. And this, I would say, is often done and is very important. For example, I might be out in construction and find something and say we're going to do it this way, someone else has suggested a different way that's easier and more correct, so I adopt it."* This can also be seen by TL5's words, who admits that *"as a team leader, I have to communicate with both the engineer and the foreman and sometimes I will even get feedback from a skilled technician"*, and therefore he shared two personal experiences who received feedback from bottom, and made use of that in deciding to proceed with specific corrective actions, regarding the sequence of works in his first story and the change of the composition of the design team in his second one.

- **Leadership**

As they have already been presented in previous sections, there are two informal reverse mentoring interactions which resulted in the team leaders' adoption of a more effective leadership style, meaning that the team leaders understood the need to alternate their leadership style according to the team members' needs. In the first one the team member informed his superior, the TL1, to become more present on the project by saying; *"you have to do something because now you are not visible as a project manager."* Although he is admitting that he is *"not that style of project manager who is going to say; "Let's go, we have to do this!"*, finally he took action, by alternating his leadership style. Specifically, he mentions that *"I really valued that (meaning the subordinate's feedback) and I took action to get the team together, introduce them and explain to them how I am working. So, it really helped me."* The same goes also for the TL2, since his subordinate told him to become more assertive as a leader by saying; *"you are very flexible, but sometimes you can be more critical. You always understand but you don't have to, so you can say to me; we just have to do it and I am not going to explain it anymore. Then, I am going to adapt, I need that! You have to give some push back, not always being the understanding people manager."* The TL2, accepted the subordinates' feedback and took action, something which is evident by the fact that he asked for feedback again from the same person after a while; *"What do you think, did I improve on this area"*, with the team member responding; *"Yeah, yeah. You are really doing it in a very good way"*. Therefore, by receiving positive feedback, it means that he adopted a more effective leadership style by alternating it when it was needed, according to the team member's request.

- **Humility**

What is also very interesting about the informal leadership alternation reverse mentoring interactions is that it can be seen that both interactions helped the team leaders to understand their blind spots. What it is meant, is that during the interviews, when both participants started talking about their weaknesses, they both recognized as their main weakness the negative feedback that they had received by their team members. Specifically, the TL1, mentions *"I think that sometimes I can be more present or more assertive in the project and take more the lead. It really depends on the team. Sometimes the team might need a stronger lead, but I have to say that this is not my style but if you are a good project manager you should apply different styles of leadership"*, while the TL2, adds that *"I don't say; no, I don't help; I also do that with my kid, who is getting eleven now. I am doing things for him, like making sandwiches…I would say that doing stuff for people, listening to people is my way of showing them that I love them. But I have to realize that, it doesn't necessarily help them. Sometimes I should say, just do it yourself. First try to figure it out yourself and if it doesn't work come to me. I think that is always my pitfall."*

In the following table the experience-based benefits are further broken down into team members benefits, team leaders' benefits and project team benefits based on the above findings.

Successful Informal Reverse Mentoring Interactions			
Experience-based Benefits related to:	**Team Member's Benefits (Mentor)**	**Team Leader's Benefits (Mentee)**	**Project Team's Benefits**
1. Creativity & Innovation	-	Be benefited on procedural issues	Incorporation of the digital way of working into technical solutions
	-	Understand & take advantage of the new technologies' usage	-
2. Conflict Solving	-	Better management of conflicts	Conflicts reduction
3. Soft skills	Communication skills improvement	Communication skills improvement	-
4. Quality Relationships	-	Gain better understanding of your team member as a person	Strengthen the relationship between the team leader & the team members
5. Commitment	Feel honored	-	-
	Feel more important & involved in the project	-	-
6. Decision Making	-	Adoption of a better technical solution in construction site	-
7. Leadership	-	Adoption of a more effective leadership style	-
8. Humility	-	Understand your blind spots	-

Table 5.3: Experience-based benefits of reverse mentoring in construction projects on team's and participants' level

5.1.2 Interaction Enablers

The interaction enablers were extracted by taking into account the above success stories of informal reverse mentoring interactions within construction projects but also by considering some failed examples, which are going to be presented below. This is why the identified enablers have a two-fold meaning, since they can also be perceived as barriers if the opposite action or behavior occurs. The interaction enablers are grouped in two broad categories, those which affect the actual interaction process (Process Enablers) and those which affect the actions and the behaviors of the participants (Participants Enablers). The latter is also broken down into internal (how do they feel) and external (how do they act) factors which help the team members and the team leaders to reach a successful reverse mentoring interaction.

In the next table, the different categories of the recognized interaction enablers are presented as well as how many times they appeared in the interviews and by whom.

	Interaction Enablers	How Many Times Appeared	Who Mentioned What
1.	Process Enablers	(4)	TL1, TL4, TM3
2.	Team Leader's Internal Enablers	(21)	TL1, TL2, TL3, TL4, TL6, TM1, TM2
3.	Team Leader's External Enablers	(11)	TL1, TL2, TM1
4.	Team Member's Internal Enablers	(5)	TM1, TM2, TM3
5.	Team Member's External Enablers	(18)	TL1, TL2, TL4, TL6, TM1, TM2, TM3

Table 5.4: Reverse mentoring interaction enablers based on interviewees' success and failed stories

In the next part of this paragraph, each one of these enablers are going to be described, while the desirable actions, feelings and behaviors are going to be recognized.

- **Process Enablers**

The first identified enabler relates to the creation of a safe environment for participants to express themselves freely. This is why the TL1 chose to have one on one sessions since he thinks that *"people tend to talk more if they are one on one, since some people tend to disappear in the mass if the group is big. So, you have to talk to them one on one and often they come up with valuable things, which they do not dare or want to say at the group sessions. It might also have to do with the hierarchy within the group, since there are seniors, mediors and juniors."* Not being afraid as a team member about your position is another thing that contributes to the creation of a safe environment for participants to express themselves freely according to TL4, who adopted a better technical solution on site proposed by a craftsman. So, he admits that what contributed to that is the fact that his subordinates can *"be very direct towards me without any hesitation saying something like; "what you are doing is not right", because they know that it will not have any impact elsewhere."*

The second recognized enabler is the confidentiality assurance of the interaction substance during the process. This is exactly what the TL1 did, by saying to each one of his team members during the one on one sessions; *"trust me, you can share with me whatever you want, since everything discussed here will stay between you and me. If you don't want to make known what you are going to say outside, be sure that it will not happen, so tell me what is bothering you and maybe I can help you to avoid something or even make it better."*

Another process enabler was extracted, by taking into account one of the TM3's experiences. As he mentions, he gave some communication advice to his superior, with the latter giving *"that back to me, so we had long beach walks together and elaborated hours about situations and what could be."* Therefore, it seems wise to support that during the process interaction should be promoted as a two-way interaction between the participants, in order to achieve a deeper relationship.

- **Team leader's Internal Enablers**

Being humble is identified as the first internal enabler for team leaders to be receptive to subordinates' point of view. It seems important for them to be aware that they do not know everything. For example, TL4 admits that *"maybe another weak point is that I don't have all the knowledge for all the tasks."* Although he perceives that as a weakness for himself, it seems to be crucial for listening to craftsman point of view on site and therefore adopt a different technical solution. Such an attitude seems desirable for reverse mentoring interactions especially in construction projects since as the TL6 mentions; *"The technical part is a huge subject in which it is obviously impossible to know everything."*

As for the TL1, he believes that as a team leader *"you should have an attitude to be open to feedback even if it's negative feedback and even thank people for negative feedback, because this is going to help you since you will be able to do things differently, towards hopefully a better result."* That is something which also characterizes TL4, since he admits that *"if the other's point of view is more correct than mine, then I will adopt the other's point of view."* Therefore, being open to negative feedback as a team leader, is perceived crucial for reverse mentoring, not only by taking into account the success stories of the informal interactions but considering the failed ones as well. For instance, TM1 communicates his failed experience as follows; *"It was about a report and I said to this guy (meaning the superior) like ok maybe you can be more constructive in your feedback and then I wrote down some examples but, in the end, he said that's just how I roll. So, then I thought that the feedback session was over because it is like he said that's the way I do things. So, I tried to give the feedback but then they say it is over."* A similar experience comes also from TM2, who tried to propose a different way of reporting during the project to his team leader. He specifically mentions that; *"at the beginning of the project, I had some struggles with the project leader. He wanted to have the report in a certain way and I did not agree with him. I had a discussion and then he eventually said; ok I have been doing this for a while and we are just going to do it this way and you just have to accept that."* While he continues saying that; *"I also tried to convince him why I think my way would be better, but he never really went into a discussion. He was just like; no, I've been doing this for twenty years, just listen to me and we are going to do it this way."*

Furthermore, it seems important for team leaders to trust their subordinates in order to take their feedback for granted. This is exactly what the TL1's success informal interaction which resulted in leadership style change, shows, since the TL1 says about his team member; *"he came to me and he is someone who I really trust, since when he gives feedback, he overthinks that before and he doesn't say something vague or something ridiculous."*

The last recognized internal enabler for team leaders is being relaxed during the interaction and comes from TL2, who mentions that explicitly as follows; *"Well, something I have learnt about myself is that when I read the feedback, or listen to the feedback, I must be relaxed."*

- **Team leader's External Enablers**

Externally, what is identified by the informal reverse mentoring interactions that helps team leaders to accept the subordinates' opinions are the following actions either during or after the interaction process. According to TL2's interaction experience, the team leader should ask questions to understand the team member's point of view through examples; *"first of all I want to understand it, by asking some questions like; what do you mean by this or can you give an example where you expected something else from me. And this is actually what I asked from him."*

Another recognized external enabler based on the same team leader's experience is that it is helpful to write negative feedback down. According to him, not only does it help towards not taking negative feedback personally but it also enables tracking progress and therefore becoming motivated to improve. This is confirmed by his following words; *"if you give me feedback, I would write it down. It would help me to not take it too personally, because I would just write it down. I still wouldn't like it, but if I would write it down, you can track your progress by asking for instance the same people, after half a year; "Do you think I improved?" It would be really motivating to me, since I would like very much to hear something like; "You really improved it!" I love recognition, I love compliments!"*

Thinking also of negative feedback later, after the interaction process takes place, it seems important for team leaders to finally accept it and take action. Specifically, TL1 says that even if at first he considers the subordinate's point of view as ridiculous, *"maybe sometimes it stays in my mind and this is why I ask the same person a couple of weeks later; "did you really mean that?" or "are you still convinced that you were right at that time?" If they still are, and I value their opinion, maybe I have to think it over again."* While TL2, admits that although once, he ignored his team member's feedback, *"then I thought about it, and actually I did something with it. But it took me a few weeks because I thought it was not fair to the feedback that he gave*

me." And this is something that is recognized also by the TM1's point of view. He believes that although an interaction attempt may seem like a failure at first place, the team leader finally *"does something with it, like at the moment the discussion is over but still I think you do accomplish something later."*

The final identified external enabler for team leaders, concerns the feedback verification by the team leader, through discussion with other people too. The TL2, when he received his team member's feedback about changing his leadership style towards him, he tried to have discussions with other team members too about that topic. He admits that *"the other people also said the same; They said; "You can also be more unreasonable and use your position of power more. Just use it. Sometimes you could just say; "do it like this or hey I hold you responsible for not doing it." But I don't like to use that power. I always try to ask questions, understand etc. But they said; "No, no it sometimes takes too much time, so you maybe don't like doing it – no problem, you still have to do it.""* So, it seems important for team leaders to verify the team members point of view with the other team members opinions in order to be convinced.

