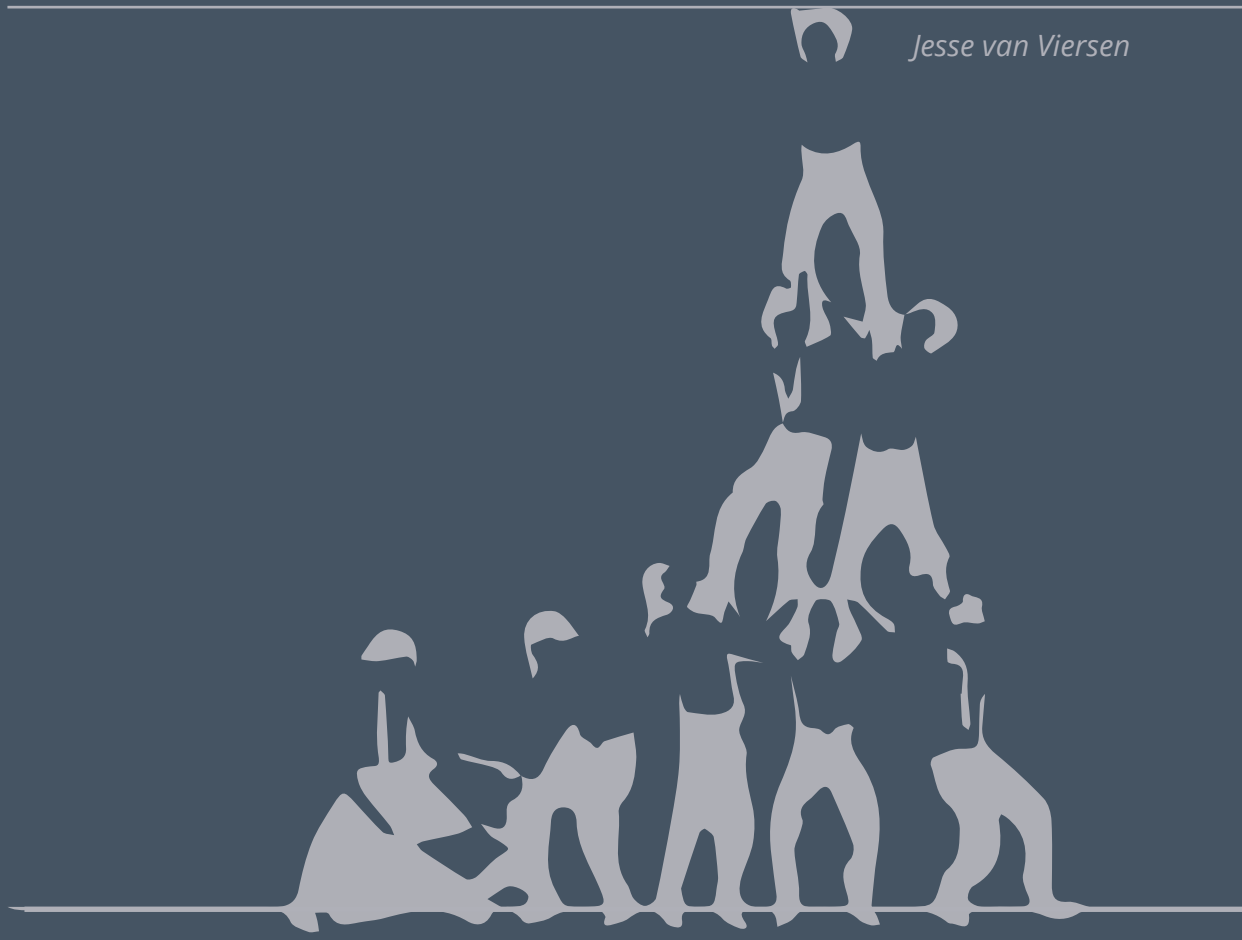
KEY FACTORS IN TEAM COLLABORATION

A QUALITATIVE STUDY TO DETERMINE THE TEAM EFFECTIVENESS OF AN INTER-ORGANIZATIONAL, INTERNATIONAL PROJECT-BASED INTEGRATED DESIGN TEAM.

Jesse van Viersen



P5 MASTER THESIS - TU DELFT

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P5 Report
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Author
Jesse van Viersen
linkedin.com/in/jesse-van-viersen-47940386

Graduation studio
Design and Construction Management

Technical University Delft
Faculty of Architecture
Management in the Built Environment
Julianalaan 134
2628BL Delft
Nederland

First mentor
ir. J.S.J. Koolwijk
J.S.J.koolwijk@tudelft.nl
Management in the Built Environment
Design & Construction Management

Second mentor
Dr. C.J. van Oel
C.J.vanoel@tudelft.nl
Management in the Built Environment
Housing management

Delegate of the board
Ir. F.R. Schnater
F.R.Schnater@tudelft.nl
Architectural Engineering + Technology
Ontwerpen van Bouwconstructies

Internship mentor
A.P.Hamel MSc MBA
p.hamel@abt.eu
Senior Advisor ABT

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Preface

PREFACE

Before you lies the result of my graduation research conducted for the master Management in the Built Environment of the Delft University of Technology. The research indicates factors that influence the collaboration between different companies collaborating towards the design of an integrated complex building project.

The main reason at the start of this research was to study “soft” skills in project management, focused on the collaboration in complicated multi-disciplinary organizations. This mainly for two reasons, the first was that the master, in my opinion, did not provide this knowledge and focused too much on the “hard” skills of project management. The second reason is my passion for team sports and the idea that I wanted to know if the things that I thought to know about “soft” skills, through team sport, could be implemented in professional teams. During the research period, I found out that even though I wanted to focus only on the “soft” skills, also “hard” skills were needed to improve the case. I am very happy with the end result and I think that the conclusions could be of very much use for comparable project-based teams and their project managers.

This all would not have been possible without the support of my family, friends and roommates, who were always providing me with the right energy and motivation to get me back on track. A special thanks to my supervisors Jelle Koolwijk and Clarine van Oel for their guidance, keeping me in the right direction, supporting me with literature and their time and patience even when I sometimes really had no idea what to do. Also a special thanks to Peter Hamel, who helped constructing the structure of my research, shared his knowledge and experience on the research topic and to guide me when I needed it. I also want to thank Jeroen van Dorst, who gave the initial idea for the research and helped me with finding my case study project, Geert van der Pas, who helped whenever I had questions concerning issues over the project team or the case.

Finally, a big thanks to all the participants of the research, the involved companies and everyone else who in some way provided me with the needed information to conduct this research.

Jesse van Viersen
Rotterdam, 2019

ABSTRACT

Aim: The aim of this thesis is to investigate team effectiveness in the field of construction. With this study, influential factors on team collaboration between different companies and within teams will be defined. By defining these factors, project managers of comparable project-based integrated design teams can improve the team collaboration within the project team and with that optimize their team's effectiveness. The research focuses on a big complex building project, which will be used as a transportation hub, in the Netherlands.

Research question: What are key factors which influence team collaboration of a project-based integrated design team in context of a large-scale complex building project, influenced by fast growth, different cultures and a changing scope?

Methodology: The factors are explored by conducting a single case study research. The starting point was a literature study towards team effectiveness. The outcome of this study was used as input for the case study research. The case study was used to collect data, the data was generated by conducting semi-structured interviews. After these interviews were conducted, observations, off the record conversations and inspection of restricted documents were used to discuss and validate conclusions.

Findings: The literature research concluded in the backbone of this research. The IMOI model of Ilgen et al. (2005), structure the inputs, mediators and outcomes of the team's effectiveness. The model is used to determine different factors that could influence the team collaboration.
The case study research determined three events which are important for the further course of the project. Due to a lack of management during these events, the client in combination with leading members of the team had to overrule the management layer.
The events; assembling the team, collaboration during the project and involving team members have to be managed with both organizational and interpersonal skills.

Limitations of the research: It is a qualitative research; therefore, the research is always subject to biased opinions and interpretations of the data. Besides that, the research is conducted on only one case and therefore not automatically representative for all comparable cases. However, the factors resulting from this study need to be kept in mind, due to the fact that it will always be factors that influence the team collaboration, not said that they have to be the most influential for every comparable project-based integrated design team.

Practical implications: The research addresses factors that affect the team collaboration of a project-based integrated design team. These factors should be taken into account when starting a comparable project team. Even though the case study of this research concluded with these factors, it is not excluded that there are more factors that influence the team collaboration of a project-based integrated design team. Therefore, more studies should be conducted in this area of research.

Scientific relevance: There are a lot of studies conducted towards the team effectiveness of composed teams, however, more research is needed to define the factors that influence the team collaboration of a project-based team. This research could be used as a starting point for further research, while it is one of the first studies conducted on a project-based team of this size and complexity, subjected to designing a big complex building project.

Keywords: Project-based integrated design team, team collaboration, team effectiveness, project management, IMOI framework.

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01

Introduction

1. INTRODUCTION

This chapter explains the background of the study. The introduction provides knowledge about the problem, aim of the research, the research question and a short introduction to the background and case study of the research. The chapter starts with the short research introduction before elaborating the problem, research aim and question more in depth.

1.1 Research introduction

The goal of this research is to optimize the team efficiency of a project-based design team. This will be done by defining the main factors that influence the collaboration within the team. This research can be used by comparable teams. The results can be implemented at the start of the project, by doing this, the team will become more effective. The research question following this goal is:

"What are **key factors** which influence **team collaboration** of a **project-based integrated design team** in context of a **large-scale complex building project**, influenced by **fast growth**, different **cultures** and a **changing scope**?"

The reason for this research is the building industry which has become more complex. The reason for this is the knowledge that has become scattered amongst specialized companies and individuals in different fields of the building industry (Edmondson & Nembhard, 2009). As a result these companies have to form partnerships in special created project design teams. According to Mathieu, Heffner and Goodwin (2000), forming teams enables a better productivity due to the possibility to share workload, monitor each other's work and contribute expertise on subtasks.
Two types of teams can be distinguished, the first, teams consisting out of homogeneous team members, with the same competencies and qualities, and secondly, teams consisting out of heterogeneous team members, a diverse team, with a mix of competencies and qualities. The preference for one of the two teams depends according to Bowers, Pharmer and Salas (2000), on the difference in task difficulty. According to them, homogeneous teams improve performance on low-difficulty tasks, while heterogeneous teams, have a better performance on high-difficulty tasks. The strength of a heterogeneous team, the diversity, is automatically also the management challenge. A diverse team brings diverse problems that have to be managed. The better these problems are processed, the better the performance of the team (McGrath, 1964).

IPO model

In order to study these problems and their effect on the team performance, McGrath (1964), created an Input-Process-Outcome (IPO) model to study performance of teams. It describes three parts; input, process and outcome, as showed in figure 1. According to the IPO model, performance of the team is dependent on three different types of input factors; organizational, team and individual, the effects of these inputs on the performance are processed by activities, which can positively or negatively influence the performance of the team (Mathieu, Maynard, Rapp, & Gilson, 2008).

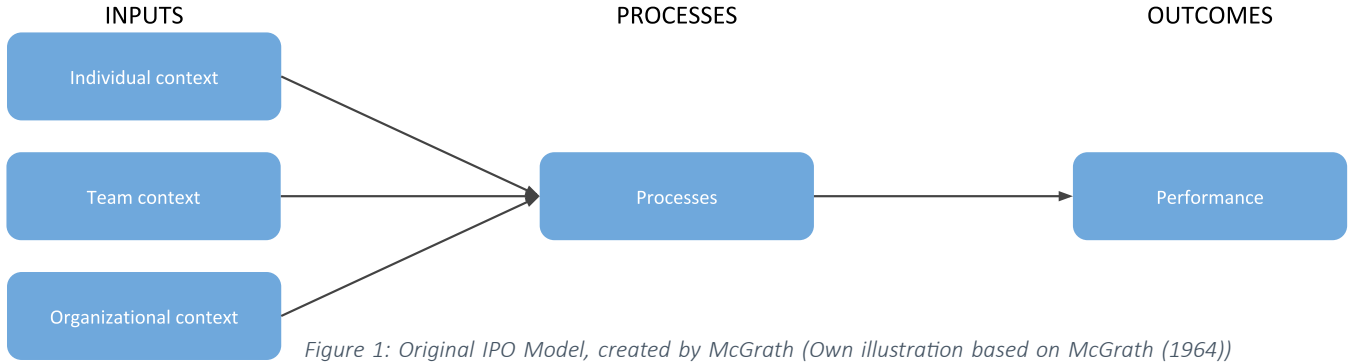

Figure 1: Original IPO Model, created by McGrath (Own illustration based on McGrath (1964))