- **Team Member's Internal Enablers**

Based on the communicated experiences about the informal reverse mentoring interactions by the team members and team leaders, only one internal enabler is identified for the former and this is related to how they feel about the hierarchy within the project team. Loose hierarchy, stimulates people to speak up and feel responsible. That is something that helped almost all the Dutch team members to approach their superiors and communicate their concerns, since as they indicate, they *"do not feel hierarchy"* (TM3) and they are *"not afraid of speaking up to their bosses"* (TM1). The same goes for the TM2, who is comparing the Dutch reality with what he is currently experiencing in the project in Belgium. Specifically, he says that *"people in Belgium are way more hierarchical than we are. It is quite a difference. They speak the same language but it's just a different country, so just across the border things are done differently. I was listening to people talk in Antwerp last time and they were talking about a technical issue. There were three people and they all felt they were not responsible for it, so they did not care. That's because hierarchy also means that people just think; ok that's not my responsibility, so let it go. Here in the Netherlands I think that everyone feels more responsible in that regard and if something is not managed well then people jump in and say; I will handle it."*

- **Team Member's External Enablers**

First of all, it seems that the team member who is going to advise his superior, especially on technical issues, should have a very good knowledge of the topic. Otherwise, according to TL6, *"if someone tries to pass on something to you, which is not in his field, it may be even worse, because it is much better not to know a subject than to think that you know it, but in fact you know very little. The latter I would say is very dangerous. It is therefore better to admit that you do not know something than to be willing to share things about which you are ultimately not knowledgeable, because it will be a waste of time."* This is obvious also by TM2's success story related to the digital turn in construction. In order to convince his skeptical superior about his created program in python, the TM2 *"took him along in the process, showing that the result from the program matches with the actual result that the calculations gave."* So, he really took his superior *"by the hand to show him that it is something he can trust."* Thus, it is evident that the team member had a very good knowledge about programming and doing things smarter, which led his superior to accept his idea.

The latter story also shows that the team member during the interaction process should be very well prepared so that the superior will not run over him. This is something which is mentioned as well by the TM1, who says that *"I try to prepare myself when I go into one of those conversations and I try to set out points regarding what I want to discuss, because otherwise I know they will run over me by saying, I do not agree or I do not care or whatever"*, while the TM5, mentions that when you approach your superior *"you should go well prepared, with particular tools because otherwise I think there is no chance that any request will be accepted."*

Another external interaction enabler is identified based on the TL2's success story, related to team leader's leadership style change. What actually happened is that the team member during the interaction process *"shared a personal story about himself, telling me that he had a conflict with his parents where one of them said; "I don't trust you". So, he was really sensitive to not being trusted. So, then I said; "This is so good that you shared that with me, I really didn't know. And what are more things that you think I should do better?""* Therefore, it is observed that a personal story sharing from the team member, increased trust between the team member and the team leader, with the latter asking him new feedback which had as a result, if we look back to the whole story, the adoption of a more effective leadership style.

Conveying information and giving feedback with the proper way, is the last identified external interaction enabler for team members, and maybe the most crucial one since according to the interviewees' stories and beliefs you have to take into account many things. First of all, you should place it in the correct context, just like what TM3 did in his leadership advice interaction with his team leader. *"So, what I specifically did is that I have watched you, I have listened to you in this meeting, these are my observations of the reactions of the team, how do you look at it? He said I would do this, this and this. I said, ok that's possible but I look at this in this way. And then he said, oh yeah!"* Therefore, by observing and mentioning the facts, you can put feedback in the correct context, avoiding any mistake of doing it too personal. And this is something which the TL1 has experienced; *"sometimes when I think; well this is sort of ridiculous you are talking, it's frustration that is coming not from me but from somewhere else, then I say; "I can't do anything for that.""* Another important thing is that you have to keep a balance between the positive and the negative feedback, with the positive feedback coming first and being followed by the negative one. This is exactly what prevented the TM2 from accepting the received feedback although he admits that it was context wise correct; *"Maybe he is right in his feedback"*, but *"it felt a little bit as if it was not fair. I saved him a lot of times, and he didn't give any positive feedback either. I didn't tell that, but it was my internal process but I thought "come on!""* Moreover, it can be supported that even if you have placed your feedback in the correct context and have kept balance between the positives and the negatives comments, it is still not sufficient for team leader's acceptance. According to TM1's words, you should also explain the negative feedback by giving examples. Specifically, he mentions that; *"give an example and say what the result of that was up to you."* That means also that you should be very careful of *"talking about yourself and not others."*

Summing up the desirable actions, feelings and behaviors for each one of the interaction enablers categories, the following table is structured.

Process Enablers	Team Leader's Internal Enablers	Team Leader's External Enablers	Team Member's Internal Enablers	Team Member's External Enablers
Safe environment creation for participants to express themselves freely	Be humble	Ask questions for getting examples	Do not feel too much of hierarchy within the project team	Very well knowledge of what is going to share on a technical level
Important to ensure interaction trustworthiness & confidentiality	Be open to feedback	Write feedback down	-	Be prepared, so that superiors won't run over you
Promote a two-way interaction between participants	Trust your subordinate	Think again of feedback later	-	Personal stories sharing, establishes trust & stimulates new feedback
-	Be relaxed	Discuss feedback also with others for verification	-	Right way of giving feedback and conveying information

Table 5.5: Interaction enablers of reverse mentoring in construction projects

5.1.2.1 Interpretation & Discussion

As it can be easily realized, a reverse mentoring interaction does not mean that it will always reach a successful result within construction projects. Not only should an undesirable situation take place first and therefore the team member most likely take the initiative to approach his team leader, giving him his point of view, but the identified interaction enablers of table 5.5 should also be satisfied by both.

What can be observed is that, the main role of team members in general is to take the initiative and communicate properly their thoughts and their advice to their superiors. Here, maybe it is worth doing a parenthesis and thus emphasizing on the recognized internal enabler for team members, in order to take the initiative and speak up. Almost all the Dutch team members mentioned that they do not feel much of hierarchy within their project teams, so it is easy for them to speak up to their bosses. This is something which has not been mentioned by the Greek team members, while in turn one of them, the TM6 who has been in the industry for more than 25 years, during his interview and while he was going to share a personal story said; *"I will try to give you an example since I am not afraid to speak, I am now at an age and after so many years where I can speak freely, I am not afraid of anything"*, which possibly shows that at least for a long period of time he was afraid to share his opinion. Those facts can possibly be explained by Hofstede's research on cultural dimensions. As it was already described in chapter 4, the Netherlands is a low power distance country (PDI=38) and therefore less hierarchical compared to Greece (PDI=60). Therefore, after taking into account Hofstede's study and of course the above feelings and words of the Dutch and Greek team members, it does not seem to be a coincidence the fact that sometimes two of the total four Greek leaders, the TL4 and the TL6, while they were talking about themselves and their team members, they were using army terms, which is the strictest form of hierarchy. For instance, the TL6, in order to show his trust to some of his team members, says that he calls them as *"the loyal soldiers"*, while in another time during the interview, he describes his role as well as his team members role, by saying that; *"a general never won a battle without soldiers or captains. The general sits on the hill and watches with binoculars, but the others do the fighting. The general sets up the team but the real battle is done by the rest. Why? Because the general has too many things on his mind and he cannot look at each one separately what they are doing."* Therefore, it seems like hierarchy can easily turn into an internal barrier for team members in high power distance countries like Greece.

In terms of the team leaders, they have to satisfy, according to table 5.5, several internal and external enablers in order to lead to a successful reverse mentoring interaction. In other words, their role is equally or maybe even more crucial than their team members role, since they should be truly ready both internally and externally for a reverse mentoring interaction.

The process and participants' enablers, make us think that some sort of structure might be advisable also within projects, so that you can influence some of those factors and increase the chances of succeeding a healthy reverse mentoring relationship. But what is the participants' opinion?

5.2 Reverse Mentoring Implementation in Construction Projects

One of the questions that was tried to be answered during the interviews is whether or not some kind of structure is needed for enabling reverse mentoring within construction projects. According to the vast majority of the interviewees, the answer is yes. Only two team leaders, the TL2 and the TL7 were clearly against inserting such a new process in their projects since according to the former, is how informally you can get closer to your team members and thus develop a mutual exchange relationship, while the latter supports that everything works well within his projects, so he would not challenge at any expense its status quo by inserting an interaction process that requires time. However, the advocates, not only do they feel that many of the above described enablers can easily be transformed into barriers and thus block reverse mentoring, but also many of them, like the team leaders 2 and 3, as well as the team members 2 and 3, support that especially technical people find change very difficult and tend to return to their old behavior and habit, and so a more structured process would be advisable. Moreover, the TM2 further explains that

introverted people like him, tend also to be quiet and adopt a let it go behavior, which does not help much towards reverse mentoring. Therefore, based on our discussion with the interviewees who advocate a more structured reverse mentoring program, the below implementation factors are identified.

Implementation Factors	How Many Times Appeared	Who Mentioned What
1. Sessions	(20)	TL2, TL3, TL4, TL5, TL6, TM1, TM2, TM3, TM4, TM5, TM6, TM7
2. Pairings	(6)	TL2, TL4, TL5, TM5, TM7
3. Place	(5)	TL4, TL5, TM1, TM5
4. Participants' Commitment	(19)	TL2, TL3, TL4, TL5, TM1, TM2, TM5, TM7
5. Training	(9)	TL2, TL3, TL5, TM1, TM3, TM5
6. Trainer's Involvement	(7)	TL2, TM1
7. Starting Point	(9)	TL2, TL3, TL4, TL5, TL6, TM5, TM7
8. Ending Point	(5)	TL2, TL3, TL4, TL5, TM5
9. Frequency	(8)	TL2, TL3, TL4, TL5, TM1, TM2, TM5

Table 5.6: Reverse mentoring implementation factors based on the interviewees' perception

In the following sections, based on the interviewees' perception, the important decisions and actions that need to be taken into account about each one of the implementation factors are indicated. It is worth mentioning that it is also going to be presented, the reason behind each decision, since one decision may reject another about a specific implementation factor.

- **Sessions**

  As it can be observed by the interviewees' beliefs, the first important decision about structuring a reverse mentoring process within a construction project team, relates to the dilemma between conducting group sessions or one on one sessions. The TL2 strongly supports that such a process should start in group sessions, since he thinks that everyone within the project team *"faces a difficulty in receiving feedback. So, if you organize that in group sessions, maybe you can support each other, and just say it is normal to get feedback and therefore you do not have to take it personally."* Thus, what he would do, is to say to the team leaders *"stop with the leadership, and bring one of your team members to the session; we are going to practice giving feedback to each other and you will also see other duos. It would be very interesting if you have to bring your own team members feedback workshop. And then do it together with let's say six couples, six team leaders and six of their direct reports. And then alternate this a little bit, in order to create a feedback culture. I think it would work, but I never thought about it. This is the first time!"* In that way, he believes that not only would the group sessions create a feedback culture within the project team but it would also stimulate honesty, since as he explains the team member *"would give me feedback in a group session, where also other leaders are present, then there is a real reason to be more honest."* Therefore, starting with group sessions, which consist of dependent team members and team leaders' pairings from different project teams is his suggestion in order to create feedback culture first while he admits that due to time pressure in construction project, group sessions might not be possible after a while and therefore *"it could continue one on one later. Maybe later, they could say; Oh, I don't have time to prepare for the sessions, it's so difficult to plan. But you can repeat the exercise just with your team members, giving each other feedback."* The latter is what most interviewees would choose to do from the scratch. For instance, the TL5 says that *"I see it as a face to face discussion in a relaxed context, in which the subordinate could talk more freely and about issues that do not strictly concern the pressing part of tasks and project progress."* So, he considers one on one sessions as the preferred choice since they create a safer environment for team members to express themselves freely (identified enabler).

In any case, from both team leaders' beliefs it is acknowledged the importance to be promoted a two-way interaction during either the group or the one on one sessions. This is also confirmed by some team members who explicitly mention that *"feedback never should be one-way direction; it should always be a two-way direction between mentor and mentee"* (TM1), since *"if it's only one way, perhaps you miss a lot of important information"* (TM3).

- **Pairings**

Almost all interviewees, who advocate towards creating a more structured process for enabling reverse mentoring interactions, agree on the fact that team members should be alternated in each session. So, at every session the team leader should stay stable and the team members should be alternated. The vast majority of the interviewees mention that team members' alternation is important for ensuring team members' fairness, like the TL4 who says that; *"I am in favor of alternating team members with the leader, so that all team members have the opportunity to express their opinion."* Another reason for taking such a decision can be extracted by encountering the TL5's words *"because of the fact that we do the work with the people we have; I have to try to get the maximum that each person can give me. So, this process could possibly be useful in discovering things about people that I might not have realized, maybe it is a way to see if my team members can offer or give something else or I can find that I have them in the wrong position while somewhere else they would be more productive."* Therefore, the better evaluation of the team members by the leader can be achieved only if the team members can change at every session. While, the TM7 and the TM8 support that in case the opposite would take place, meaning that *"not everyone has the opportunity to participate in the program, the one who will be chosen may convey a distorted image of the reality to the team leader"* (TM7).

- **Sessions Place**

The next decision that comes into play is where those sessions are going to be held. The interviewees do not seem to care about the place, for example the TL4 mentions that the sessions could take place everywhere, even during construction on site *"in the mud"*, however they all seem to prefer a face to face interaction; *"I would always do it face to face. No calls, no emails, only face to face"* (TM1), *"because that is the structure of the construction industry"* (TL5). The TM5 also adds that the sessions *"should take place at the end of each week, since during the first days, you are very busy with all the information and problems you have to deal with in the following days of the week. So, in that way the program would be more productive."*

- **Participants Commitment**

It can be supported that the interviewees emphasized a lot on the need to ensure the commitment of participants to the process, sharing many different suggestions for that topic. First, the TL5 and the TL2 mention the need for writing down stuff in order to make a journal, since being professional, as they say, counts for participants, with the latter explicitly mentioning that; *"I think that people will be scared at first, but they will really appreciate that this program is organized in a professional way. You should really make it practical, write down stuff, make a journal or something like that and make sure you follow up."*

Moreover, it should be mentioned that, almost all interviewees who referred to participants' commitment theme, focused also on the need to establish measurements. Engineers need practical measurements to feel committed to the process, since both team members mention that it is important to *"check how the process is going by looking both back and forward"* (TM2), and *"if you have done anything with the received feedback"* (TM1), while team leaders emphasize on the need for a measurable outcome. For instance, the TL4 says that *"I would like feedback, like for example you should do this to be better there. Meaning that, I would like a measurable result. I don't know if it could come out as a percentage, for example the way you do this particular job is not correct or that you should act differently there."* A more specific suggestion about what to measure

and how to measure it during the whole process for participants' commitment comes from the TL2. Specifically, he says that; *"I would just check, measuring attendance, I would evaluate the frequency of the sessions, the length of the sessions, the subjects of the sessions and just ask questions like; "How valuable do you think it is, with a scale from one to ten?" Thus, if the number goes down, then I would ask; "What's the reason?". I think that asking the participants is the best way to check it."*

However, he thinks that the established measurements for participants' commitment go hand in hand with consistency. He perceives the reverse mentoring process like the *"football players training process who are trained every day. So, once every three months, we have a feedback session, bring your own boss, and we're just going to give feedback and get better, and maybe sometimes it is frustrating, maybe sometimes it doesn't seem fair."* So, *"make sure you follow up, so not one moment but follow up in three months, follow up in the next three months, see what you can do in the one on ones, also measure stuff, how satisfied are you, ok we do these sessions on a scale from one to ten, in which extend do you think that this helps project's efficiency, project's results, client's satisfaction, your own development, your competences, your monthly salary etc. You can examine that, do something with the feedback, implement it again and just be consistent. You have to be consistent. If you say; "Let's skip this and do something else, and see if that works." No, this kind of logic doesn't work. Really make it a success."* This is something very important also for the TM7, who believes that *"organization plays a very important role in making it a habit and sticking to this process. If you know the structure of the program from the beginning, I believe that there will be consistency from the participants' perspective."*

Furthermore, the TL4 believes that the team members' commitment to the process depends also on the team leaders' attitude towards them during sessions. He says that; *"I believe that from the beginning the superior should be willing to accept the position of the subordinate. If from the first conversation, some kind of friction between the participants appears, like "I do not accept and do not tolerate what you say!", then this process will not make sense."* This is completely confirmed by the TM8, mentioning that; *"If it's just for the leaders to have fun, and essentially, they do it just for the sake of it, it wouldn't make any sense and I would lose my interest."* However, the TL5 puts another parameter into this discussion mentioning that he would be more willing to take such a process seriously into account if the higher management was involved somehow into the process, otherwise *"its implementation cannot fall solely on the project leader's responsibility, since it makes it even more difficult."*

Finally, the daily reference to success reverse mentoring stories by the team leader is crucial, according to the TL5, for increasing the team members' and other team leaders' interest towards the process. He believes that *"through formal or informal team members meetings, I can present/point out cases that I see are of interest and are good and useful examples of reverse mentoring. I think that it is a very good idea/suggestion to increase the dynamic and importance of this process since I would pass on to the team members the usefulness of the model."*

- **Training**

Before participating in the one on one sessions it seems advisable for the participants to receive some training on the proper way of giving feedback and conveying information. What is observed here is that the team leaders (construction managers) and team members (construction engineers) from the construction phase of the project, emphasize more on the need for taking such kind of training the team members (construction engineers) while the design engineers (team members involved in the design phase of projects), communicate the need for taking such kind of training both participants with the emphasis being on the team leaders' side. For example, the construction manager (TL5) mentions that the team member *"must have a simple but also a polite way to convey the information"*, something which is not happening always within his project team, since *"there are examples of dominant people in the present project group, which create friction."* The need for some kind of guidelines for team members is mentioned also by the construction engineer (TM5) who says that as a team member *"you cannot "beat" with words your boss from one day to the next. I think that rules*

and agenda are very important." From the performance team's consultant (TM3) general point of view, it is explained that *"there is a risk, if you don't give feedback properly, since the process becomes unsafe."* He further explains that *"a specific skill that people miss in construction, is communication without violence and thus people should be trained on this."* This is something that is supported by the design engineers, the TM1 and the TM2, with the exception that they feel that this applies more to their design managers, with the latter mentioning that *"I feel that our generation is more on the soft skills. When we start here, we do a young professional program, where you learn a lot about soft skills. I think that the older generation never had that, especially in an engineering company where the soft part is sometimes lacking a bit. So, I think it could be really good to do these kinds of things."* While he continues saying that within the project *"you can experience that there is really a generation gap related to the soft skills. So, people are sometimes too impersonal maybe, since they do not always think about the person at the other end."*

- **Trainer's Involvement**

In the case of choosing group sessions as the way of conducting the reverse mentoring process, then it seems important to involve in the process a trainer with great competences. As it is mentioned by the TL2, the trainer should ensure the process safety, communicating to the participants and especially to the team leaders that *"we will make sure that it's safe, we won't let you lose face."* He further explains that, even in case of conflicts between the team members and the leader, the trainer can ensure the process safety by recognizing the problems and pointing out the overall process goals. Therefore, he could say something like; *"maybe some of you brought their own boss, that you didn't want to do because your relationship on a scale from one to ten, is a three. No problem! I am experienced, I will help you. You will take it from the three to four, from the four to five and from the five to six. We will help each other. So, the only thing we want is to get better and to make a better project, so that we have better results."* Also, the TM1 mentions that the process safety in group sessions in general is difficult to be achieved without the trainer's or the facilitator's presence, since otherwise you run the risk of being led to a let it go chaotic session with zero results.

According to the TL2, the trainer should also teach participants during the sessions *"how to give feedback properly and therefore start doing it immediately"*, while at the same time he should try to create an empathy culture between participants. Specifically, the TL2 as a trainer *"would ask the group, let's say that we have twelve people, six bosses and six team members/direct reports; "Ok guys, how are you going to help each other. So, if one leader has difficulty in receiving feedback, all the other five colleagues, how are you going to help your colleague? Also, if somebody knows only negative feedback, how are you going to help that person in order to see the positive things and share the positive things?"*

- **Starting Point**

By taking into account the interviews, there are two streams regarding the starting point of the reverse mentoring sessions. The following participants, TM6, TL4 and TL6, support that the process should start immediately after the team's formation, with the TL4 saying characteristically that; *"I believe that such a program should start from the beginning, when we know that we are going to build this particular thing and we also know that we have these particular people who will work together to make it happen."* On the other hand, there are participants like the TL2 who thinks that it is better to start such a process *"after three to six months"* from team's formation so that *"getting some experience with knowing each other."* The same rationale is also held by the TM5 and the TL5, with the latter mentioning that; *"if we take as an example the project I'm currently in (4 years), maybe such a program could start after the first year. That is, let's say about 25% of the way through the project. At this point the relationships between the members of the group have developed, new members have been added, therefore the group begins and acquires a homogeneity, a recognition, a first assessment."* However, it is observed that the difference between the two streams lie in the extent to which the newly formed team is differentiated compared to the previous projects. Specifically, the first participants (TM6, TL4, TL6) belong in project teams that they are more or less the same on every

project; *"all the guys you see here have known each other for a long time"* (TL4), so people already know each other very well from the beginning while it does not apply for the TL2, TM5 and TL5 interviewees.

- **Ending Point**

In terms of the ending point of the process, some interviewees like the TM5 and the TL2 believe that it depends on the participants motivation over the process, so the TL2 for example, mentions that you have to keep track on your established measurements and *"when the learning curve gets less steep or goes down, you have to stop. Otherwise the concept will not work anymore."* However, there are other interviewees like the TL3, the TL4 and the TL5, that think that the sessions should remain until the end of the project since as they say this is when the team finishes its mission while the TL5 mentions also that *"it would be important to see some results towards the completion of the project, e.g. to find out if the team leader embraced some ideas which he probably received during the program and therefore see if this would have any measurable effect on the completion of the project."*

- **Frequency**

Again, there are two different opinions from the interviewees regarding the frequency of the sessions. Some participants believe that they should be held either *"every quarter"* (TL2, TL5, TM1) or *"once per month"* (TL3, TM2), in order to have time to prepare for the sessions, without putting extra pressure on themselves, since their daily work conditions are already characterized by extreme time pressure and work intensity in order to meet the project's deadlines. Whereas there are other interviewees, like the TM5 and the TL4, who advocate for more frequent sessions, either *"once per week"* (TL4) or *"once every two weeks"* (TM5), since their target lies on adopting or proposing better technical solutions, within the very dynamic project environment where unexpected problems arise on a daily basis.