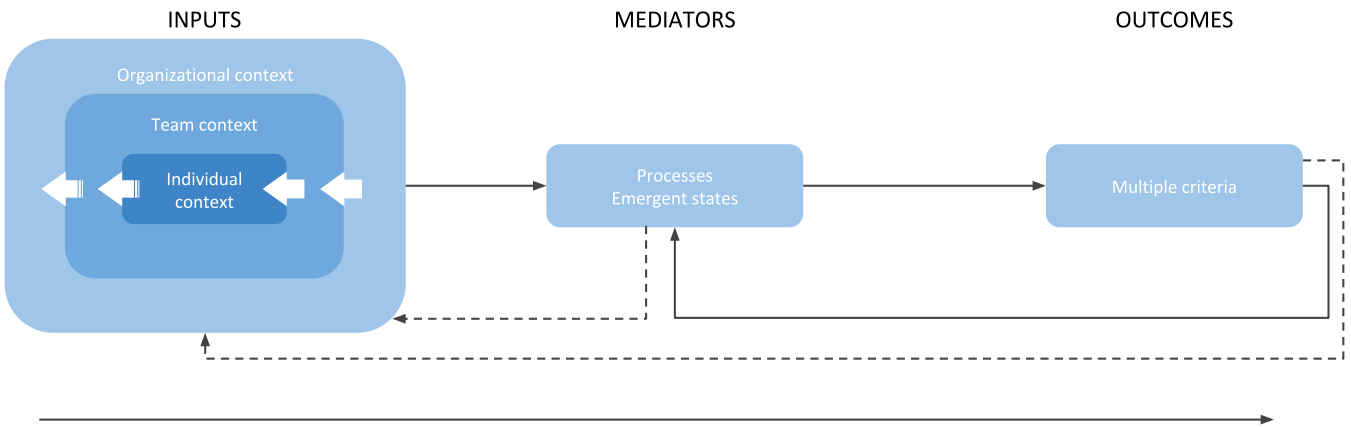

Figure 2: IMOI model, created by Ilgen, Hollenbeck, Johnson, & Jundt (Own illustration based on Ilgen et al. (2005))

IMOI model

This research will use an adapted model of the original IPO model, the Input-Mediator-Outcome-Input (IMOI) model of Ilgen, Hollenbeck, Johnson and Jundt (2005), shown in figure 2. The model combines more recent insights concerning the IPO model. According to Mathieu et al. (2008), the IMOI model takes the multilevel nature of teams into account. It arranges the three different types of inputs in shells, these shells influence each other. The highest influence is from the outer shell inward, although that also the inner shell slightly influence outward. Also, the IMOI model adds emergent states to the earlier defined processes, which results in mediating factors which influence the inputs. Ilgen et al. (2005), define emergent states as factors that are conceived as cognitive, motivational or affective states. Examples are for instance psychological safety, team climate, trust and cohesion. Besides that, the IMOI model assumes that the process through the model isn't linear but iterative, the steps in the model repeat themselves continuously, these steps will go faster, due to the fact that the team learns over time. The final modification is the outcome, where the original IPO model results in objective outcomes, like for instance time or money, the IMOI model results in subjective outcomes which can vary for different stakeholders of the project, these outcomes can for instance be feelings of team members.

Research design

The research will be a qualitative research based on a single case study. The case will be studied by a context analysis, semi-structured interviews and observations. The case is one of the largest transportation building projects in the Netherlands. The project-based design team exists out of four different companies joined in a Joint Venture (JV). Two of these companies are Dutch, two are located in Spain. Of both the countries one architectural and one engineering firm joined the JV. The complexity of the case results from the amount of smaller project teams with overlapping and conflicting goals within the team. Besides that, the project team is subject to a continuously changing environment. The team has to adapt to different cultures, a changing scope and fast growth of the team.

The research starts with a literature framework. This framework describes the potential inputs and mediators examined in earlier studies. This framework will be used as guideline for the empirical research.

1.2. Problem statement

Construction projects become much more complex. Companies in the building industry are becoming specialized in parts of the work. In order to design a complex building projects, these companies would therefore need to work together. As a result, project-based design teams are constructed. These teams are created with the single purpose of completing one assignment. To become effective as a team, the different companies have to work collaboratively to fulfill the task. Although the teams have the same goal to create the best outcome of the project, the team is most of the time subject to factors that negatively influence the collaboration. This research therefore explores which of these factors have the highest influence on the collaboration of the team.

1.3. Research aim & question

The aim of the research is to optimize the efficiency of a project-based team. The amount of collaboration within the team is one of the indicators for team efficiency. Therefore this research focusses on exploring the factors that have the most influence on the team collaboration of a project-based integrated design team. The research question that follows the aim is therefore:

"What are **key factors** which influence **team**

collaboration of a **project-based integrated design team** in context of a **large-scale complex building project**, influenced by **fast growth**, different **cultures** and a **changing scope**?"

To study these factors, the research will follow the studies of McGrath (1964) and Ilgen et al. (2005). Their studies provided models which help to examine team effectiveness. The models describe factors; inputs and processes/mediators that have an impact on the outcome of a project. By defining the most important factors, future comparable teams and project managers could create a better working environment from the start of a project. As a result, the team should become more effective.

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Methods

2. RESEARCH DESIGN

In this chapter, the qualitative research strategy, research methods and analyzation techniques for data collection and procession will be described.

2.1. Interpretive qualitative research strategy

According to Bryman (2016), this type of research is a scientific research method which uses non-numerical data to collect and analyze a research. The qualitative research strategy involves developing themes for exploration of specific experiences through text, narrative or visual-based data to understand human experience and behaviors (Given, 2008, in Jon, 2019). In order to understand earlier research towards and having a better picture of the phenomenon that has to be studied, a literature research is conducted. The empirical research follows the grounded theory approach, this approach is characterized by the continuously alternation of data collection and analyzing. After processing data, the researcher will implement the results to focus the next part of data collection. The grounded theory is based on inductive analysis, which allows research findings to emerge from frequent, dominant or significant themes inherent in raw data, without the restraints imposed by structured methodologies (Thomas, 2006).

The main data collection will be collected through semi-structured interviews, but due to the fact that during the entire time of the research I was able to observe the project team as "a fly on the wall" I more or less became part of the team. A consequence of this is that this could introduce subjectivity towards results of the data. But even though becoming part of the team could create a troubled frame of reference and could reflect a more subjective interpretation of the results, it also gave extra insights. Becoming part of the team gave access to internal documents, these became possibilities for extra study, besides that, being introduced in the team gave possibilities to start discussions with team members concerning results and conclusions that were drawn.

2.2. Single case study research design

According to Bryman (2016), a case study uses a case as an object of interest, the researcher aims to provide an in-depth examination of it. What distinguishes a case study is that the researcher is usually concerned to reveal the unique features of the case. The basic case study entails according to Bryman (2016) a detailed and intensive analysis of a single case.

Case selection

As starting point, the initial ideas for the research were shared with an engineering company, which was interested to accommodate the research among one of their projects. Due to that, the case had to be one of the projects where the company was part of. The other criteria for case selection where:

- The project team had to design a complex building project.
- The project needed to be on-going for the duration of the research.
- The project team had to exist out of multiple collaborating companies with different expertise.
- The project team had to exist of companies with different cultural backgrounds.
- Project members had to be open to the collection of data through interviews and observations.

Case description

The selected case is an ongoing big complex building project in the Netherlands. The project team exists out of four companies, two Dutch and two south European. Besides that, of both the companies there is one engineering and one architectural firm. There are three companies that are privately owned and of comparable size and a lot bigger and one state-owned. This results in a complex environment with complex organizational and contractual structures.
The case study involves the design of a large complex building project in the transportation sector in the Netherlands. The initial building needed to be designed as transit station and consisted of 100.000 m2, but this changed during the design to a hub station with an increased building surface of 20%.

Case study design

The case study starts by implementing the conducted literature research and knowledge concerning the case in semi-structured interviews. The interviews are held within the main project team, which is entrusted with the task to design the main building. Within the team, the focus lies on team members of the Dutch engineering companies, ranging from modellers to project managers. By having a wide range, data from the whole team is gathered. After processing and concluding the data from the semi-structured interviews these data is tested with "fly on the wall" observations, internal documents and by sudden and unprepared discussions with team members. These observations will lead to discussions on the conclusions which will be used to create lessons learned from the case in the form of influential factors on team collaboration.

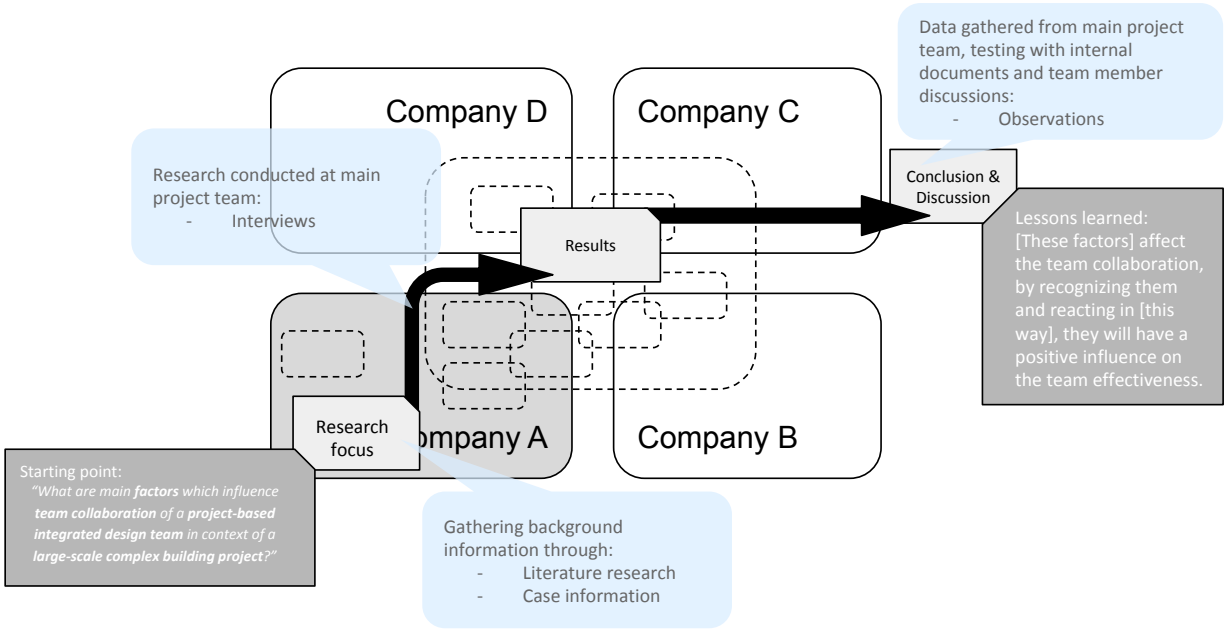


Figure 3: Case study design (own figure)

3. RESEARCH METHODS

Research methods are techniques that are used to collect data (Bryman, 2016). For this research three different types of methods will be used, literature study, context analysis, semi-structured interviews and “fly on the wall” observations and objective data processing. The use and selection of the different methods will be explained hereafter.

3.1. Literature study

A literature study is conducted to give the background of the research and to frame the interpretation of the research. The literature study is needed to identify the current knowledge about the subject. The conducted literature study was focused on theory about; collaboration, cohesion, team, group and building management theory. The final result of the literature study gave insight in current knowledge about the known factors that could influence team effectiveness. These factors are generalized in the IMOI framework of Ilgen et al. (2005). The final results will be used as input for the empirical research and as comparison with the final results of the research.

3.2. Context analysis

The context analysis is the starting point of the empirical research, the analysis gives a description of the project’s history, stakeholders and mutual relationships between them. It gives insight in the context in which the project team is working. The context analysis gives background to the behavior of different stakeholders.
The context analysis includes a project introduction, timeline organizational charts and a chart that shows the relationship and information exchange between the organization and the client. The information is collected through internal documents and contacting involved stakeholders.

3.3. Semi-structured interviews

A semi-structured interview gives according to Bryman (2016), more leeway to the interviewee about their way of replying. The researcher has a list of specific topics which he wants to be covered, documented in an interview guide. The questions for these topics are not as specified as in a normal interview. Besides that, the answers of the interviewee give a potential reason for questions which were not prepared upfront. During a semi-structured interview, the researcher is free to ask questions which come up during the interview. Although the researcher is free in questioning the interviewee, he or she need to ask all the questions in a similar wording from interviewee to interviewee (Bryman, 2016).

These semi-structured interviews will be held with people involved in the project-based team concerning the main building project of the case. Because the research focus on different teams within the consortium, different members from different teams will be interviewed. The interviewees range from modeller to project manager to gain the widest opinions of the project team. The focus of the interviews will lie on team members of the Dutch engineering company.

3.4. “Fly on the wall” observations

Besides semi-structured interviews, data will be generated through “fly on the wall” observations. The “fly on the wall” means that the researcher is allocated in the office of the project team during the duration of the research. Due to the fact that the researcher is located in the office, this result in a higher level of subjectivity, and although, the starting point of a researcher is always to stay objective and passive in the role he or she plays, it can sometimes be helpful to integrate within the environment. When being part of the team, the researcher will gain more insights in the way of working of the team. This will help when the researcher wants to combine the data gained from the interviews with discussions that will be held with members of the project-based team.

3.5. Data processing

The use of grounded theory prescribes processing data through the means of coding. This research made use of the data processing software Atlas.ti, with this program audio and written interviews can be coded. These codes can be used to count and group certain aspects that need to be studied. The quantitiy of the

used codes can be identified, but also co-occurrence of codes can be used to determine specific relationships between codes.
The appendix shows the quantity of each code, the co-occurrence of these codes are elaborated in the chapter case analysis.