By summing up the above findings, the important decisions and actions that need to be considered for each one of the implementation reverse mentoring factors within construction projects, according to the interviewees' perception, are presented in the next table.

Implementation Steps	Important Decisions & Actions
1. Sessions	a) Group sessions vs One on one sessions b) Promote a two-way interaction
2. Pairings	a) Team member's alternation in each session
3. Sessions Place	a) Everywhere but face to face
4. Participants' Commitment	a) Write down stuff – make a journal b) Establish measurements c) Be consistent d) Team leader should be really interested in the process e) Higher management involvement f) Daily reference to success reverse mentoring stories by the team leader
5. Training (for 1-1 sessions)	a) Important for one on one sessions b) Teach participants the proper way of giving feedback/conveying information
6. Trainer's Involvement (for group sessions)	a) Important for group sessions b) Teach participants the proper way of giving feedback c) Create an empathy culture between participants
7. Starting Point	a) After the team's formation, when people get to know each other
8. Ending Point	a) Keep track on your established measurements about the participants' motivation vs Until the end of the project team's mission
9. Frequency	a) Once per month – once per quarter vs Once per week – once per two weeks

Table 5.7: The recognized implementation factors and their related decisions and actions

5.2.1 Interpretation & Discussion (Answering Sub-question 5)

In this paragraph we are going to examine first the identified implementation steps of construction projects based on Jensen et al. 's research and see which steps are following the logic of either a project's or a disciplinary's society. This is indicated in the next table.

Construction Projects Implementation Steps	Decisions & Actions	Comparison Basis between Companies & Projects based on Jensen et al. 's research (Table 3.1)
1. Sessions	a) Group sessions vs One on one sessions b) Promote a two-way interaction	**Figurative Space** is predefined
2. Pairings	a) Team member's alternation in each session	**Relations** are defined by **Activity**
3. Sessions' Place	a) Everywhere but face to face	**Actual Space** is defined by **Activity**
4. Participants' Commitment	a) Write down stuff – make a journal b) Establish measurements c) Be consistent d) Team leader should be really interested in the process e) Higher management involvement f) Daily reference to success reverse mentoring stories by the team leader	**Figurative Space** is predefined

5. Training (for 1-1 sessions)	a) Important for one on one sessions b) Teach participants the proper way of giving feedback/conveying information	**Figurative Space** is predefined
6. Trainer's Involvement (for group sessions)	a) Important for group sessions b) Teach participants the proper way of giving feedback c) Create an empathy culture between participants	**Figurative Space** is predefined
7. Starting Point	a) After the team's formation, when people get to know each other	**Time** is defined by **Activity**
8. Ending Point	a) Keep track on your established measurements about the participants' motivation vs Until the end of the project team's mission	**Time** is defined by **Activity** Vs **Time** is predefined
9. Frequency	a) Once per month – once per quarter vs Once per week – once per two weeks	**Time** is predefined

Table 5.8: Implementation steps of reverse mentoring within construction projects & companies

If we bring in our mind again, the reverse mentoring implementation factors based on literature and therefore within companies (see table 3.3), we can observe that there are some obvious differences compared to the identified factors within projects on the basis of Jensen et al. 's research.

Construction Projects		**Companies**	
Implementation Steps	**Comparison Basis between Companies & Projects** based on Jensen et al. 's research (Table 3.1)	**Implementation Steps**	**Comparison Basis between Companies & Projects** based on Jensen et al. 's research (Table 3.1)
1. Sessions	**Figurative Space** is predefined	1. Participants' commitment	**Figurative Space** is predefined
2. Pairings	**Relations** are defined by **Activity**	2. Organization's Environment	**Figurative Space** is predefined
3. Sessions' Place	**Actual Space** is defined by **Activity**	3. Sessions' Place	**Actual Space** is predefined
4. Participants' Commitment	**Figurative Space** is predefined	4. Pilot Program	**Relations** are predefined
5. Training (for 1-1 sessions)	**Figurative Space** is predefined	5. Selection process	**Relations** are predefined
6. Trainer's Involvement (for group sessions)	**Figurative Space** is predefined	6. Pairings – Matching process	**Relations** are predefined
7. Starting Point	**Time** is defined by **Activity**	7. Duration	**Time** is predefined
8. Ending Point	**Time** is defined by **Activity** Vs **Time** is predefined	8. Frequency	**Time** is predefined
9. Frequency	**Time** is predefined	9. Training	**Figurative Space** is predefined

Table 5.9: Differences of reverse mentoring implementation steps between firms and projects based on Jensen et al. 's research

If we take a closer look at the above table, we can notice that although several implementation steps are the same between construction projects and companies, the emphasis on most of them, based on their related decisions and actions that need to be taken, is different. In general, it can be supported that within construction projects, there is not any need to predetermine as many factors as within companies. For instance, within companies in order to find

the pairings you have to go through into three steps. First, you have to decide the participants' number of the pilot program, then the participants' selection process takes place and therefore the matching process in order to form the pairings. On the other hand, in construction projects it seems advisable to alternate the team members in each session, so that every team member has the opportunity to develop a reverse mentoring relationship with his team leader. This is something, that it can be explained by literature, since the relationships within projects are not fixed like companies, but described as connections (Jensen et al. 2016), since team members may come, not only from different disciplines but from different organizations as well, while they can enter and leave the team during the project (Tyssen et al. 2013, Ong 2008). Also, based on Jensen et al. 's research, it seems rational that the reverse mentoring activity will finally define the reverse mentoring relationship between participants at construction project level and not the opposite, which applies within companies. The same difference is also observed in terms of space and time. Starting with the space, although figuratively the space has to be predetermined both at a firm's but also at a project's level, literally it does not seem important, based on the interviewees' perspective, since reverse mentoring can start everywhere, meaning again that the activity is going to define the actual space of the sessions (Jensen et al. 2016). In terms of time, it can be seen that within companies, we are talking only about duration, without emphasizing on the starting point, since companies have a permanent structure and not a temporary one like projects (Jensen et al. 2016). Therefore, in construction projects it is needed to be defined as a starting point, because usually most of the people are unknown to each other during the team's formation. As for the ending point and therefore the program's duration, according to the interviewees' majority, it depends on the participants motivation and thus by the reverse mentoring activity, just like what the Jensen et al. 's research suggests.

5.2.2 Perception-based Benefits

The term "perception-based benefits" is used since the current paragraph's benefits are coming from some interviewees on the basis of a hypothetical reverse mentoring implementation within construction projects. In the next table, the positively influenced factors after taking place a reverse mentoring program are indicated, according to the interviewees' perception.

Perception-based Benefits related to:	How Many Times Appeared	Who Mentioned What
1. Conflict Solving	(5)	TL2, TL5, TM5, TM7
2. Soft Skills	(3)	TL2, TM2, TM7
3. Quality Relationships	(12)	TL2, TL4, TL5, TM5, TM7
4. Communication	(3)	TL2, TL4, TM1
5. Creativity & Innovation	(4)	TL2, TL5, TL6
6. Commitment	(3)	TL4, TL5, TM6
7. Team Composition	(5)	TL5, TM5
8. Project Goals	(2)	TM1, TM5
9. Culture	(2)	TL5, TM6

Table 5.10: Perception-based benefits of reverse mentoring in construction projects

As it can be seen from the table, there are nine different recognized factors that might be positively influenced by possibly implementing reverse mentoring within projects. A detailed description on how these factors might be affected as well as at what level (participants' level or team's level) is presented below on the basis of the interviewees' words.

- **Conflict Solving**

A formal reverse mentoring program could possibly help team leaders to better manage conflicts either on a personal or on a team level. According to the TL2, such a process would contribute to the solution of *"conflicts between team members and their boss"*, while the TL5, perceives the program as a process which would help him to prevent conflicts on a project team's level by gathering the appropriate information from their subordinates and *"based on that envision a possible future conflict between the members of the group and therefore being led to take measures to prevent it."* From some team members' perspective, like the TM5 and the TM7, think that they can also propose solutions to the conflicts that arose but yet their opinion is not taken into account. Specifically, the TM5, shares the reality of the project team's meetings, saying that; *"just to give you an image of the meetings that take place in the project, for issues such as solving a problem or seeing how we will manage a new material that must be included in the project or who is responsible for mistakes that have been made in the project, very high tensions and disagreements are created. In other words, I cannot say that the situation is usually civilized"*, while he further adds that; *"if the superior was receptive to listening, perhaps the above situation would improve, since the one-sided treatment of some problems in a project, by a person who does not have full contact with the problems of the members, creates more problems."*

- **Soft Skills**

There are references within the participants' interviews which support that the reverse mentoring implementation would possibly benefit the team leaders and the team members, in terms of developing some of their soft skills. For example, the TL2, supports that both reverse mentoring participants would *"learn the proper way of giving feedback and start doing it immediately."* According to the TM2, this is something very important especially for the older team leaders, because as he explains that *"our generation is more on the soft skills. When we start here, we do a young professional program, where you learn a lot about soft skills. I think that the older generation never had that, especially in an engineering company where the soft part is sometimes lacking a bit."* However, the TM7, admits that he would be benefited too; *"I would be able to see which of the knowledge and information I impart, what I ask for is taken into account or not. It would help me then, in terms of how to present my reasoning, i.e. a situation, a problem, a solution so that it becomes understandable."*

- **Quality Relationships**

Many interviewees think that such a program would contribute towards building strong relationships between the team leaders and the team members, by increasing the empathy between them, in terms of gaining better understanding of what the other person goes through and understanding each other at a personal, deeper level. Specifically, the TL2 perceives the program *"as a kind of relation therapy"*, with the TL5, believing that *"a better and more direct relationship would be created between me and the team members."* This can be achieved by increasing first the empathy within the project team, in terms of knowing what the other person goes through on a technical level. This is important both from the team leaders and the team members' perspective. For instance, the TL4, says that *"many people on the construction site rather question the way of thinking and the work that some people do. So, if there is an interaction of positions, opinions, etc., maybe they will understand each other what everyone really knows and goes through."* The same thing is also supported by the TM5 and the TM7. On the one hand, the former shares that as a team member *"it's easy to have a very bad impression of your bosses, but once you understand their position, you might change your opinion about them"*, something that can potentially be achieved through a reverse mentoring program since *"you will be able to communicate your problems, and you in turn will understand the problems that your superiors are facing, such as the pressure they are under from those above them or the client"*, while on the other hand the latter believes that the opposite also applies, meaning that the team leaders will be able to better understand their subordinates, since as he explains; *"always your boss, no matter how close he is to*

you, he doesn't know exactly what obligations you have and how you live your day. We hear what we should do, what we should do differently or what more we should do, but he does not have a clear picture of what we really go through and how exactly we feel as his subordinates. So, I think it will be very instructive for any supervisor to have an accurate picture of what their subordinates are doing, and to understand for example how much time is actually required to perform some tasks that they often wrongly assume." As they explain this process will also probably help them to further develop a deeper relationship. The TM5 says that *"from the moment you would be given the opportunity to talk to someone superior, you would be given the opportunity to get to know him and also for him to get to know you better, because usually leaders don't get to know you personally"*, whereas the TL4, believes that *"through this process you would be able to better understand the character of a person and therefore promote personal contact and friendship. The latter may already exist but you don't know if it is real or not."*

- **Communication**

There are also participants who think that the communication within the project team could be improved after conducting such a program, by explicitly mentioning either that; *"the communication will be more open"* (TL2) or that; *"the channels of communication will certainly open"* (TL4). The reason behind why this could happen, may be explained by the TM1's words; *"for me it is easier to go to someone if I have talked to him informally before. Meaning not talking about calculations, not technically. So that can be a feedback session or just a drink or just a coffee machine talk, it doesn't really matter. So, for me it makes it easier to go to these people and talk and also, I have the feeling that it is easier for others to be a bit more open to this. I would not say everyone, but we have some people who are in their own zone and it's super hard to get them out. So, I think that the only chance to get them out it's to connect with them on a personal level and therefore you can reach that through communication."*

- **Creativity & Innovation**

Some team leaders see the potential to foster creativity and innovation by applying reverse mentoring mainly to technology-related topics. The TL3 believes that, *"if people know each other better it is easier for them to make mistakes and therefore go out of their comfort zone and innovate."* Taking also into account that the team members are more familiar with the new technologies, he further explains that this process might lead to the adoption of more effective procedural stuff, like better reporting formats. The TL5 even believes that the team members might be able to *"give some ideas and think differently even in the actual technical part of the project, like proposing a software that makes snag lists which we have been doing it manually until now."*

- **Commitment**

Some team leaders believe that a reverse mentoring program would possibly help the team members to feel more important and involved in the project, something which seems to be confirmed by the latter. For instance, the TL4 shares his opinion about the effect of a possible reverse mentoring process implementation on his subordinates, saying that; *"you would give the subordinate the possibility to communicate his knowledge to the superior but also you would give him greater encouragement in what he does in the project. This is very important. I will say again that unfortunately, I don't know if this happens only in Greece, but the work of some people who are not visible is greatly degraded. So, I believe that through such a program you will be able to highlight their role."* A similar opinion comes from the TL5 as well, who mentions that; *"the freedom that would be given to team members to express themselves and get opportunities to act like seniors would make them feel important."* This is confirmed by the TM6 who thinks that he would feel honored towards his superiors behavior since, according to him *"one of the most important things for each member of the group is to freely express his opinion and this in turn to be taken into account. So, through such a process the team leaders would show that they really care about the opinion and also the development of the*

subordinates. As a subordinate I believe that if I saw such humble behavior of the leaders, I would feel much more the need and the motivation to get the job done for them as people too."

- **Team Composition**

There are two interviewees, one team leader and one team member, who think that a possible reverse mentoring implementation during a construction project would enable team leaders to better evaluate or reevaluate their team members and therefore achieve a better team composition result. What might be interesting to be mentioned, is that the TL5, seems to be a firm supporter of that opinion, since there are several references on that topic in his conducted interview. In one of those references he says that; *"because of the fact that we do the work with the people we have; I have to try to get the maximum that each person can give me. So, this process could possibly be useful in discovering things about people that I might not have realized, maybe it is a way to see if my team members can offer or give something else or I can find that I have them in the wrong position while somewhere else they would be more productive."* This is exactly what the TM5 mentions as well; *"the team leaders would have a better idea of your technical knowledge, intelligence, how you might be able to offer in another position, maybe even higher, they would know exactly what you can do. What I mean is that many times superiors may say to you, do this, but in order to complete it, you have to find a complete solution documented and then execute it, a process which requires an effort that the superior may not have realized. And for the leader, I believe it will be important to learn how you think, how you speak, because it will give him different confidence to use you in different roles within the project."*

- **Project Goals**

There is also some team members' view that they would gain a better understanding of the project's overall picture. Specifically, the TM1, thinks that he would *"gain knowledge in how team leaders structure their projects because it's all different companies working together and it will be good to understand why stuff is done in a certain way"* while the TM5 adds that he would possibly have the opportunity to *"see the side of the project that you don't see, since as I've said before you deal with the detail and you don't see the bigger picture of the project."*

- **Culture**

Many interviewees and almost all the team members, both Dutch and Greek, mentioned that there should be a change in culture within their project teams, emphasizing more on people and not only on productivity. Some of them also made a link between culture change and reverse mentoring, perceiving it as a tool that could contribute towards that direction. The most characteristic example is coming from the TM6, who has been working for over 25 years in construction projects, and came to that conclusion after sharing a personal story of the Stavros Niarchos project, where he was involved in. He said that *"in the Stavros Niarchos project, we had a reunion with old people who were together in older projects and what happened is that the superiors were the same and had the same treatment towards us as they had 20 years ago. Therefore, even though so many years have passed, the situation has remained the same. I believe that if such a process was implemented systematically maybe this situation and mentality of the leaders would change, and they would show that they really care about the opinion and also the development of the subordinates."* One extra direction of culture change within construction projects is coming from the TL5, who thinks that such a process could pass on to the higher levels as well. He explicitly mentions that this process would be *"important for culture change, for the enhancement of the relationships between team members and leaders and that perhaps this could be passed on to other higher levels, between let's say higher management and the team leader."*

In the following table the perception-based benefits are further broken down into team members benefits, team leaders benefits and project team benefits based on the above findings.

Hypothetical Reverse Mentoring Application			
Perception-based Benefits related to:	**Team Member's Benefits (Mentor)**	**Team Leader's Benefits (Mentee)**	**Project Team's Benefits**
1. Conflict Solving	-	Better conflict management on team level	Better conflict management on team level
2. Soft Skills	Feedback skills improvement Communication skills improvement	Feedback skills improvement -	- -
3. Quality Relationships	Gain better understanding of your team leader as a person -	Gain better understanding of your team member as a person -	Strengthen the relationship between the team leader & the team members Increase empathy between the team leader & the team members
4. Communication	-	-	Open communication fostering
5. Creativity & Innovation	-	Be benefited on procedural issues	Incorporation of the digital way of working into technical solutions
6. Commitment	Feel more important & involved in the project Feel honored	- -	- -
7. Team Composition	Gain visibility within team	Better team members' (re)-evaluation	-
8. Project Goals	Gain better understanding of the project's overall picture	-	-
9. Culture	-	-	More emphasis on people and not only on productivity

Table 5.11: Perception-based benefits of reverse mentoring in construction projects on team's and participants' level

5.3 Benefits of Reverse Mentoring in Construction Projects: Interpretation & Discussion (Answering Sub-question 4)

In the current paragraph, we are going to summarize first the benefits of reverse mentoring in construction projects that were identified through either the interviewees' experiences of informal reverse mentoring interactions within construction projects (experience-based benefits) or the interviewees' perception after considering a hypothetical reverse mentoring process within their projects (perception-based benefits). The overall findings are presented below.

Positively Affected Factors	**Experience-based Benefits**	**Perception-based Benefits**
1. Conflict Solving	✓	✓
2. Soft Skills	✓	✓
3. Quality Relationships	✓	✓
4. Communication	-	✓
5. Creativity & Innovation	✓	✓
6. Decision Making	✓	-
7. Commitment	✓	✓
8. Team Composition	-	✓
9. Project Goals	-	✓
10. Leadership	✓	-
11. Humility	✓	-
12. Culture	-	✓

Table 5.12: Overall benefits of reverse mentoring in construction projects

Therefore, it can be supported that based on the conducted interviews there are twelve factors that could be possibly affected positively at construction project level, if a successful reverse mentoring process would take place. Of course, the experience-based benefits hold greater value than the perception-based benefits, since they have already appeared in the interviewees' communicated stories. However, many of them appear as perception-based benefits by other interviewees as well, adding extra value to those factors. Therefore, the experience-based benefits of this table can be perceived as the strong base of the process overall benefits with the potential to experience some longer term, perception-based, benefits like team communication, better team composition and team culture change.

Here it should be also mentioned that almost all the above factors are appeared also in literature and therefore at firm's level (see tables 2.2 & 2.3), but with the emphasis being elsewhere for some of them, just like in the application steps of the reverse mentoring process, which was described in one of the previous sections. For example, according to Gugercin (2017) & GE's application, reverse mentoring increased mentors' visibility, leading them to better career positions within the organization, while at project level it might lead to better team composition. The same goes also for leadership. Many studies in literature mention that reverse mentoring led to leadership skills' acquisition by mentors in order to become future leaders (Murphy 2012 etc.), whereas within projects the emphasis is on the mentees' side, and how reverse mentoring helped them to adopt more effective leadership styles according to their team members' needs. One final example, is that one of Gadomsk-Lila (2022), who mentions that reverse mentoring within companies had positive effect on culture, on the basis of the mentors' better understanding of the organization's culture, while in projects the emphasis is on influencing the team culture by emphasizing more on people and not only on productivity, something which is crucial based also on Bakker & Kleijn's (2018) work. Those differences, can be substantiated by bringing again into the discussion the Jensen et al. 's research on the differences between a disciplinary and a project society. For example, the fact that reverse mentoring contributed firms to develop their employees for gaining higher positions or becoming future leaders matches with the permanent structure of the disciplinary society and not with the temporary structure of projects which demand sooner results that reverse mentoring can possibly offer by compositing a better team or adopting a more effective leadership style by the team leader.

The only factor that does not seem to be related with any of the literature findings is humility. In literature it is indicated only the possibility through reverse mentoring of gaining better understanding of the other person but not of their own self. In construction, where the technical part is a huge subject, it seems important especially for team leaders to fully understand their own self, in terms of strengths and weaknesses, making them open to acquire new learning from others, something that reverse mentoring seems to offer. The importance of leaders' humility is substantiated by Chiu et al. 2022 research, who support that humble leaders can serve a dual goal towards establishing a supportive environment and improving the overall team effectiveness. On the one hand, positive interactions between group members can be encouraged by the humble leaders' attitude towards continuous learning, which is perceived as a shared value, while on the other hand, leaders' humility can prevent conflict between group members.

5.3.1 Reverse Mentoring Benefits & Construction Project Team Effectiveness

In this paragraph, we are going to compare the recognized reverse mentoring benefits at construction project context with the factors of high effective project teams that recognized through literature in chapter 3 (see table 3.4 & 1st column of table 5.12). Considering the discussion of the previous paragraph, it seems rational to observe some differences between the possible established link between reverse mentoring at firm's level and construction project team effectiveness of chapter 3 (see table 3.5 & 2nd column of table 5.12) and the final established link by taking into account the concept's benefits at project level in construction (see 3rd column of table 5.12).

Elements of Highly Effective Construction Project Teams	Reverse Mentoring Benefits based on Literature (Firm's Level)	Reverse Mentoring Benefits based on Interviews (Construction project's Level)
Process Factors		
1. Communication	✓	✓
2. Decision Making		✓
3. Conflict Solving	✓	✓
Team Factors		
4. Leadership		✓
5. Quality relationships	✓	✓
6. Climate	✓	×
7. Composition (team skills, size & stability)		✓
8. Team learning		
Individual Factors		
9. Soft Skills	✓	✓
10. Hard Skills	✓	×
Other Factors		
11. Goals & Objectives		✓
12. Clear Roles & Responsibility	✓	
13. Mutual Trust & Commitment/Shared Values	✓	✓
14. Owner's Satisfaction		
15. Team members' satisfaction	✓	×

Table 5.13: Linkage between reverse mentoring & construction project team effectiveness

Taking into account the above table, the reverse mentoring practice within projects can influence, based on the interviewees' experiences and perspective, 9 out of 15 recognized elements of high effective construction project teams. Starting with the process factors, we can see that they could all be influenced by applying reverse mentoring. Decision making for corrective actions and better technical solutions as well as better management of conflicts from the team leaders constitute experience-based benefits, while the creation of open communication lines within a team constitutes solely a perception-based benefit as it was described in paragraph 5.2.2.