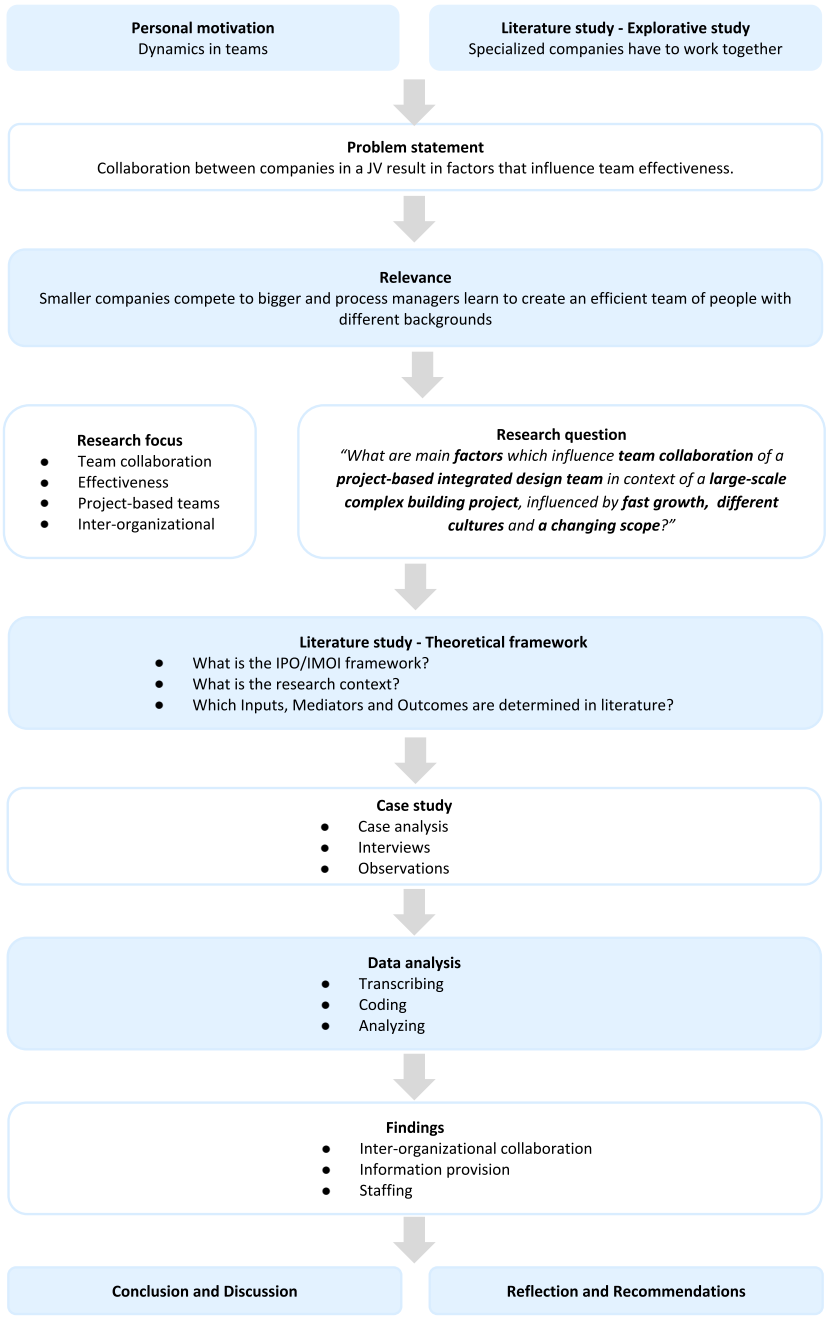


Figure 4: Research process (own illustration)

4. RESEARCH PROCESS

5. DATA ANALYSIS APPROACH

For the analysis of the case seven interviews were conducted. These interviews focused on the collaboration of the project team. Of these interviews an analysis is created to order the interviews and create findings resulting of them. To gain an overview of the interviews, the interviews have all been coded with codes that could influence the collaboration of the project team. The coded interviews together gave 50 codes, as showed in the appendix, of which five codes focus on the actors within the project team and four codes that coded examples. Besides that, one code was the code for collaboration, which naturally was coded the most. Therefore 41 topics were coded. Of these, the codes were chosen which were coded more than 25 times over all the interviews, this gave eight codes. These eight codes are shown in table 1, the table shows the co-occurrence of these codes. The table suggests two pair of highly discussed topics; information provision/communication and structure/information provision. Besides that, there are several minor discussed topics. Of these minor discussed topics, the co-occurrences with fast growth are merely notable due to the fact that fast growth has a relationship with both the topics information provision and structure, which apparently has an influence on the highly discussed topic of structure/information provision. The second remarkable side co-occurrence relationship is the fact that structure is more or less has a mediocre or high co-occurrence with four of the seven other topics, which seems to have a big impact on the overall outcome. Finally, the last unusual result is the low co-occurrence of collocating with one of the topics, collocating is known in literature to improve communication, information provision and integration of the organization. The probable reason to introduce collocating in this case would be to improve one or multiple of these factors.

Besides delving into the reciprocal co-occurrence of the topics, the code occurrence table of the topics with different actors, table 2, also suggests two pair of topic combinations; Culture/mother company and structure/management. With the mediocre combinations of communication/client information provision/client, information provision/management, structure/client and structure/mother company. As mentioned in the former paragraph, also here structure has a big co-occurrence with a lot of the actors. Besides that, the results show the high occurrence of the topics with client and management, while having a low occurrence with specialists and employees.

	BIM	Collocating	Communication	Culture	Fast growth	Info provision	Integrate	Structure
BIM	0							
Collocating	2	0						
Communication	7	9	0					
Culture	0	3	1	0				
Fast growth	0	2	3	4	0			
Info provision	7	7	22	4	11	0		
Integrate	7	7	8	4	2	5	0	
Structure	2	6	5	13	14	21	10	0

Table 1: Co-occurrence frequency of factors that influence collaboration of the case study project team.

	Client	Employees	Management	Mother company	Specialists
BIM	1	0	2	0	0
Collocating	4	0	0	2	0
Communication	12	1	3	3	1
Culture	0	6	4	21	6
Fast growth	1	5	1	2	0
Info provision	17	3	12	4	4
Integrate	4	0	2	3	2
Structure	16	2	20	11	8

Table 2: Co-occurrence frequency of factors that influence collaboration across actors.

A deeper analysis of the results by re-analysing the conducted interviews in combination with the findings of the co-occurrence table gave a few remarkable outcomes.

[Culture/mother company]
Reflecting on the collaboration between the different companies in the organization, it seems that the organization still has a divided work culture within the project team. This seems to be the result of the companies hang on to their known culture of their mother organization. The collaboration between the companies is therefore worse than could have been possible. This results in the first main factor, **Inter-organizational collaboration**.

[Information provision/communication, information provision/client, structure/client, communication/ client and information provision/management]
Reflecting on the information provision within the team there seems to be lack of information provision through communication. The different disciplines are not optimally using each other's knowledge. This shows in two ways, the first is the lack of using the co-located office, which is shown by the low co-occurrence of collocating with one of the other topics, and the second, the continuous exchange of information through the management layer, both to the client as between teams, companies and professions themselves. This results in the second factor, **Information provision**.

[Structure/information provision, structure/ management, information provision/fast growth and structure/fast growth]
Finally, the last factor deals with the fast growth of the company. As showed in the tables, fast growth is not one of the topics that has the highest co-occurrence but has a co-occurrence with the highly discussed topic structure/information provision. Fast growth seems to be a catalyst for the lack of information provision through the structure. This merely due to the impact of fast growth on the staffing in the organization. The fast growth seems to have negatively affected the structure of the organization. It seems that the organization was not prepared for the issues concerning a fast-changing workforce. These findings will be discussed as the third factor, **Staffing**.

03
Theoretical framework

6. IPO/IMOI

As described earlier, this research will build upon the team effectiveness research of McGrath (1964) and other studies which were conducted by following that research. In the research of McGrath (1964) a model is proposed which describes three parts of the process towards an effective team. The three parts together create the IPO model. Every team has to flow through the model as optimal as possible to obtain the best outcome for the project. The outcome of the project is dependent on two factors, the input and the process. Therefore, it is important for an effective team to know these different parts of the model.

According to McGrath (1964), there are three different types of inputs which are categorized in three sub-categories. These three categories are the individual, the team and the organizational inputs. The first category is individual team member characteristics. This category includes facts like competencies of members, which for instance tells something about the members knowledge and skills and how they translate this into sharing it with other team members, and their personalities, which tells something about how a team member fits in the group socially. The second category, the team-level factors, tells something about the team composition, the different companies that join the team and the size of the team, and the teams task structure, which is the extent to how clear the task is described and created for the team. And finally, the last category, organizational and contextual factors. This category gives insight in for instance the organizational complexity, the amount and interdependencies of forces that are at play within an organization, these are for instance the different types of cultures within the team and how these cultures match or don't match with each other, and the environmental complexity, the complexity created by the environment of the task which have to be fulfilled, for instance the clients specific wishes for the team, this could for instance be determined by their wish to adjust wishes during the fulfillment of tasks. These inputs together are the driving forces to the team processes.

The team processes that are described by McGrath (1964) are the teams or the team members interactions directed towards the fulfillment of the task. These processes describe how the inputs are transformed into outcomes and are therefore of importance to the effectiveness of the team (J. Mathieu et al., 2008). While inputs are a given fact, the team can become more effective by focusing on the processes during the accomplishment of the task. McIntyre and Salas (1995), define the processes in two different groups. The first group are processes focusing on task work. These processes are defined as functions that individuals need to perform to accomplish the team tasks. The second group are the processes that are focusing on teamwork, which they define as, the interaction between team members. From this foundation, (Marks et al., 2001), created another distinction in processes. These distinctions where, transition, the focus on tasks, action, the focus on task accomplishment, and finally interpersonal, the focus on social cohesion. The three concepts can also be defined as two different phases of the process with one overarching phase.

Every process starts with a transition phase, during this phase different appointments about activities such as mission analysis, planning, goal specification and strategies are created. After each transition phase an action phase starts. During this phase the team tries to carry out the predetermined appointments. To accomplish these appointments as good as possible, the team perform tasks like monitoring of the progress, monitoring and helping each other and coordinating team members. According to Marks et al. (2001), this process is an ongoing process of defining in the transition phase and executing in the action phase. This process keeps being repeated till during the transition phase the task is defined as completed. This could happen with the occurrence of only one action phase or by multiple action phases as shown in figure 6.

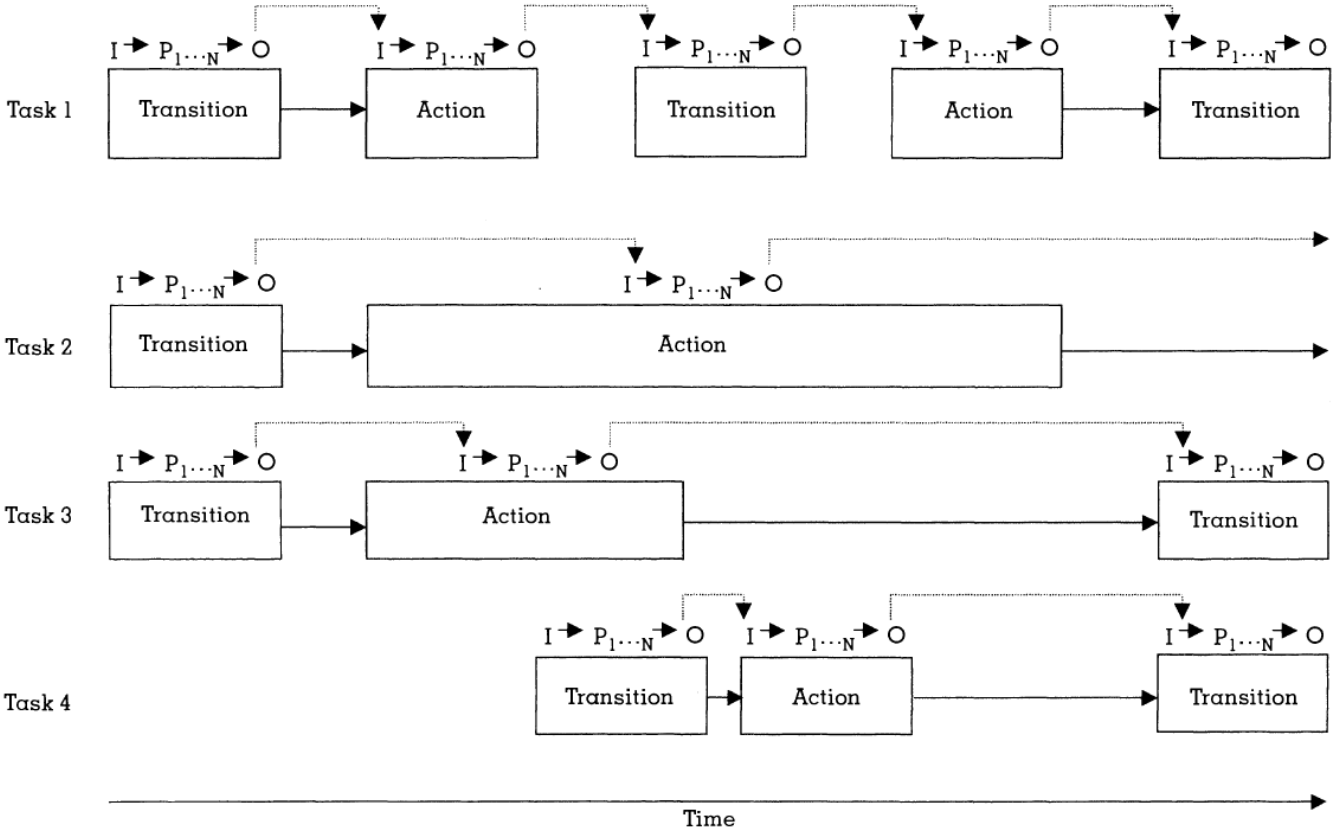


Figure 5: The rhythm of team task accomplishment (Marks et al., 2001)

During these two phases the overarching phase is the interpersonal phase. This phase makes sure that the social cohesion of the team stays intact. During the transition and action phases there will be moments which will be difficult, for instance on the relationship level between different team members or when a bad reflection on conducted work is given. During these moments it is important for the team to solve these difficulties by regulating the emotions of the team members. This will finally result in a higher productivity of the involved team members and therefore result in a more effective team.

As said earlier the inputs together with the different types of processes have an influence on the outcome of the project or task. These outcomes are a result and by-product of the team activity which are valued by one or multiple stakeholders (John E Mathieu et al., 2000). These outcomes can be defined as performances which can be measured in measurable outputs like for instance time, money and quantity. These outcomes are equal for all the different stakeholders.

As explained earlier, the research of McGrath (1964), will be used as a starting point. Since the creation of the IPO model, many other studies have used and adapted this model. The major adaptations to this model where conceptualized by Ilgen et al. (2005) in a renewed IPO model, the IMOI model. Due to the fact that this model is more up to date, this research will be built upon the IMOI model. To understand and use the IMOI model, the big adaptations in studies to the IPO model will be explained. The major adaptations to the model where the placement of the model in a larger context, adding a temporal element or the rediscovering of some subtle aspects of the model which were overlooked (J. Mathieu et al., 2008).

Ilgen et al. (2005) notified these adaptations in their study. They found and quoted: "many of the mediational factors that intervene and transmit the influence of inputs to outcomes are not processes." As examples, they referred to different studies which determined processes which did not fit the original description of processes. For instance the research of Cohen & Bailey from 1997 and the research of Marks et al. from 2001. These studies differentiated group psychological traits (Cohen & Bailey, 1997) and cognitive, motivational or affective states (Marks et al., 2001) from the processes as described by McGrath (1964), where processes involved actions of the team members. These other atypical processes were combined under the name of emergent states and later even added with blended mediators. A summary of all these different types of processes, emergent states and blended mediators can be found further in the research.

A second aspect that numerous authors emphasized where the time aspect that lacked the original IPO model. Where McGrath interpreters team effectiveness and team work in 1964 as a linear process, other authors like for instance, Ancona and Chong (1999), Marks et al. (2001) and McGrath in a later research (1991),

notify the temporal dynamics of teamwork. According to the research of Ancona, Goodman, Lawrence and Tushman (2001) and Ancona, Okhuysen and Perlow (2001), there are a number of ways to depict time. The two prominent approaches are developmental models and episodic approaches. Developmental models show how teams qualitatively change and are influenced by different factors when they progress through time, while episodic approaches, approach time as a cyclical process. During this process teams have to execute different processes at different times depending on task demands. This approach is also shown in figure 6, where Marks et al. (2001), define two different types of episodes, transition and action, which follow each other. Both these approaches are depicted in the IMOI model of Ilgen et al. (2005). The episodic approach is translated in the model through the occurrence of feedback loops. These feedback loops become relevant with the transition of one period to another and not within periods. As shown in figure 2, a differentiation in feedback loops is created by Ilgen and his colleagues (2005), where the feedback loop from outcomes to mediators is a solid line, the other feedback loops are dashed. The solid line represents an influential feedback, while the dashed lines have less influence on the earlier parts of the model. This follows from the fact that teams often adapt another mediator when the processed outcome asks for another approach. While on the other hand, the influence of the outcome or mediator, will not primarily affect the member, team or organizational inputs. The developmental model is depicted in the solid line at the bottom of the model. This line represents the developmental processes that unfold over time as the team matures.

The third adaptation of the IMOI model is to be found in the final part of the model, the outcome. Where McGrath (1964), created the model with measurable outputs as described earlier, other researchers notified that team effectiveness criteria evolved over time. Instead of one type of outcome, different forms of outcomes occurred. These new forms, like creativity or customer service, are not as easy to define in measurable outputs. Besides that, the outcomes changed from an objective output to subjective outputs, where in the IPO model the outcome was a clearly defined product; “effectiveness”, the IMOI model has changed outcome to a far more complex product. The possible outcomes will be described further on in the research.

Finally, the last big alteration from IPO to IMOI model is defined in the first part of the model. The inputs created by McGrath (1964) are three types of input, the individual, the team and the organization. These types affect the outcome through their presence, absence and how they are dealt with. In the original IPO model these inputs are separated constructs. In the IMOI model this idea is overthrown and defined as constructs which also influence each other. As shown in figure 2, the three inputs are depicted in three layers. The most inner layer, the individual context represents the individual team member characteristics. Within this layer, the different characteristics of the team members is defined, but more importantly the composition of the different team members characteristics with each other. The second layer, team context represents the team-level factors. These factors are for instance the team structure of the team, but also something like the leadership of the manager or team leader. Finally, the outer shell, organizational context, represents the organizational and contextual factors. These factors are the contexts where the team has to function within. These are both organizational factors like for instance the openness of the organization, as environmental factors like for instance cultural influences. The difference between the original model of McGrath (1964) and the adapted model of Ilgen et al. (2005) is that the renewed model notifies the influence of inputs to each other, they interact instead of being separated. According to the IMOI model, the influence works primarily from the outer shell to the inner shell, but also has a minor influence from the inner shell to the outer shell. Also, these different types of inputs will be elaborated further on in the research.

7. RESEARCH CONTEXT

7.1. Team

Distributed over thousands of different books and documents there are countless of references towards teams. There are studies focusing on influencing processes that underlie team effectiveness and understanding how they work (Kozlowski & Ilgen, 2006). There are a multiple type of teams discussed in literature, there are for instance teams who do things, who make things or who manage things. Varying from for instance project teams, executive teams or virtual teams. These teams exist out of heterogeneous or homogeneous team members (Mathieu et al., 2008).
This actually doesn't explain what a team is, in literature there are a few definitions for teams. For instance, Kozlowski and Ilgen (2006) define teams as;

"**Two or more individuals** who **socially interact**, face-to-face or virtually; **possess one or more common goals**; are brought together to perform organizationally **relevant tasks**; **exhibit interdependencies** with respect to workflow, goals, and outcomes; have **different roles and responsibilities**; and are together **embedded in an encompassing organizational system**, with **boundaries and linkages to the broader system context and task environment**".

Or a more recent definition of Chiocchio, Kelloway and Hobbs (2015), who define the team as:

"Complex open systems forming entities characterized by **two or more individuals** who exist to perform organizationally relevant tasks who **interact socially**, dynamically, recursively, adaptively and often virtually; who have **shared or common valued goals**; who hold **meaningful and high levels of task**, feedback and goal interdependencies; who are often hierarchically structured; whose group has a limited life span; whose **expertise, roles and responsibilities are distributed** and who are bounded by and **embedded within an organizational/environmental context that sets top-down constraints** and that influences and is influenced by bottom-up phenomena occurring over time and enacted by competencies and processes, emergent cognitive and affective states, performance outcomes, exchanges with other teams, and stakeholder judgments of team member and team effectiveness".

What these definitions have in common is that the teams are two or more individuals who are socially interacting, in every possible way, virtually or face-to-face. They interact to determine or solve their common goal or goals by performing relevant tasks. The members are interdependent, due to the fact that their tasks, roles and responsibilities are distributed among them. The team is installed within a bigger organizational system that gives the team area to act within certain boundaries.

7.2. Project team

Within teams as explained in the last section, a distinction can be made between different types of teams. One of these teams is the project team; a team which **unites people** with **varied knowledge, expertise and experience** who, within the **life span of the project** but over long work cycles, must **acquire and pool large amounts of information** in order to define or clarify their purpose, **adapt or create** the means to progressively elaborate an incrementally or radically **new concept, service, product, activity**, or more generally, to generate change (Chiocchio et al., 2015).

The difference between this definition of a project team and the combined definition of a team as pointed out in the previous section is the fact that the project team is focused on the variety of knowledge, expertise and experience that have to be brought together. This needs to be done to acquire large amounts of information to adapt or create a new concept, service, product or activity. And finally, this has to be done within the life span of the project.

7.3. Project-based integrated team

A project-based integrated team is a type of project team, it is like a project team structured around one particular project and has team members with different backgrounds, which range from different disciplines, companies or even countries. The members of the team are interdependent and therefore have to collaborate

with each other to achieve a common goal. These teams are led by one or multiple project managers, which results into a new hierarchical structure within the structure of a company or companies. In the case of multiple companies that engage in the project-based team, a contract is created which binds the companies together for the length of the project which the team is created for.

The result is that within the hierarchical structure of a company a new hierarchical structure arises, as showed in figure 7. The essential company functions are kept within the main hierarchical structure, which lead to different executives for different issues. There's a leading manager for project related work and company related issues are processed within the main management structure.

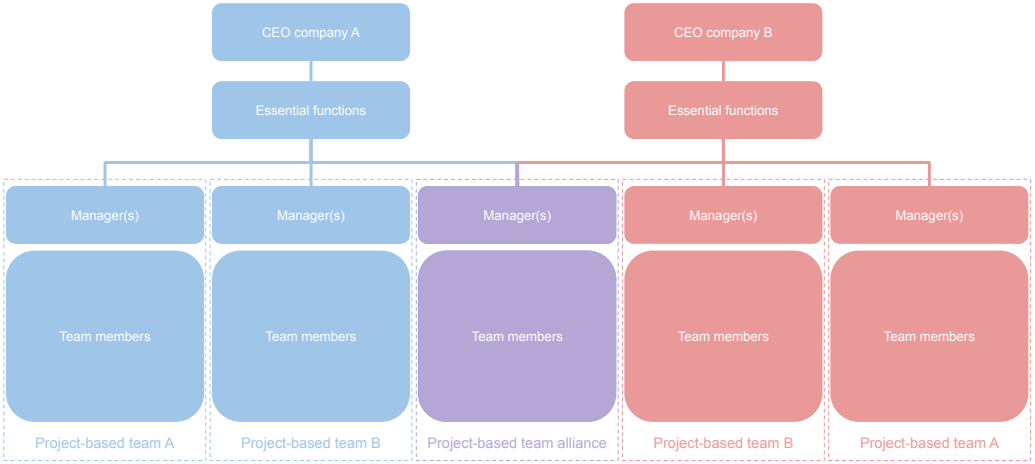


Figure 6: Project-based team structure (own figure)

8. THE IMOI MODEL

8.1. Inputs

As explained earlier, the measurement output and mediators are influenced by one or multiple of the three possible inputs, team member characteristics, team-level factors and organizational and contextual factors. Earlier research has conducted studies towards these inputs. As explained earlier the inputs affect both the other parts of the IMOI model as each other. The major effect works from outer shell, the organization towards the inner shell, the individual. This chapter summarizes these studies by their umbrella construct in order of inner to outer shell

8.1.1. Team member characteristics

This part of the literature study focuses on aspects of team members and their impact on mediators and outcomes. Instead of focusing only on the characteristics of individuals, the main influence is the composition of the different individual characteristics.

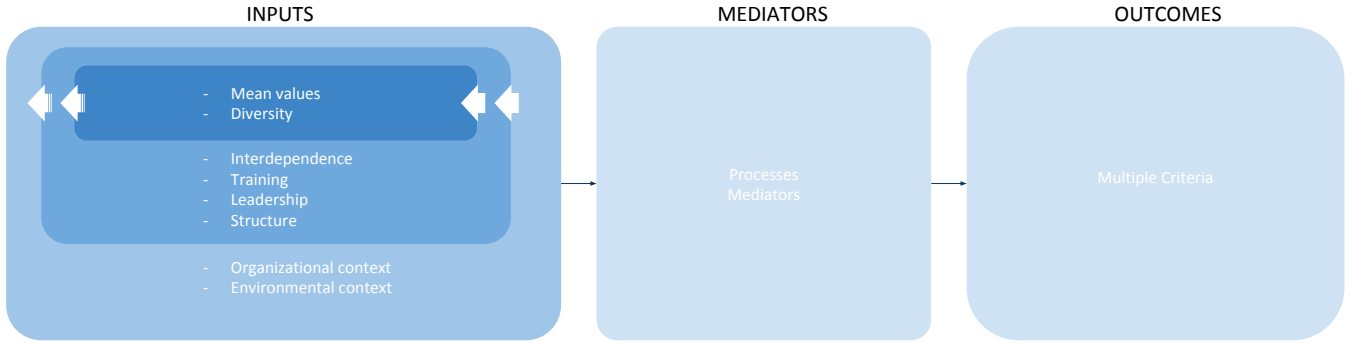


Figure 7: Inputs defined in literature, illustration based on IMOI model of Ilgen et al. (2005), inputs defined by Mathieu et al. (2008)

This part of the research therefore explains how to compose the individuals according to different principles, mean values, diversity and complex combinations.

Mean values

Mean values measure the combination of different members characteristics through the pooled value of a characteristic. With this measurement, an average is taken over the number of members who possess a certain characteristic (Barrick, Stewart, Neubert, & Mount, 1998; Stewart, 2006). Characteristics that are measured through mean values are explained hereafter.

Personality

Originally the most studied personality factors consisted out of the "Big five" of personality traits, these traits were; openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. More recent research has enlarged the range of traits with; achievement orientation, dependability, assertiveness and locus of control (Boone, Van Olffen, Van Witteloostuijn, & De Brabander, 2004; LePine, 2003; Pearsall & Ellis, 2006).