Moving on to the team related factors, team leadership and quality relationships have already been experienced by the interviewees through their informal reverse mentoring interactions, as the adoption of a more effective leadership style by the team leader according to his team members' needs, in respect to leadership and as increasing understanding and empathy with each other for building stronger relationships, in respect to quality relationships. Team composition is also included in the reverse mentoring benefits but only as a perception-based one, which shows that it can possibly influence that recognized element for highly effective project teams only in terms of team skills and not in terms of size or stability. Here it could also be supported that, in case a better communication between the project team members would take place, with conflicts reduction and better-quality relationships, this would have a positive effect on the project team climate as well. However, because of the fact that this highly effective element did not appear explicitly in the interview transcripts, it has not been indicated as a possible influenced factor.

The same, more or less, goes also for the hard skills factor. Specifically, the TL4, was the only one who mentioned explicitly that he could possibly gain technical knowledge even from a skilled technician on a construction site and therefore we did not include that factor in the reverse mentoring's benefits. Adversely, soft skills advancement appears both as a perception but also as an experience-based benefit both for the team leaders and for the team members.

The two final elements of high effective construction project teams that seem to be influenced are, goals and objectives as well as mutual trust/commitment and shared values. What it might be important to mention here, is that these two factors seemed to be very important for team effectiveness from the interviewees point of view as well. Regarding the goals and objectives, every team leader mentioned their importance for the project team's functionality, although without making any link to reverse mentoring. However, what is interesting, is that the team leaders 1 and 7 mentioned that the team members' mentality many times has a negative influence on the overall project goals and objectives, since they tend to get lost into the details and do not see the bigger picture. For example, the TL1 says that *"engineers mostly want to go into more detail; "Oh I work on that but I didn't sort out everything. I found that, oh I have another problem, so I have to look at it. They never get to an end, that's a typical engineer, because everyone tends to work on an island and just focus on the things they have to do and they don't see the project as a whole."* This problem can possibly be tackled by applying reverse mentoring according to the team members 1 and 5, since as they support, they would have the opportunity to better understand the overall picture of the project. The things are more clear for the commitment parameter of the last influenced factor. Some interviewees, like the TL4 and the TM1, repeatedly mention to their interviews about the importance of gaining your subordinates as a team leader and the importance of feeling important as a team member, in order to make team members committed towards their work, with the TL4 specifically linking commitment with the reverse mentoring practice. Something which is confirmed by the TM3, who explains that during his informal reverse mentoring interaction with his leader, he felt honored, making him more committed towards him and therefore his project work. As for the shared norms and values they seem to be related with the perception-based benefit of culture's influence, meaning that probably the established norms and values will be implemented under a proper way that the established culture will demand.

6 Conclusions & Recommendations

In the present chapter and specifically in the first paragraph, the research sub-questions are going to be answered first and then the answer of our main research question will follow. At the same time, the most interesting findings will be pointed out. Finally, the chapter closes with making known the study's limitations and our suggestions for further research in paragraphs 6.2 and 6.3 respectively.

6.1 Conclusions

The present study has focused on understanding the reverse mentoring practice within the project setting in construction for the first time ever in literature, aiming to explore the model's applicability as well as its potential contribution to the overall project team effectiveness. It should be mentioned again that reverse mentoring, is the inverted process of traditional mentoring whereby a subordinate employee receives the role of mentor while the superior that on of mentee. Specifically, this relatively new practice was explored on the basis of a power difference reverse mentoring relationship between leaders and members of construction project teams. Therefore, a qualitative research approach, with the use of fifteen semi-structured interviews with team leaders and members, was adopted, targeting to collect different experiences and viewpoints about reverse mentoring in construction and therefore to answer our main research question which was formulated as follow:

Main Research Question: What is the added value (if any) of the reverse mentoring model to the overall project team effectiveness in construction projects & how (if possible) it can be achieved?

The main research question was broken down into five sub-questions, meaning that by answering each one of them the main research question is successfully tackled. Thus, in the current paragraph, the answers of the five sub-questions are provided first, while their collective answer to the main research question follows.

Sub-question 1: What is the possible link between reverse mentoring and construction project team effectiveness based on literature?

After conducting a thorough review of reverse mentoring academic's and practitioners' literature, the main benefits of the model within firms were recognized for both reverse mentoring participants and the organization as a whole (see tables 2.2 & 2.3). At the same time fifteen main elements of highly effective construction project teams were identified based on construction project teams' literature (see table 3.4). What was interesting about those results, is that the benefits of reverse mentoring, however at firms' level, seemed to have a positive influence on a series of

different project team effectiveness factors. Therefore, a tentative link was established between the nine out of fifteen factors. That link can be seen in figure 6.1, including also some of the reverse mentoring benefits that led us to this tentatively established link. We use the term "tentative", since the reverse mentoring benefits found in literature concern companies and not projects.

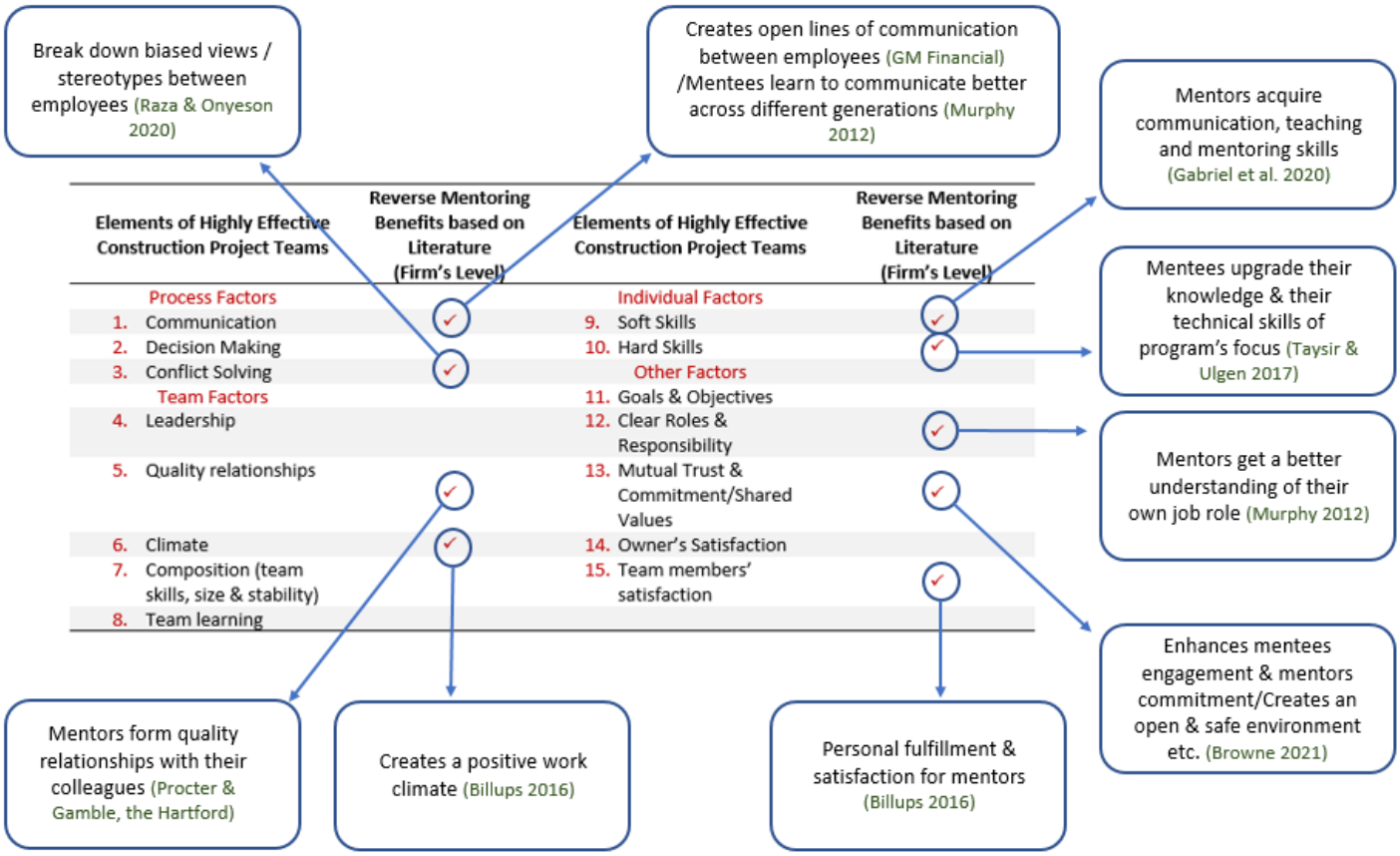

Figure 6.1: Tentatively established link between reverse mentoring and construction project team effectiveness based on literature

Sub-question 2: How can the reverse mentoring concept be conceptualized based on literature and therefore within organizations?

The purpose of reverse mentoring has shifted over the years from a tool that solely attempts to transfer technological knowledge from young employees to the older ones, to an innovative process which expands its use into the address of modern workplace problems, like organizational issues on diversity and inclusion, that most today's companies are facing. This happens, since the model is disconnected with the age difference between the participants and also takes place on the basis of either a power or a position difference between them. As far as the knowledge and information transfer from the mentor to mentee is concerned, although it might start as a one-way direction, it ends up as a two way, something which leads to the experience of the true reverse mentoring results not only at participants' level but at organization's level as well. Therefore, reverse mentoring should be perceived as a reciprocal tool for information exchange between the participants. An alternative way of describing this relationship and thus the mutual exchange between the reverse mentoring participants is offered by some studies on the basis of two well-established theories, the social exchange theory (SET) and the leader-member exchange theory (LMX). Specifically, those studies are using SET to describe the process that both mentors (subordinates) and mentees (superiors) go through in order to either enter or terminate a reverse mentoring relationship, while LMX is used for explaining the exchange quality of the formed dyads, with the exception of role reversal, since the subordinates are those who are taking over the role of mentors, with the superiors acting as mentees (see figure 2.1).

Sub-question 3: How can the reverse mentoring concept be conceptualized based on practitioners' stories and therefore within construction projects?

The concept within construction projects, more or less, can be perceived in the same way that is done within companies. The main purpose of reverse mentoring in projects seems to be related to the digital turn in construction, resulting in either faster solutions by taking advantage of the new technology's strengths, like adopting automated solutions with programming, or more effective procedural stuff, like adopting better word and excel formats. However, reverse mentoring can extend its use to other areas, addressing crucial issues within projects, like the leaders' leadership style, the decision making on technical solutions and corrective actions as well as the conflict management. It is also worth noting here that just like in literature, the concept within construction projects should be perceived as a reciprocal tool which finally works as a two-way interaction between the participants, disconnected with age but with the superiors' vulnerability being crucial. The only significant difference compared to literature is related to the way the reverse mentoring relationship between participants is structured, since it is formed on the basis of a spontaneous process. It is believed that the extreme time pressure of the project teams for meeting the deadlines along with the fact that most team leaders' focus is solely on tasks and not on people, doesn't leave enough room for cultivating a feedback culture within the project teams. As a result, major problems have to be appeared first and therefore either the team leader or the team member should take the initiative and enter into a deeper reverse mentoring process of information exchange that would exceed the daily or weekly meetings which concern only the typical discussion about the works' progress.

Sub-question 4: Why do we need (if it is needed) reverse mentoring, based on practitioners' view – What is the link with team effectiveness (If any)?