- **Openness to experience:** Curious, imaginative, insightful, original and broad-minded.
- **Conscientiousness:** Careful, thorough, responsible, organized and self-disciplined.
- **Extraversion:** Talkative, sociable, cheerful and active.
- **Agreeableness:** Altruistic, caring, kind, supportive and sympathetic.
- **Neuroticism:** Anxious, worried, insecure and emotionally unstable.
- **Achievement orientation:** How tasks are interpreted and reacted upon.
- **Dependability:** Being able to be counted upon.
- **Assertiveness:** The quality of being self-assured and confident without being aggressive.
- **Locus of control:** degree to which people believe to have control over the outcome of events.

Besides increasing the original personality traits, research teaches the complex dynamics of these different factors, for instance the following resulted

(Bell, 2007; Halfhill, Sundstrom, Lahner, Calderone, & Nielsen, 2005):

- A combination of high levels of *conscientiousness* and *agreeableness* within a team results in the highest levels of performance.
- An average team *conscientiousness, agreeableness, extraversion, emotional stability* and *openness to experience* relate positive to field setting performance.
- High levels of agreeableness resulted in teams that were not competent in team learning.

Competencies

Working in teams demand different knowledge, skills and abilities (KSAs) than working as an individual. For effective performance in team settings a special set of KSAs is needed (Morgeson, Reider, & Campion, 2005). The functional amount of cognitive ability (learning and problem solving) in the team predicts team performance. This relationship is more noticeable to teams that perform intellectual and decision-making tasks than teams that perform physical tasks. This is even more important for teams that perform their task over time (Mathieu & Schulze, 2006).

Diversity

Diversity is the construct that copes with the heterogeneity of the team member characteristics of the team. Studies have created different opinions about diversity in the team. In some cases, diversity can be beneficial to the effectiveness of the team, but on the other hand also detrimental to the outcome. There are also studies that don't notice the impact of diversity on the outcome. Due to the undefined and different results of the studies, this chapter will not further elaborate on the diversity in demographic, functional, personality and attitudes.

8.1.2. Team-level factors

Throughout studies over time, a big number of researches consisting team-level factors are published. Like other parts of the literature study for this research, this research will focus on four important factors as described by Mathieu et al. (2008). The four factors are; interdependence, training, leadership and team structure. In their review, Mathieu et al. (2008) also notify virtuality as a factor, this factor is not taken into account. The reason is the unimportance for this study, the investigated team is working mainly in the same office and is therefore not a virtual team. There is always a virtual working environment, but the degree of cooperating in that environment versus the degree of cooperating and meeting in the office is almost nothing.

Interdependence

Interdependence, the extent to which team members cooperate and work interactively to complete tasks (Stewart & Barrick, 2000), could potentially be an informative way to characterize teams in their type and degree of interdependence. The different types of interdependence can be characterized by their impact on processes and effectiveness (Guzzo & Shea, 1992). Therefore, the three primary types of interdependence are input, process and outcome interdependence.

Input interdependence is dependent on the individual skill sets of team members and the degree to which they have to share resources and technologies. Process interdependence is dependent on the way in which work is structured (Wageman, 1995). Outcome interdependence depends on the motivation of the group through linking individual feedback and rewards to the group's performance (Campion, Medsker, & Higgs, 1993).

Besides the three primary types, research has also determined the importance of the manner in which interdependence is conceptualized (Mathieu et al., 2008). For instance, the type of task affects the relationship of interdependence with performance. For conceptual tasks, the relationship of interdependence with performance could be described as a U-shaped relationship (Stewart & Barrick, 2000), while for behavioral tasks, the relationship was exactly the opposite, an inverted U-shape (McGrath, 1984).

Training

Training is a highly emphasized concept used within organizational improvements. The training refers to systematic, planned intervention aimed at facilitating the development of job-related knowledge, skills and abilities (Goldstein, 1992). Studies towards this concept have shown a small to moderate correlation between the use of team training principles and performance increase. The type of training that had the highest influence on team performance in comparison to guided team self-correction and cross-training interventions, was the training focused on adaptive team mechanisms (Eduardo Salas, Nichols, & Driskell, 2007).

Team training consists of different aspects which has to be taken into account when incorporated within the team. For instance, the composition individual or team and how to train the team, face-to-face or computer steered. There's little empirical evidence

towards the desired composition of the training and which benefits both the types have. But although there is low evidence, most researchers agree that individual training gives better results when focused on developing task-related skills (Dyer, 1984), while team training is better to develop behaviors and attitudes for effective team functioning (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). The desired way of training is also dependent on what to train. The commonly used face-to-face training is not always the best solution, computer steered training is upcoming due to the higher flexibility and lower cost.

Leadership

Research has divided three types of leadership; external leadership, coaching and shared leadership. The three types all have their reasons why it should be incorporated in the team.

External leadership is the traditional approach towards leadership. It contains a leader who is responsible for and has the authority over the team's performance. It has a positive influence on realizing team affective and behavior-based outcomes. The external leaders are valuable because they guide the creation of the team's vision, are the coordinators of operations and the connection with other teams and management. Burke et al. (2006), defined the tasks of the external leader in person-focused and task-focused, which both had a positive relationship towards team effectiveness (person-focused) and team performance (task-focused).

Coaching refers to "direct interaction with a team intended to help members make coordinated and task-appropriate use of their collective resources in accomplishing the teams' work" (Hackman & Wageman, 2005). There is no overall conclusion between the relationship of coaching with team performance, some studies show a positive influence, while others show no influence. But there is a positive relationship between coaching and self-management, team member relationship quality, member satisfaction, team empowerment and psychological safety (A. Edmondson, 1999; Wageman, 2001).

Shared leadership is leadership which is distributed among multiple team members instead of derived from one single, formal leader. This leadership is not a top-down process, but emerges from the team members collective knowledge, skills and abilities. Just like coaching, there is no overall conclusion about the relationship of shared leadership with team performance. For instance, Ensley, Hmieleski and Pearce (2006) find a positive relationship, while others like Mehra, Smith, Dixon and Robertson (2006) found that this type did not necessarily benefit performance. There are conditions under which shared leadership could be most effective, for instance, the effect of shared leadership is highest when other team members also have high levels of leadership influence (Taggar, Hackew, & Saha, 1999).

Structure

The team's structure is seen as de bridge that serves between organizational-level strategy decisions and staffing decisions (Hollenbeck et al., 2002). There are a number of different typologies of structures. For this research we consider two of them; functional and divisional departmentalization.

Functional departmentalization happens when individual members within the team are organized to the similar tasks they perform, while divisional organizes individuals based on the geographic area served and/or the specific type of product for which they are responsible. According to Ellis et al. (2003), neither of the two types offers the "best" solution in terms of an optimal balance between commonly and uniquely distributed information. A compromise structure is needed. This structure motivates members to share expertise and responsibilities. In their research Ellis et al. (2003) found out that these teams experienced significantly more learning than teams that were functionally or divisionally ordered.

8.1.3. Organizational and contextual factors

Teams operate in a context which both facilitate but also hinders their functioning. These contexts can be distinguished in either two ways, features that embed the organizational system and features that come from the larger environment outside of the organizations. Organizational context is defined by sources of influence that are external to the team yet emanate from the larger organizational system within which they are nested. The environmental context is defined by sources of influence that emanate from outside of the organization yet influence team functioning.

Organizational context

To measure the contextual factors that have influence on teams there are different possibilities. One of the possibilities is the micro-context approach, which uses the members perceptions of organizational features, without taking into account the hierarchical nesting of these teams in the context. The other way, macro-organizational is a cross-level design.

Human resource system

Through the use of the micro-context, the organizational human resource factors such like recognitions and rewards and training systems are measured, which have a direct and indirect effect on the group effectiveness (Hyatt & Ruddy, 1997), also team-based human resource policies are measured in this way and relate positively to team empowerment (B.L. Kirkman & Rosen, 1999).

On the other hand, the macro-organizational approach, showed that team learning for multinational corporations could work both negatively and positively. Negatively for globally integrated team learning and positive to local responsiveness team learning. Also, team learning related positive to team performance rated externally and to interpersonal relations (Zellmer-Bruhn & Gibson, 2006).

Openness climate

According to Lawler (1993), employee involvement is the key ingredient of successful organizational designs. Top management has to sculpt a vision, implement various structures, rewards and create a climate that is supportive to the employee involvement and teamwork. Also, Kirkman and Rosen (1999) found a positive relationship between an open well-developed social structure and sociopolitical support with team empowerment and outcomes. Additionally, by testing the macro-organizational district-level influences, Tesluk, Vance and Mathieu (1999), found that the extent to which the climate in the team encourages participation is a function of the practices and policies that support employee involvement.

Multiteam systems coordination

Multiteam systems is a special organizational arrangement whereby teams of teams have to work collaboratively to achieve collective goals. These teams work, according to Hyatt and Ruddy (1997), more effectively when they have strong information networks along with communication and cooperation channels, within and between the teams.

Environmental context

The review of Mathieu et al. (2008), which is followed by this literature framework focuses on two main topics for environmental context. Top Management Team (TMT)-environment interface and cultural influence on teams. The first, TMT-environment interface is left out of consideration due to the type of team which will be studied. Therefore, only the topic cultural influence on teams will be elaborated.

Cultural influence on teams

Several studies tried to examine the influence of cultures on the teams. Some presumed it would be supportive, others thought not. The major issue is the type of research, there are numerous studies performed, but all on different types. Some studied the difference between groups of one culture versus groups of a different culture and their outcome based on these different cultures. The more interesting studies for this research are the studies focusing culture as team composition variable. These are elaborated under team composition effects and therefore not explained here.

	Input		Explanation	Result
Team member characteristics	Mean values	Personality	The pooled value of the different personality traits.	- Combination of high levels of *conscientiousness* and *agreeableness* within a team results in the highest levels of performance. - An average team *conscientiousness, agreeableness, extraversion, emotional stability* and *openness to experience* relate positive to field setting performance. - High levels of agreeableness resulted in teams that were not competent in team learning.
		Competencies	The pooled value of the different knowledge, skills and abilities.	The functional amount of cognitive ability (learning and problem solving) in the team predicts team performance.
	Diversity		Construct that copes with heterogeneity of the team member characteristics in the team.	Different opinions; diversity can be beneficial to the effectiveness, but also detrimental to the outcome.
Team-level factors	*Interdependence*		The extent to which team members cooperate and work interactively to complete tasks.	Type of task affects the relationship of interdependence with performance. Conceptual tasks: U-shaped relationship. Behavioural tasks: inverted U-shaped relationship.
	Training		Systematic, planned intervention aimed at facilitating the development of job-related knowledge, skills and abilities.	Increase of performance, training with the highest influence on team performance was training focused on adaptive team mechanisms
	Leadership	External	Traditional approach: a leader who is responsible for and has the authority over the team's performance.	Positive influence on realizing team affective and behaviour-based outcomes.
		Coaching	Direct interaction with a team intended to help members make coordinated and task-appropriate use of their collective resources in accomplishing the teams' work.	No overall corresponding outcome towards impact on performance.
		Shared	Leadership distributed among multiple team members instead of one formal leader.	No overall corresponding outcome towards impact on performance.
	Structure		Team structure is the bridge that serves between organizational-level strategy decisions and staffing decisions.	A combination of functional and divisional departmentalization is needed to offer the "best" solution in terms of an optimal balance between commonly and uniquely distributed information.
Organizational and contextual factors	Organizational context	Human resource system	A combination of constructs which are focused on the HR of an organization.	Team-based human resource policies relate positive to team empowerment. Team learning relates positive to team performance and interpersonal relations.
		Openness climate	An open well-developed social structure and socio-political support. The extent to which climate encourages team member participation is function of the practices and policies that support employee involvement	A positive relationship with team empowerment and outcomes.
		Multiteam systems coordination	A special organizational arrangement where teams of teams have to work collaboratively to achieve collective goals.	Works more effective when a strong information network along with communication and cooperation channels within and between the teams exist.
	Environmental context	Cultural influence on teams	The influence of a group of individuals with corresponding culture versus another group of individuals with another corresponding culture.	No defined effect, due to different types of cultural studies which don't have one corresponding outcome.

Table 3: Inputs framework

8.2. Mediators

Since the IPO model of McGrath (1964) was adapted by Ilgen et al. (2005), more researchers have begun to research the different mediating processes which explain why certain inputs give a certain effectiveness to the team. As explained earlier, the mediating principles can be distinguished into three different types of mediators. First, the team processes which played a major role in all team effectiveness models (Gist, Locke, & Taylor, 1987; Guzzo & Shea, 1992). Secondly, Emergent states, which are the dynamic processes that vary as function of team context, inputs, processes and outcomes (Marks, mathieu, & Zaccaro, 2001). And finally, there is also a small group of undefinable mediators which are combined under the name blended mediators. The three different groups will be explained with their corresponding mediators and earlier conducted research towards these mediators.

8.2.1. Team processes

Team processes are the mediators which have always played an important role in research towards team effectiveness. From the introduction of the IPO model, researchers have always used team processes as the central role in team effectiveness models. Team processes have always been categorized in two different types; “taskwork” and “teamwork”.

Taskwork describes the functions that individuals must perform to accomplish the team’s task, whereas teamwork describes the interaction between team members. Building on this knowledge, …. Developed a system which placed the different processes in one of three categories: transition, action and interpersonal. Marks et al. (2001), argued that

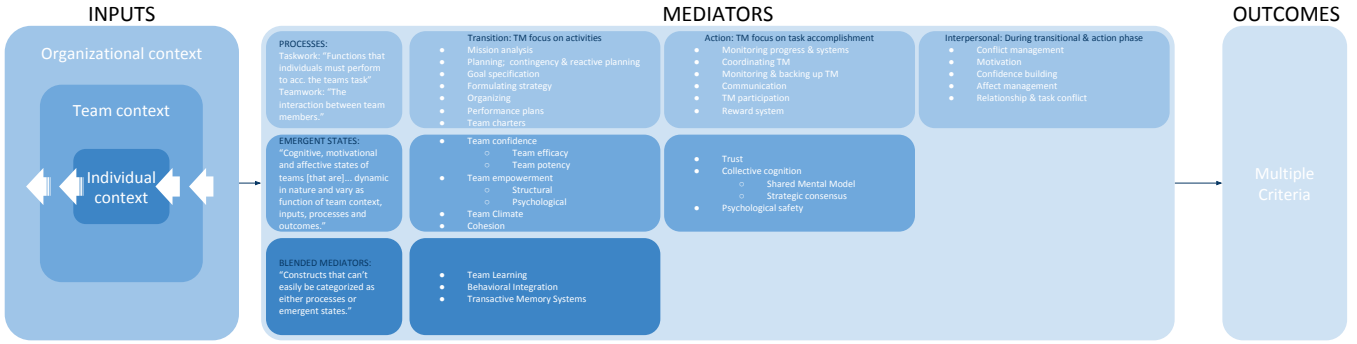


Figure 8: Mediators defined in literature, illustration based on IMOI model of Ilgen et al. (2005), mediators defined by Mathieu et al. (2008) and Marks et al. (2001)

different processes occurred during different periods of a project. Transition processes during the transition period, action processes during action phases and interpersonal processes during both the transition and action phase.

Transition

The processes categorized within the transition category, have their influence during the transition phase. This phase is the period of time when teams focus primarily on evaluation and planning activities. This phase is to guide the accomplishment of a team goal or objective. The processes: Mission analysis, Planning, Goal specification and Strategy formulation typically occur during time which is set aside for analyzation, evaluation and future directions. According to Marks et al. (2001), these processes happen for instance, during staff meetings, retreats and after-action re-views.

Mission analysis

According to Marks et al. (2001), the mission analysis is the interpretation and evaluation of the team’s mission, including identification of its main tasks as well as the operative environmental conditions and team resources available for mission execution. The interpretation of a mission works cognitively. Team members interpret their responsibilities within the boundaries of the team’s abilities, resources and time constraints. The process includes verbal discussions to ensure that all members have the same idea of the team’s purpose and objectives. (Marks et al., 2001).

Mission analysis is a blend of two focus points; backward evaluation and forward visioning. Backward evaluation includes diagnosing previous performances and interpreting the causes for success and failure. Research shows that when teams better understand underlying causes of previous performances, they can better prepare for future efforts (Blickensderfer, Cannon-Bowers, & Salas, 1997).

Forward visioning is concerned with how teams charge for the future in the context of the events that are already in progress. Teams that fail to conduct a good mission analysis will fail under changing circumstances or will operate purely in reactive mode. According to Gersick (1988), it can even become worse when teams fail to conduct a good mission analysis, they have the risk to misguide their attention and efforts until it is to late to recover.

Deliberate and contingency planning

Planning can be subcategorized into three different types of planning; deliberate, contingency and reaction planning. Deliberate and contingency planning are processes which occur during the transition phase, while reaction planning occurs during the action phase.

Deliberate planning, defined as: "the formulation and transmission of a principal course of action for mission accomplishment", is a major activity during the transition phase. The decisions which are made are based on different types of info, for instance the size of the event, amount of time and complexity, capabilities of members, the importance of a certain event and its location. Contingency planning is defined as: "the a priori formulation and transmission of alternative plans and strategy adjustments in response to anticipated changes in the performance environment". With contingency planning, the team creates an alternative course of action in case that it needs to be used. For instance, a plan has to be created in case that a team falls behind schedule. When this event occurs, the team knows how to adapt an alternative plan to get back on track. A contingency plan is a good plan as long as it rests on the "if/then" logic for different important events.

Deliberate and contingency planning are differentiated from reaction planning due to the reason that the processes of deliberate and contingency planning are aforethought processes. They are primarily a transition period activity, whereby the alternatives for the contingency planning can be adapted during the action phase.

Goal specification

Goal specification is defined as: "identification and prioritization of goals and subgoals for mission accomplishment" (Marks et al., 2001). With this process, teams develop and assign overall mission goals and subgoals. By going through this process, members know what and how much must be accomplished by a specified time and with a certain quality. The process is often in combination with the mission analysis and strategy development. In the best situation, goals are in line with the developed strategy and timeline.

However, sometimes goals also have to be (better) specified during an action phase. This is because of the team's inability to completely anticipate all possible situations. Tesluk and Mathieu (1999), give the example of a snow removal team who wanted to plow 100 percent of the highways in a day, but due to changing weather conditions or failing equipment have to re-specify the percentage of plowing for the day.

Ineffective goal specifications are poorly conceptualized, they are overly general, vague, conflicting, ambiguous, unattainable, impractical or not valued by team members. They will not stimulate effective strategies, timelines and collective activities for effective performance. If a team neglects the goal specification period entirely than it will end up with no shared understanding of the teams purpose (Marks et al., 2001).

More in: (Levine & Moreland, 1990; O'Leary-Kelly, Martocchio, & Frink, 1994)

Strategy formulation

Strategy formulation involves how team members have to achieve their missions, discussion of expectations, relay of task-related information, prioritization, role assignment and communication of plans to all team members (Stout, Cannon-Bowers, Salas, & Milanovich, 1999). And is defined as: "Development of alternative courses of action for mission accomplishment" by Marks et al. (2001).

Good strategy formulation includes considering multiple variables like: situation and time, team resources, expertise of the team members and the changing environment of the project. In the strategy formulation, the team has stated information about the members their roles and responsibilities, the order and timing of actions and how the tasks should be executed.

A poor strategy formulation occurs when the team is unable to make plans for successful goal accomplishment. The result is that the team has ineffective strategies, which makes teams completely dependent on earlier experiences or improvisations while already performing.

More in: (Weldon, Jehn, & Pradhan, 1991)

Action

The processes in the category action are processes which take place in a period of action, or the action phase. During this period of time, teams conduct activities leading directly to goal accomplishment (Marks et al., 2001). The five following processes are most common used.

Monitoring progress toward goals

According to the research of Marks et al. (2001), monitoring progress towards goals is defined as: "Tracking task and progress toward mission accomplishment, interpreting system information in terms of what needs to be accomplished for goal attainment and transmitting progress to team members". The tasks are providing feedback to the team on their path to goal accomplishment. The status

on their path has to be communicated so that the members can determine their progress and chance of success during a certain period of a given task. By reflecting, the teams can determine the difference between the goals and their current situation.
Monitoring progress is a form of self-regulation due to the fact that monitoring is not only about detecting progress, but also processing this knowledge into action whenever this is needed. This can result into team members who have to work over-time, members who know when help needs to be called in or teams that adjust their strategies or goals. Processing the knowledge is not only done by team members on their own task, but it also includes transmitting the determined progress to the team members. Statements to the team members contain information about how well the team members have implemented the task strategy, but also how the team needs to adjust their goals, plans, activities or effort level, to increase the team's effectiveness or to avoid problems. If monitoring is poorly performed, teams will drift, procrastinate or stray off their tasks. This will result in teams that lose track of their purpose for an extensive period of time. Besides that, teams will be unaware of their progress and will therefore be unable to provide themselves with the appropriate feedback.
The frequency of monitoring is varying. It depends on the type of team, some teams monitor regularly during action phases and others periodically, in that case the monitoring can happen during special transition periods especially created as progress report periods.
More in: (Jentsch, Barnett, Bowers, & Salas, 1999)

Systems monitoring

Systems monitoring relates to "Tracking team resources and environmental conditions as they relate to mission accomplishment, which involves (1) internal systems monitoring (tracking team resources such as personnel, equipment, and other information that is generated or contained within the team), and (2) environmental monitoring (tracking the environmental conditions relevant to the team)." (Marks et al., 2001). This means that effective teams monitor both their internal as external environments, by monitoring changes that occur as they perform. Internal environments that are monitored are things like equipment and resources, external environments are things like economy, news events or weather patterns. Monitoring these environments leads to situational awareness (Jentsch et al., 1999).
An effective team that has to work in a dynamic environment has to continuously monitor the systems. They have to rely on technology like machines and monitors to facilitate this process. For instance an operating team keeps constant track of the heart-monitoring machine, if any changes occur they are communicated (Marks et al., 2001). Teams working in less dynamic environments have specific time periods to monitor the internal and external environments. They conduct for instance weekly meetings to review the resource allocation for different projects.
Poorly monitoring is apparent from wrong interpretation of critical internal and external elements, this is for instance, a wrong estimation of the weather conditions. This wrong estimation could leave construction teams in a dangerous environment.

Team monitoring and backup behavior

Assisting team members to perform their tasks. Assistance may occur by (1) providing a teammate verbal feedback or coaching, (2) helping a teammate behaviorally in carrying out actions, or (3) assuming and completing a task for a teammate (Dickinson & McIntyre, 1997).

Coordination

Orchestrating the sequence and timing of interdependent actions (Brannick, Roach, & Salas, 1993)

Reaction planning

As explained for the transition phase processes, there are three types of planning, deliberate, contingency and reaction planning. Deliberate and contingency are transition phase planning, due to the fact that they are aforethought before they were implemented. Reaction planning occurs when unexpected events are happening or when errors are detected in the initial strategy of a team. This results in an unforeseen need for strategic change, a reactive strategy has to be adapted. This reactive planning is defined by Marks et al. (2001) as: "the alteration of the existing plan in response to unanticipated changes in the performance environment and/or performance feedback." When a team notifies a change in the performance environment, which neither the deliberate or contingency plan is able to act against, then it has to invent a new plan.
Either because of a fault in the original plan or the unpredictable environment of the team, an effective team has the ability to act directly to reconsider, abandon or adjust the original plan (Marks et al., 2001). This can happen due to unpredictable situations or faulty original plans.

Interpersonal

The final processes are processes which are categorized within the interpersonal category. These processes

are used to manage interpersonal relationships. The management of these relationships occur throughout both the transition as the action phase. They lay the foundation for the effectiveness of other processes (Marks et al., 2001).

Conflict management

Preemptive conflict management involves establishing conditions to prevent, control, or guide team conflict before it occurs. Reactive conflict management involves working through task and interpersonal disagreements among team members (Cannon-Bowers et al., 1995; Gladstein, 1984; Karen A. Jehn, 1995; Simons & Peterson, 2000).

Motivation and confidence building

Generating and preserving a sense of collective confidence, motivation and task-based cohesion with regard to mission accomplishment.

Affect management

Regulating member emotions during mission accomplishment, including (but not limited to) social cohesion, frustration and excitement (Cannon-Bowers et al., 1995).

8.2.2. Emergent states

"Cognitive, motivational, and affective states of teams [that are] … dynamic in nature and vary as function of team context, inputs, processes, and outcomes." (Marks et al., 2001)

Team confidence

Exists in either two ways, team efficacy and team potency. Team efficacy is described by Kozlowski and Ilgen (2006) as; "A shared belief in a group's collaborative ability to organize and execute courses of action required to produce given levels of attainment." While team potency is described by Shea and Guzzo (1987) as, "collective belief regarding the team's ability to be successful."

Team empowerment

Has like team confidence two different types, structural and psychological. Research explains structural as; "the impact that the actual practice of delegating, authority & responsibility can have on performance" (Arnold, Arad, Rhoades, & Drasgow, 2000). Psychological team empowerment is explained in literature as; "the team's collective belief that they have the authority to control their proximal work environment and are responsible for their team's functioning" (Mathieu, Gilson, & Ruddy, 2006). However, of these two only psychological team empowerments can be seen as an emergent state.

Team Climate

The climate of the team is described in literature as "a set of norms, attitudes & expectations that individuals perceive to operate in a specific social context" (Pirola-Merlo, Härtel, Mann, & Hirst, 2002). Within team climate, research is conducted towards multiple different variants. The most research, like the research of Pirola-Merlo et al. (2002), used to be conducted towards the influence of general team climate on performance. Nowadays more team climate research focuses on specific dimensions of team climate like; creativity, learning transfer, safety, service and justice climates.

Cohesion

The term cohesion is already thoroughly researched by multiple different researchers. The definition created by Goodman, Ravlin and Schminke (1987) is: "the commitment of team members to the team's overall task or to each other". Within cohesion a distinction is made in three different dimensions. The interpersonal cohesion, task cohesion and group pride. All the three are significantly related with team performance and when team workflow increases, the relationship between cohesion and performance became even stronger (Beal, Cohen, Burke, & McLendon, 2003).

Trust

Most researchers adopted the definition of trust from Mayer, Davis and Schoorman (1995). They describe trust as: "the willingness of a party to be vulnerable to the actions of another party based on the expectations that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party". Teams need to have a certain amount of trust to work effectively. However, Langfred (2004) researched the effect of high trust and high individual autonomy in self-managing teams. The outcome of the research was that team-level trust has a downward concave curve relationship with the level of monitoring within the team. The problem with a high level of trust is that team members are not monitoring each other anymore due to the fact that they have confidence in other team members their skills and working abilities. When this is combined with high levels of individual autonomy, the performance of the team suffers. But Langfred (2004) notes that this outcome is based on a team with a high level of individual autonomy. The research questions if these outcomes would still hold

with other types of teams.