Based on the interviewees' experiences and perceptions about reverse mentoring in construction projects, twelve different benefits were recognized for either team members or team leaders or for the whole project team (see table 6.1). The team leaders' humility benefit is the most interesting one, since it has never been perceived as a benefit of reverse mentoring in literature. It seems that reverse mentoring offers the opportunity to team leaders to better understand their own self in terms of weaknesses and therefore become more open to acquire new learning from others.

Positively Affected Factors by Reverse Mentoring	
1. Conflict Solving	7. Commitment
2. Soft Skills	8. Team Composition
3. Quality Relationships	9. Project Goals
4. Communication	10. Leadership
5. Creativity & Innovation	11. Humility
6. Decision Making	12. Culture

Table 6.1: Overall benefits of reverse mentoring in construction projects

In the present study, it was also identified that the above benefits seem to positively influence the nine out of fifteen, recognized by literature, project team effectiveness factors. Therefore, the final link between reverse mentoring and project team effectiveness in construction is presented in the next table.

Elements of Highly Effective Construction Project Teams	Final Link with Reverse Mentoring	Elements of High Effective Construction Project Teams	Final Link with Reverse Mentoring
Process Factors		Individual Factors	
1. Communication	✓	9. Soft Skills	✓
2. Decision Making	✓	10. Hard Skills	×

3. Conflict Solving	✓	Other Factors	
Team Factors		11. Goals & Objectives	✓
4. Leadership	✓	12. Clear Roles & Responsibility	×
5. Quality relationships	✓	13. Mutual Trust & Commitment/Shared Values	✓
6. Climate	×	14. Owner's Satisfaction	×
7. Composition (team skills, size & stability)	✓	15. Team members' satisfaction	×
8. Team learning	×		

Table 6.2: Linkage between reverse mentoring & construction project team effectiveness

Sub-question 5: How could we lead (if possible) to a high-quality reverse mentoring relationship at project level, based on practitioners' opinions?

The fact that a reverse mentoring interaction within projects happens through a spontaneous process, where plenty of enablers need to be present at both process and participants' level (see paragraph 5.1.2) in order to finally reach a successful reverse mentoring relationship, makes us believe that some standardization is needed. Therefore, based on the conducted interviews, nine different application steps are suggested for practitioners to take into account in order to organize a more formal reverse mentoring process within projects, increasing the possibility of reaching a high-quality reverse mentoring relationship and therefore experience the most out of the model's benefits. Those application steps as well as their corresponding decisions and actions are presented in the next table.

Implementation Steps	Important Decisions & Actions
1. Sessions	a) Group sessions vs One on one sessions b) Promote a two-way interaction
2. Pairings	a) Team member's alternation in each session
3. Sessions Place	a) Everywhere but face to face
4. Participants' Commitment	a) Write down stuff – make a journal b) Establish measurements c) Be consistent d) Team leader should be really interested in the process e) Higher management involvement f) Daily reference to success reverse mentoring stories by the team leader
5. Training (for 1-1 sessions)	a) Important for one on one sessions b) Teach participants the proper way of giving feedback/conveying information
6. Trainer's Involvement (for group sessions)	a) Important for group sessions b) Teach participants the proper way of giving feedback c) Create an empathy culture between participants
7. Starting Point	a) After the team's formation, when people get to know each other
8. Ending Point	a) Keep track on your established measurements about the participants' motivation vs Until the end of the project team's mission
9. Frequency	a) Once per month – once per quarter vs Once per week – once per two weeks

Table 6.3: Reverse mentoring implementation steps and their related decisions and actions

In paragraphs 5.2 & 5.2.1, there is a detailed description about the implementation steps and their corresponding decisions and actions presented in the above table (paragraph 5.2), as well as the great extent to which these steps differ from the corresponding ones within companies (paragraph 5.2.1). Here we will briefly mention that the main differences focus on those steps that are attempting to establish the reverse mentoring relationship between the participants (Step 2: Pairings), the reverse mentoring's actual place (step 3: Sessions' Place) and the program's time duration (Step 7: Starting Point & Step 8: Ending Point). As far as the first application step is concerned, it is believed that it contains the most surprising finding that came from the interviews, differing completely from the existing literature on that topic. So, within projects it is not taken for granted that reverse mentoring should be always applied in one on one sessions. Adversely, there is also the possibility to organize group reverse mentoring sessions, including more than one pairing of superiors and subordinates, for both stimulating honesty and establishing a feedback culture within the project team.

Main Research Question: What is the added value (if any) of the reverse mentoring model to the overall project team effectiveness in construction projects & how (if possible) it can be achieved?

The added value of reverse mentoring to the overall project team effectiveness based on the conducted interviews concerns the nine out of fifteen elements of highly effective construction project teams (see table 6.2). This result means that reverse mentoring might not make a huge difference to the overall project team effectiveness that would require every project team to apply the concept, but at least it has a positive effect on the majority of the team effectiveness factors. So maybe it is upon each project team to decide on which factors they need improvement and therefore determine whether or not a reverse mentoring practice should be adopted. However, our suggestion for experiencing the most out of reverse mentoring benefits, is to formalize at some extent such a process by taking into account the application suggestions, presented in table 6.3.

6.2 Limitations

The present study has a few limitations which are listed below.

- During the theory part of the current report, fifteen main elements of highly effective construction project teams were recognized based on literature. It is possible that there could be identified more elements in construction project team effectiveness literature.
- The results of reverse mentoring in construction projects were based solely on the qualitative findings from the performed interviews since the concept has never been examined before within the project context and therefore the existing literature could not add any further information.
- Due to time constraint, fifteen 1-hr interviews were conducted with different people who were actively involved in different construction projects. In case more interviews were conducted, maybe more data could be gathered in terms of new experiences and perspectives about reverse mentoring in construction projects.
- Due to the fact that the current study was not conducted in collaboration with a construction company it was not possible to validate our findings by implementing the model in practice.

6.3 Recommendations

In this paragraph some recommendations for further research are going to be presented.

- First of all, an empirical study that would apply the model in practice within a project team in construction, by making use of our findings would possibly add new insights about reverse mentoring for team effectiveness in construction projects. Specifically, it might offer new findings in terms of new links between reverse mentoring

and project team effectiveness while at the same time the implementation steps could be corrected or differentiated to some extent.

- The fact that reverse mentoring was examined by interviewing participants who belonged in two opposite cultural national societies, meaning Greece and the Netherlands, helped us to tentatively observe that subordinates from Dutch companies did not feel much of hierarchy within their project teams, so it was easy for them to speak up to their bosses, something which was not the case for Greek team members. Therefore this prompts us to tentatively conclude that the more hierarchy within a project team, the bigger the need for implementing the model but the harder it would be. Therefore, we believe that it is a hypothesis that is worth further exploration.
- Finally, because of the fact that the interviewees were coming from both the design and the construction phase of projects, it was tentatively observed that there is a substantial difference in the degree that people responded to the questions. Specifically, construction managers working in the field were more open to talk about their personal experiences and discuss in depth the importance of an essential interaction with their colleagues. On the other hand, managers who were mainly structural designers were hesitant to recite their experiences in depth and talk extensively about possible new processes. What is more interesting is the fact that from their point of view, the importance of the technical knowledge of their colleagues outweighed by far the need for communication in the realization of a project. Since the reverse mentoring model is based largely not only on the communicational skills of the people that are involved but also on their eagerness to try something new and be open to discuss how possible new ideas can be accomplished, here a distinction might be useful to be made. It might be the case that the reverse mentoring model is more realistic for engineers working in the field. It is possibly their social skills that have been developed through their years of experience due to the nature of their job that has made them more suitable candidates for such a model to be tried on. Therefore, that is another tentative hypothesis that calls for further research.

References

Academic Literature

[1] *Alharbi, M. A. B. (2022). Factors influencing project team effectiveness to achieve quality of building projects in the kingdom of Saudi Arabia (Doctoral dissertation, Queensland University of Technology).*

[2] *Alvarez, D. M., Blair, K., Monske, E., & Wolf, A. (2005). Team models in online course development: A unit-specific approach. Journal of Educational Technology & Society, 8(3), 176-186.*

[3] *Azmy, N. (2012). The role of team effectiveness in construction project teams and project performance. Iowa State University.*

[4] *Blau, P. (1964). Power and exchange in social life.*

[5] *Boysen, P. G., Daste, L., & Northern, T. (2016). Multigenerational challenges and the future of graduate medical education. Ochsner Journal, 16(1), 101-107.*

[6] *Brinkmann, S., & Kvale, S. (2018). Doing interviews (Vol. 2). Sage.*

[7] *Browne, I. (2021). Exploring Reverse Mentoring;" Win-Win" Relationships in The Multi-Generational Workplace. International Journal of Evidence Based Coaching & Mentoring, 15.*

[8] *Chaudhuri, S. (2019). Perspectives in HRD—Reverse mentoring: Hallmarks for implementing an intergenerational intervention. New Horizons in Adult Education and Human Resource Development, 31(3), 65-71.*

[9] *Chaudhuri, S., & Ghosh, R. (2012). Reverse mentoring: A social exchange tool for keeping the boomers engaged and millennials committed. Human resource development review, 11(1), 55-76.*

[10] *Chaudhuri, S., Park, S., & Johnson, K. R. (2021). Engagement, inclusion, knowledge sharing, and talent development: is reverse mentoring a panacea to all? Findings from literature review. European Journal of Training and Development, 46(5/6), 468-483.*

[11] *Chen, Y. C. (2013). Effect of reverse mentoring on traditional mentoring functions. Leadership and Management in Engineering, 13(3), 199-208.*

[12] *Chen, Y. C. (2014). Examining traditional mentoring functioning scale considering reverse mentoring and the work characteristics of millennials. International Journal of Technology, Policy and Management, 14(3), 205-219.*

[13] *Chiu, C. Y., Balkundi, P., Owens, B. P., & Tesluk, P. E. (2022). Shaping positive and negative ties to improve team effectiveness: The roles of leader humility and team helping norms. Human relations, 75(3), 502-531.*

[14] *Cismaru, L., & Iunius, R. (2019). Bridging the generational gap in the hospitality industry: Reverse mentoring—an innovative talent management practice for present and future generations of employees. Sustainability, 12(1), 263.*

[15] *Clarke, A. J., Burgess, A., van Diggele, C., & Mellis, C. (2019). The role of reverse mentoring in medical education: current insights. Advances in medical education and practice, 10, 693.*

[16] *Cotugna, N., & Vickery, C. E. (1998). Reverse mentoring: A twist to teaching technology. Journal of the Academy of Nutrition and Dietetics, 98(10), 1166.*

[17] *Daniel Smith CMA, C. P. A. (2013). Reverse men toring-something for everyone!. Strategic Finance, 94(10), 21.*

[18] *Gabriel, A. G., Alcantara, G. M., & Alvarez, J. D. (2020). How do millennial managers lead older employees? The Philippine workplace experience. Sage Open, 10(1), 2158244020914651.*

[19] *Gadomska-Lila, K. (2020). Effectiveness of reverse mentoring in creating intergenerational relationships. Journal of Organizational Change Management.*

[20] *Güğerçin, U. (2017, November). Leveraging the differences: A case of reverse mentoring. In Proceedings of the 11th International Management Conference "The Role of Management in the Economic Paradigm of the XXIst Century", Bucharest, Romania (pp. 2-4).*

[21] *Harrison, A. E. (2017). Exploring millennial leadership development: An evidence assessment of information communication technology and reverse mentoring competencies. Case Studies in Business and Management, 4(1), 25.*

[22] *Hechl, C. (2017). Affective commitment to organizations: a comparison study of reverse mentoring versus traditional mentoring among millennials. Binus Business Review, 8(2), 157-165.*