Shared mental model

A shared mental model is defined as "an organized understanding or mental representation of knowledge that is shared by team members" (Mathieu, Heffner, Goodwin, Cannon-Bowers, & Salas, 2005). Shared mental models are separated in two types, the task-mental-model and the team-mental model. Team mental models have a direct impact on performance, while task-mental-models have an indirect impact, due to their effect on processes (Mathieu et al., 2000).

Strategic consensus

Strategic consensus according to Kellermanns, Walter, Lechner and Floyd (2005), is the shared understanding of strategic priorities among managers at the top, middle and/or operating level. This varies from shared mental models through the fact that shared mental models consist out of overlapping mental representations on various levels and strategic consensus focuses on the agreement on strategic priorities. Dooley, Fryxell and Judge (2000) proved that strategic consensus has a positive impact on commitment to the strategic decision among the members of the team. Moreover, the commitment of the team engendered by consensus has a positive impact on successful decision implementation.

Psychological safety

"a shared belief held by members of a team that the team is safe for interpersonal risk taking".

8.2.3. Blended mediators

The earlier discussed mediators can easily be categorized in either process or emergent states. However, there are mediators that are less easy to categorize into one of these two constructs. These mediators are a blend of processes and emergent states. Three different blended mediators are considered by (J. Mathieu et al., 2008). The three blended mediators are team learning, behavioral integration and transactive memory, they will also be used for this research.

Team learning

According to both the researches of Argote, Gruenfeld and Naquin (1999), the idea behind team learning is that it represents an ongoing process of reflection and action. Through this process, teams acquire, share, combine and apply knowledge, which positively influences both task performance and the quality of intrateam relations (Zellmer-Bruhn & Gibson, 2006). Besides that, Edmondson (1999), provided evidence that team learning can be seen as a mediator between the relationship of psychological safety and performance.

Team learning reflects an active set of team processes, but the knowledge gained have to be embedded within the team (Argote & Olivera, 1999). Embedding the knowledge requires that the teams write down what they have through their work processes. By documenting their progress, they convert tacit knowledge into explicit knowledge (Gibson & Vermeulen, 2003), which can be implemented within the following period of the project or for projects that follow.

Behavioral Integration

The concept of behavioral integration exists out of three major elements. The elements "Quantity and quality of information exchange", "Collaborative behavior" and "Joint decision making". The team is in a state of behavioral integration when the team engages in the three types of processes, thus it is a blended construct that describes how the three related processes yield a resulting state (Hambrick, 1994).

Behavioral integration is negatively related to goal preference diversity, educational diversity, size of the team (Simsek, Veiga, Lubatkin, & Dino, 2005) and organizational decline (Carmeli & Schaubroeck, 2006). On the other hand, it is positively related to firm performance (Simsek et al., 2005) and decision quality (Carmeli & Schaubroeck, 2006).

Transactive Memory Systems

Transactive memory systems are defined in literature as: "the collection of knowledge possessed by each team member and a collective awareness of who knows what" (Austin, 2003; Rulke & Rau, 2000). Teams benefit from transactive memory systems through the groups' awareness of the collective knowledge that is available and where it is available within the team, this enhances the communication and coordination within the team (Wegner, 1986). This results into a positive impact of transactive memory systems on team performance and viability (Lewis, 2004).

As a negative relationship, Ellis (2006), investigated the role of acute stress on the team performance. This resulted in the outcome that the negative effect of stress on performance is a result of the negative impact of stress on transactive memory systems and shared mental models.

	Mediator	Definition	Effective if	Results in
Team processes *Transition*	Mission analysis	Interpretation and evaluation of the team's mission, including identification of main tasks, operative environmental conditions and team resources available for mission execution		Not relying on reactive mode, but team members know what to expect and/or will be able to continue under changing circumstances. The teams don't have the risk to misguide their attention and efforts until it is too late to recover.
	Deliberate planning	The formulation and transmission of a principal course of action for mission accomplishment	A plan or parts for mission accomplishment is created.	
	Contingency planning	The a priori formulation and transmission of alternative plans and strategy adjustments in response to anticipated changes in the performance environment	It rests on the if/then logic and/or does take multiple events into account	The team and its members know how to adapt another alternative plan to get back on track when needed.
	Goal specification	Identification and prioritization of goals & sub-goals for mission accomplishment	Challenging, attainable goals that are aligned with the larger organizational vision and with collective strategies. In regard, ineffective goal spec. is poorly conceptualized; goals are overly general, vague, conflicting, ambiguous, unattainable, impractical or not valued by team members	Members will know what & how much needs to be accomplished by a specified time and/or with which quality. If entirely neglected, the team will end with no shared understanding of the team's purpose.
	Strategy formulation	Development of alternative courses of action for mission accomplishment	Consideration of situational and time constraints, team resources, member expertise and the changing nature of the environment. The team is able to make plans for successful goal accomplishment; it keeps in mind one or multiple variables like: situation & time, team resources, expertise of team members and the changing environment of the project.	Effective strategies, which contain information about member roles and responsibilities, the order and timing of actions and how task-related activities should be executed. It will create teams that are not completely dependent on earlier experiences or improvisations during performing.
Team processes *Action*	Monitoring progress toward goals	Tracking task and progress toward mission accomplishment, interpreting system information in terms of (1) what needs to be accomplished for goal achievement and (2) transmitting progress to team members	The self-regulation is performed properly, the team is detecting the progress and is processing this knowledge correctly.	The team will not drift, procrastinate or stray off tasks. The team gains track of purpose for an extensive period of time and will be aware of its progress and will be able to provide themselves with appropriate feedback.
	Systems monitoring	Tracking team resources and environmental conditions, which relate to mission accomplishment. This involves (1) internal systems, team resources such as personnel, equipment etc. and (2) monitoring of environmental conditions relevant to the team	The team is continuously monitoring the systems and the technology which facilitate the process.	Good interpretation of critical internal/external elements.
	Team monitoring & backup behaviour	Assisting team members to perform their tasks. Assistance occurs by (1) providing verbal feedback to a teammate, (2) helping a teammate in carrying out actions, or (3) adopting and completing a task for a teammate	Team members know each other's roles & tasks and will therefore know how to assist other team members.	The whole team can trust on each other, it is not vulnerable to one team members shortcoming. If one team member fails, the rest of the team will make sure that the team will not fail.
	Coordination	Orchestrating the sequence and timing of interdependent actions		
	Reaction planning	The alteration of the existing plan in response to unanticipated changes in the performance environment and/or performance feedback	The team is able to act directly. In this way it can abandon, reconsider or adjust the original plan.	

Team processes *Interpersonal*	Pre-emptive conflict management	Establishing conditions to prevent, control or guide team conflict before it occurs	Norms for conflict resolution are competitive instead of cooperative, there are contracts that specify how team members handle difficult situations and finally, the team rules and norms about the nature and timing of conflict are established	A higher productivity of work
	Reactive conflict management	Working through task and interpersonal disagreements among members	There's good identification of conflict between team members, problem solving, compromising, openness, flexibility and willingness to accept differences of opinions	Higher productivity of work
	Motivation & confidence building	Generating and preserving a sense of collective confidence, motivation and task-based cohesion with regard to mission accomplishment.	The team is capable of motivating other members by communicating their beliefs about; team ability, competence on tasks and feedback on team success.	Processes such as social loafing & shirking will not occur. This occurs when low motivation levels are reducing the effort of team members on the team tasks, which result in lowering the collective performance
	Affect management	Regulation of members emotions during the accomplishment of missions, this includes social cohesion, frustration and excitement	Team members are not ignored, isolated or fuelling angry team mates. They make sure that members are calmed down, provide empathy, control their frustration, the team morale is boosted and that there is cohesiveness among members.	Calibrating team member stress, which results from task conditions (failure/temporal stress), personal factors (animosity among TM) or situational factors (job security concerns), will improve.
Emergent States	Team confidence *Team efficacy*	A shared belief in a group's collaborative ability to organize and execute courses of action required to produce given levels of output	The relationship between efficacy and performance is higher when teams have greater, as compared to less, interdependence (Gully and colleagues, 2002; Gibson, 1999)	Positive relationship with the team's level of strategic risk (Knight, Durham & Locke, 2001)
	Team confidence *Team potency*	Collective belief regarding the team's ability to be successful		A positive relationship with satisfaction, effort and overall performance (Lester et al, 2002) Can have negative implications on performance (de Jong, de Ruyter and Wetzels, 2005)
	Team empowerment *Psychological*	The team's collective belief that they have the authority to control their proximal work environment and are responsible for their team's functioning		Positive impact on customer service, job satisfaction and organizational and team commitment. (Kirkman & Rosen, 1999) Positive indirect effect on performance & customer satisfaction. (Mathieu et al, 2006)
	Team Climate	Set of norms, attitudes & expectations that individuals perceive to operate in a specific social context		
	Cohesion	The commitment of team members to the team's overall task or to each other		Interpersonal, task and group pride cohesion significantly related to team performance, when team workflow increase, the relationship becomes stronger. (Beal et al, 2003)
	Trust	The willingness of a party to be vulnerable to the actions of another party based on the expectations that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party	The relationship between the amount of trust is in relationship with the level of monitoring in the team.	Positive mediator of the team training proficiency with the team performance. (Kirkman, Rosen, Tesluk & Gibson, 2006) Moderator between task and relationship conflict. (Simons & Peterson,2000)
	Shared Mental Model *Task*	An organized understanding or mental representation of knowledge that is shared by team members about task aspects	The team has a shared knowledge about the task mental model when a common schema regarding their tasks and environmental potential roles which can play are known	Indirect impact through their effect on processes. (Mathieu et al, 2000)

	Shared Mental Model *Team*	An organized understanding or mental representation of knowledge that is shared by team members about team aspects	The team has a shared knowledge about the team mental model when understanding between team members about how they will interact with one another are known.	Direct impact on performance. (Mathieu et al, 2000)
	Strategic consensus	The shared understanding of strategic priorities among managers at the top, middle and/or operating level	A well-defined agreement on strategic priorities. Successful top management teams did not possess it immediately, this gradually moved to consensus near the end.	Positive relationship to organizational performance. (Iaguinto & Fredrickson, 1997)
	Psychological safety	A shared belief held by members of a team that the team is safe for interpersonal risk taking		
Blended Mediators	Team Learning	Representation of an ongoing process of reflection and action, through the process, the team acquires, shares, combines and applies knowledge, which positively influence both task performance and intrateam relations.	The team codifies what they have learned by documenting work processes. Hereby, they convert tacit knowledge into explicit knowledge.	Positive relationship with task performance and quality of intrateam relations (Zellmer-Bruhn & Gison, 2006)
	Behavioral Integration	A team is in state of behavioural integration when the team engages in three types of processes; quantity & quality of info exchange, collaborative behaviour and joint decision making.		Positive relationship with decision quality (Carmeli & Schaubroeck, 2006), firm performance (Lubatkin, Simsek, Ling & Veiga, 2006) Negative relationship with organizational decline (Carmeli & Schaubroeck, 2006), TMT goal preference diversity, educational diversity & size (Simsek, Veiga, Lubatkin & Dino, 2005)
	Transactive Memory Systems	Collection of knowledge possessed by each team member and a collective awareness of who knows what.	High awareness of the groups collective knowledge that is available and where it resides, this results in enhanced communication and coordination.	Positive relationship with team performance & viability (Lewis, 2004),

Table 3: Mediators framework

8.3. Outcomes

As explained earlier in the research, the team effectiveness output changed with the transition of the IPO model into the IMOI model. Where the first model had a clearly defined measurable output, the new model has multiple different more difficult to define outcomes. There are studies which tried to categorize different types of outcome, for instance, Cohen & Bailey (1997), created in their research towards team work a categorization of effectiveness into three categories: performance, attitudes and behaviors. But also, others have created more explicit lists of different categorizations. However the difficulty according to Mathieu et al. (2008) is that there are only subtle nuances between the different categorizations. Therefore, this research, like the study of Mathieu et al. (2008) will follow the traditional broad classifications of Team performance and Members' Affect and Viability.

8.3.1. Team performance

According to (Mathieu et al., 2008), there has been a lot of literature written about the construct of team performance, due to the fact that it has long been argued that the definition of a team is that they produce something useful for an organization. Their review follows the literature through three subcategories, which this research will also follow. The three subcategories are: organizational-level performance, team performance behaviors and outcomes and role based performance (Mathieu et al., 2008).

Organizational-level performance

This type of performance is particularly relevant for top-management-teams (TMT), due to the fact that there is a one-to-one alignment between team characteristics and organizational outcomes (Mathieu et al., 2008). As an example, Barrick, Bradley, Kristof-Brown, and Colbert (2007) give the positive influence of communication and cohesion on their firm's financial ratios. But on the other hand, it is difficult to define the influence of for instance a team of maintenance workers on the organizational outcome. If non-TMT organizations adopt team-based designs there will be a need to create models to determine how team outcomes reflect to their output in organizational benefits (Mathieu et al., 2008).