[23] *Henderson, S., & Walkinshaw, O. (2002). Command team assessment: Principles, guidance and observations. Unpublished report. QinetiQ, Fort Halstead.*

[24] *HLM Bakker, JP de Kleijn (2018). Projects & People: Mastering Success*

[25] *Hofstede, G., Hofstede, G. J., & Minkov, M. (2005). Cultures and organizations: Software of the mind (Vol. 2). New York: Mcgraw-hill.*

[26] *Jensen, A., Thuesen, C., & Geraldi, J. (2016). The projectification of everything: Projects as a human condition. Project Management Journal, 47(3), 21-34.*

[27] *Katzenback, J. R., and Smith, D. K. (2003). The wisdom of teams. Harvard Business School Press, Boston. Harper Business Essentials, New York, 320*

[28] *KELEŞ TAYŞİR, N., & ÜLGEN, B. (2017). " Reverse Mentoring" Designs of Banking Sector in Turkey. Journal of Administrative Sciences/Yonetim Bilimleri Dergisi, 15(29).*

[29] *Khattak, S. R., Rahman, S. U., Zafar Saleem, M. F., Fayaz, M., & Iqbal, K. (2021). Reverse Mentoring: Improving Technological Skills of Older Peers: A Moderated Mediation Approach. Multicultural Education, 7(4).*

[30] *Kram, K. E. (1983). Phases of the mentor relationship. Academy of Management journal, 26(4), 608-625.*

[31] *Lawrence, T. M. (2017). Reverse Mentoring Literature Review: Valuing Diverse Generations' Contributions to Future Successes. Proceedings of the Northeast Business & Economics Association.*

[32] *Leedahl, S. N., Brasher, M. S., Estus, E., Breck, B. M., Dennis, C. B., & Clark, S. C. (2019). Implementing an interdisciplinary intergenerational program using the Cyber Seniors® reverse mentoring model within higher education. Gerontology & geriatrics education, 40(1), 71-89.*

[33] *Madison, E. (2019). Piloting journalistic learning in a rural Trump-supportive community: A reverse mentorship approach. Journal of Media Literacy Education, 11(3), 49-60.*

[34] *MAKHUBELE, L. M., & KEKWALETSWE, R. Knowledge sharing in Information Systems Development Projects: a Social Exchange Theory Perspective.*

[35] *Marcinkus Murphy, W. (2012). Reverse mentoring at work: Fostering cross-generational learning and developing millennial leaders. Human Resource Management, 51(4), 549-573.*

[36] *Maxwell, J. A. (2012). Qualitative research design: An interactive approach. Sage publications.*

[37] *Murphy, J., & Adams, A. (2005). Exploring the benefits of user education: a review of three case studies. Health Information & Libraries Journal, 22, 45-58.*

[38] *Ong, E. M. S. (2008). Trust, Commitment, Satisfaction and Learning in Construction Project Teams (Doctoral dissertation, UNSW Sydney).*

[39] *Parker, G. M. (2003). Cross-functional teams: Working with allies, enemies, and other strangers. John Wiley & Sons.*

[40] *Paulus, P. (2000). Groups, teams, and creativity: The creative potential of idea-generating groups. Applied psychology, 49(2), 237-262.*

[41] *Peterson, C., & Ramsay, D. (2021). Reducing the gap! Reciprocal mentoring between Black, Asian and minority ethnic (BAME) students and senior leaders at the University of Gloucestershire. Perspectives: Policy and Practice in Higher Education, 25(1), 34-39.*

[42] *Raza, A., & Onyesoh, K. (2020). Reverse mentoring for senior NHS leaders: a new type of relationship. Future Healthcare Journal, 7(1), 94.*

[43] *Stebbins, R. A. (2001). Exploratory research in the social sciences (Vol. 48). Sage.*

[44] *Tyssen, A. K., Wald, A., & Spieth, P. (2013). Leadership in temporary organizations: A review of leadership theories and a research agenda. Project Management Journal, 44(6), 52-67.*

[45] *Verschuren, P. J. M., Doorewaard, H., Poper, R., & Mellion, M. J. (2010). Designing a research project (2nd ed.). The Hague: Eleven International Publishing.*

[46] *World Economic Forum (2018:20) Shaping the Future of construction: Future scenarios and implications for the industry, March, Geneva: WEF*

Practitioners Literature

[47] *ACE (2018), Transforming the workplace: Piloting reverse mentoring*
[48] *DeAngelis, K. L. (2013). Reverse mentoring at The Hartford: cross-generational transfer of knowledge about social media. Chestnut Hill, MA: Sloan Center on Aging & Work, Boston College.*
[49] *Welch, J. (29). Leadership Secrets from Jack Welch. New York: McGrawHill.*
[50] *Welch, J., & Byrne, J. A. (2003). Jack: Straight from the gut. Business Plus.*
[51] *https://www.gmfinancial.com/en-us/company/newsroom/reverse-mentorship.html*
[52] *https://www.linkedin.com/pulse/reverse-mentoring-you-need-help-emily cosgrove/?trackingId=c0zUXjKXRz2BkHJyVMm6jA%3D%3D*
[53] *-https://flylib.com/books/en/2.125.1.63/1/*
[54] *-https://www.computerworld.com/article/2590381/coaching---the-boss.html*

Appendices

Appendix A: Semi-structured interview guide for Team Leaders

Theme 1: Interviewees Background

Suggested questions:

- Could you introduce yourself and tell me a bit about your career?
- What type of projects have you got involved in and which was your role in these projects?
- What is the project you are currently working on and what is your role?
- How long have you been functioning with the team you are currently working for?

Theme 2: Interviewees Experiences with Mentoring & Reverse Mentoring

Suggested questions:

- How are you trying to influence your team members?
- Have you ever taken something back from a subordinate?
- Were there also moments that a subordinate tried to pass on something to you but you ignored him or her?

Theme 3: Reverse Mentoring Formalization

Suggested questions:

- If we would like to formalize such a process based on your good and bad experiences with subordinates trying to pass on something to you, how would you create such a system?
- Do you think that it would be possible to be implemented in the project you are currently working on?

Theme 4: Reverse Mentoring for Team Effectiveness

Suggested questions:

- If were running such a process do you think that you could be benefited on a personal level in terms of knowledge and skills?
- How do you ensure that your project team is sufficiently effective, meaning that it is able to achieve the project goals and also that team members feel satisfaction within the team?
- Do you think that such a process would have any effect on team effectiveness?

Appendix B: Semi-structured interview guide for Team Members

Theme 1: Interviewees Background

Suggested questions:

- Could you introduce yourself and tell me a bit about your career?
- What type of projects have you got involved in and which was your role in these projects?
- What is the project you are currently working on and what is your role?
- How long have you been functioning with the team you are currently working for?

Theme 2: Interviewees Experiences with Mentoring & Reverse Mentoring

Suggested questions:

- Were there people who really influenced you throughout your career?
- Were there moments where you thought you gave something back to someone superior?
- Were there also moments that you tried to pass on something to someone superior but you felt that he or she ignored you?

Theme 3: Reverse Mentoring Formalization

Suggested questions:

- If we would like to formalize such a process based on your good and bad experiences with superiors trying to pass on something to them, how would you create such a system?
- Do you think that it would be possible to be implemented in the project you are currently working on?

Theme 4: Reverse Mentoring for Team Effectiveness

Suggested questions:

- If were running such a process do you think that you could be benefited on a personal level in terms of knowledge and skills?
- What do you think is important for a project team to be sufficiently effective, meaning that it is able to achieve the project goals and also that team members feel satisfaction within the team?
- Do you think that such a process would have any effect on team effectiveness?

Appendix C: Data analysis Example: Reverse Mentoring Benefits on Soft Skills

Phase 1: Coding Process & Thematic Analysis		**Phase 2: Narrative Analysis**
Line by Line Coding		Summaries
"what I learned from them is that If someone is sort of attacking you, don't go into the counter attack, but sort of catch the attack and bend a little backwards and then move forward. I mean not literally but with words and the actions you do." (TL1)	Team leader's communication skills improvement	*"I started talking to all the team members because I've heard some things and of course I had to do some discussions because on a personal level, there was a lot of disruption (…). There were conflicts since things didn't go as they were expected and then things escalated on a personal level. So, I started to have one on one sessions, with all the team members separately. So, I would like them to tell me what they were thinking and I chose that way of doing it because I think that people tend to talk more if they are one on one. I was also telling them; trust me, you can share with me whatever you want, since everything discussed here will stay between you and me. (…) I think that it really helped to get everybody in the right direction. What I got especially on a personal level is that, if someone is sort of attacking you, don't go into the counter attack, but sort of catch the attack and bend a little backwards and then move forward. I mean not literally but with words and the actions you do. That's what I have learnt from them. That is an important lesson that I almost use on a daily basis. There are always conflicts of interests, a lot of people in the project do not want exactly the same as you want, but you always have to keep your common goal in mind so that you can achieve a successful project.* ***That is what always helps you in your communication, even if you have a conflict or something "preliminary conflict."*** *(TL1)*
"*Then I went to my supervisor, telling him that this is not the way it should go, you should be open in your communication and just be really clear*" *(TM1)*	Team leader's lack of communication skills led to conflict creation	*the design manager, the superior, told someone about some design issues, related to the water level which was supposed to change but it might not be supposed to change, but he did not tell the whole team and finally it became like a mess. (…) I was trying to put out the fire which was not even there. Then I went to my supervisor, telling him that this is not the way it should go, you should be open in your communication and just be really clear. Therefore, he should have said to the whole team that there might be some changes but now they do not affect the design and just continue the way you are doing it. Otherwise you have people on edge. And he took that very well. He already admitted himself that he made some mistakes and even apologized for putting more work on my shoulders because he did not do his job right. However,* ***the most important thing is that we never experienced such a situation again****. (TL1)*
"this (the created conflict) happens because of the way you are communicating things." (TM3)	Team leader's lack of communication skills led to conflict creation	(…) *he also didn't understand sometimes why conflict happened around him and I explained that to him. So, this happens because of the way you are communicating things.* ***He became far more effective in meetings.*** *Also,*

		***he gave that back to me**, so we had long beach walks together and elaborated hours about situations and what could be. So, it helped us both I would say. **One of my skills I improved was not being very rigid and taking more time, letting first others speak and understanding others.** (TM3)*
"! I think that people will be scared at first, but they will really appreciate that this program is organized in a professional way, learning how you are giving your feedback, and that you immediately start doing it" (TL2)	Feedback skills improvement for team leaders and members	-
"I would be able to see which of the knowledge and information I impart, what I ask for is taken into account or not. It would help me then, in terms of how to present my reasoning, i.e. a situation, a problem, a solution so that it becomes understandable." (TM7)	Team member's communication skills improvement	-
soft factors like team members' communication skills, they play an equally important role since they facilitate the process towards establishing the team norms and values (Azmy 2012: Team Effectiveness Literature)	Soft skills factor: is one of the fifteen elements of highly effective project teams recognized in literature and thus here is used as a theme	-

Phase 3: Phase 1 + Phase 2

	Soft Skills		
	Team Member (Mentor)	*Team Leader (Mentee)*	*Project Team*
Experienced based Benefits	Communication skills improvement (TM3)	Communication skills improvement (TL1, TM1, TM3)	-
Perception based Benefits	Feedback skills improvement (TL2)	Feedback skills improvement (TL2)	-
	Communication skills improvement (TM7)	-	-