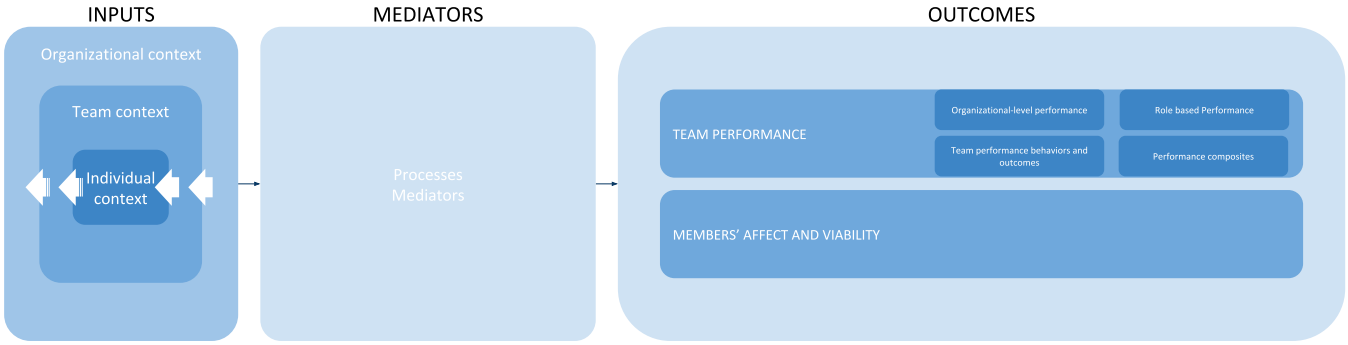


Figure 9: Outcomes defined in literature, illustration based on IMO model of Ilgen et al. (2005)

Team performance behaviors and outcomes

The construct team performance behaviors and outcomes is a combined construct of the relationship between cohesion and team performance. The team performance behaviors are actions that are relevant to achieve the goals, while the outcomes are the results of the behaviors (Mathieu et al., 2008). Some examples of behaviors are team process improvement, learning behaviors and cognitive task performance. These behaviors and their outcomes are difficult to examine. Earlier research has shown that team performance behaviors can be measured through measuring the amount of feedback seeking, error discussion and experimentation (Edmondson, 1999; Kirkman, Rosen, Tesluk, & Gibson, 2004), matching with an expert committee (Jehn & Shah, 1997) or the rating of team leaders on the team's level of proactivity (Kirkman & Rosen, 1999). Team performance behavior in combination with their outcomes where measured for instance in earlier studies by the use of supervisor rated performance (Tesluk & Mathieu, 1999), external customer satisfaction (J.E. Mathieu et al., 2006) and the use of archives to research the amount of historical events which are related to differences across teams (Mathieu et al., 2006; Perretti & Negro, 2007).

Role-based performance

Role based performance studies focus on the extent to which the members of the team have the desired competencies which are needed to perform their jobs (Welbourne, Johnson, & Erez, 1998). With this knowledge Chen and colleagues have performed multiple studies to examine whether teams are competent on three aspects: their task, the team and the organizational roles. These studies measured the outcomes by analyzing different teams which were comparable (Chen & Klimoski, 2003; Chen, 2005;

Chen, Kirkman, Kanfer, Allen, & Rosen, 2007).

Performance composites

Besides the three defined subcategories there are also studies which used a blended type of team performance. These studies combined different types of measurements to specify the outcome of the process. For instance, Barrick et al. (1998) combined objective outputs like quality and quantity with subjective measurements like initiative, interpersonal skills, planning and overall commitment. But also, another study of Hiller, Day and Vance (2006), combined planning, problem solving, support & consideration and mentoring & development. Mathieu et al. (2008) argue if this type of performance measurement might be the best way to measure the overall team effectiveness, due to the fact that teams perform multiple functions which can't be measured by only assessing one aspect of performance.

Members' Affect and Viability

The construct of members affect and viability focuses on the affective reactions and viability of teams. Important measures are the satisfaction of members about their team, the job or the organization, and also the commitment to the team and organization (Janz, Colquitt, & Noe, 1997; B.L. Kirkman & Rosen, 1999; P.E. Tesluk & Mathieu, 1999). A possible way to measure the members affect and viability, used by Janssen, Van de Vliert and Veenstra (1999) is to ask members to evaluate if their team has a good atmosphere and if the members were treated with respect.

	Name	Explanation	Measurement possibilities
Team performance	Organizational-level performance	Relevant for TMT, for non-TMT there's need for an extra model to determine how outcome is reflected in organizational benefit.	Measurement of increase or decrease in organizational output.
	Team performance behaviors and outcomes	Combined construct of relationship cohesion and team performance; Team performance are actions that are relevant to achieve the goals, outcomes are results of behaviors.	Feedback seeking, error discussion, experimentation, matching with expert committee or rating of team leaders on team characteristics.
	Role-based performance	Focus on extent to which members have the desired competencies to perform their jobs.	Comparing the outcomes of different teams on their task, the team and the organizational roles.
	Performance composite	Blended types of team performances, probably the best indicator for overall team performance.	A combination of multiple other measurements.
Members' Affect and Viability		Focus on affective reactions and viability of teams	Ask team members to evaluate the team. For instance, the atmosphere or how members are treated.

Table 4: Outcomes framework

04

Case study

9. CASE DESCRIPTION

This chapter describes the context of the studied case. The case will be elaborated with the use of a small introduction, before giving some background information on the organization and the client.

9.1. Introduction

This case study involves the design of a large complex building project in the transportation sector in the Netherlands. The initial size of the building consisted of 100.000 m2 and needed to be used as a transit station. The building will be one of the most important transportation buildings in the country.
After the start of the design, the client changed the initial demand, the building had to become 20% bigger, 120.000 m2 and needed to become a transportation hub, users needed to be able to stay in the building for a longer time. Therefore, besides passing through the building, the building became more complex with the added demand of shops and leisure areas.

9.2. Organization

The organization exists of two Dutch firms, an architectural and engineering company, and two south European firms, also existing out of one architectural and one engineering company. Of these four there are three private owned and one state-owned company, besides that, the three private owned companies are significant smaller than the state-owned south European company. The two Dutch firms have worked together earlier, just like the two south European companies. However, it is the first time that the Dutch and south European firms work together. The south European companies joined the JV due to their experience with this type of building, due to the fact that the Dutch firms have zero experience with designing such a building.
The client demanded of the companies to share a Dutch contractual relationship, therefore the companies created a joint venture (JV) under the contractual relationship of a Dutch general partnership.

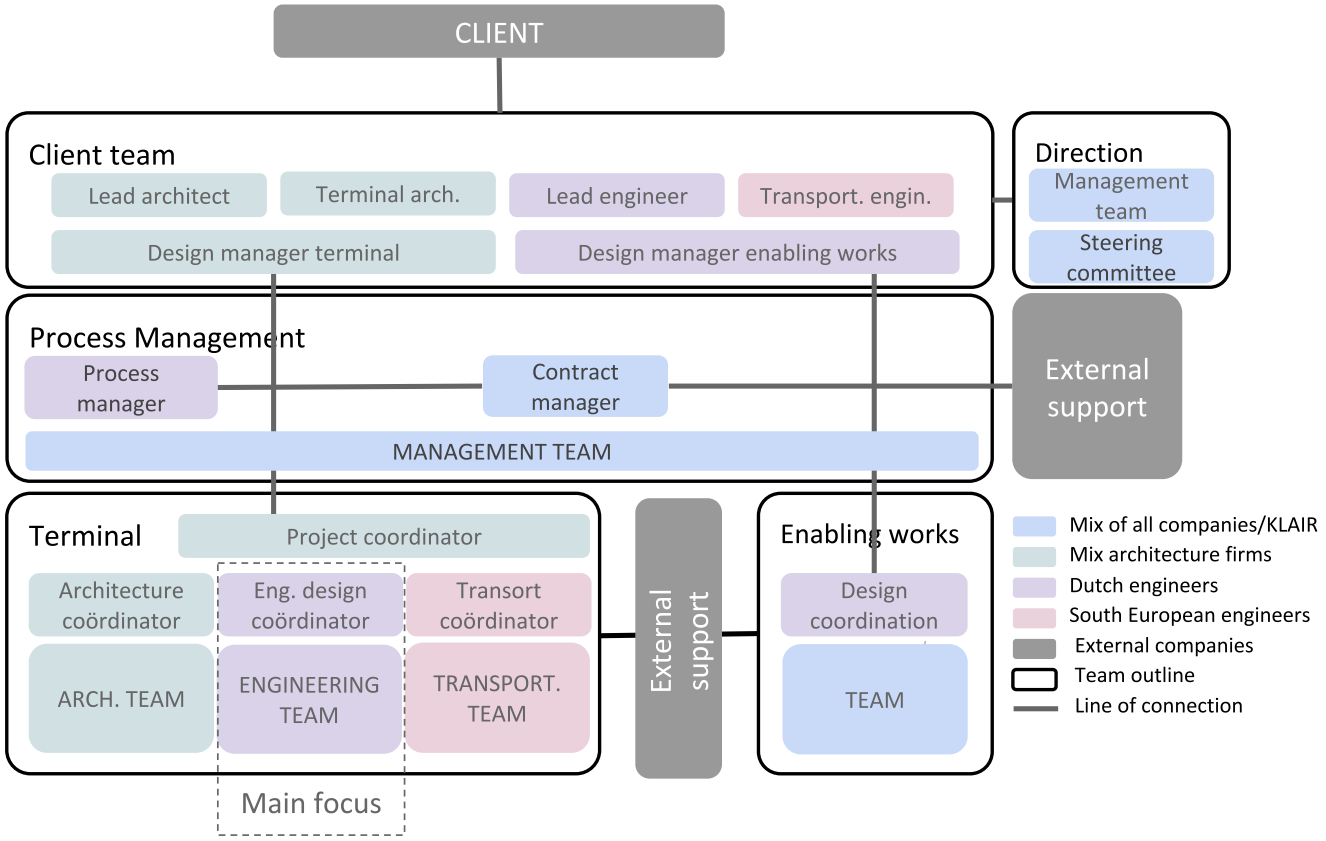
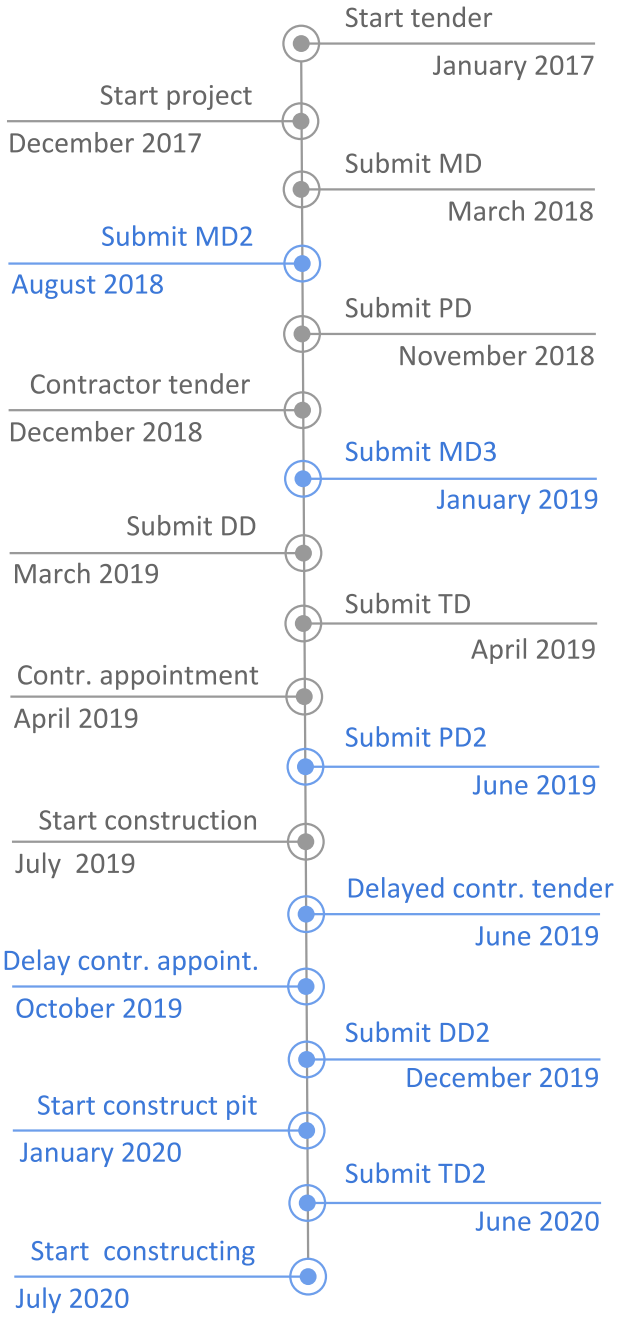


Figure 10:Simplified organizational chart, own illustration, based on the original organizational chart of the JV.



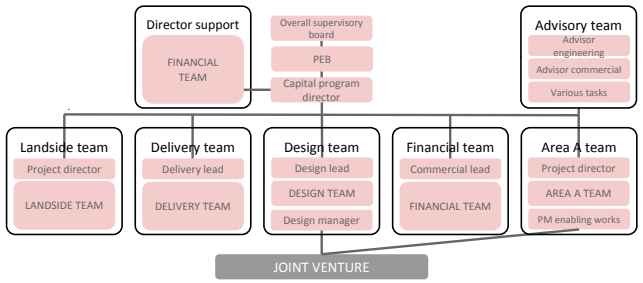


Figure 11: Simplified organizational chart of the client, own illustration, based on the original chart of the client

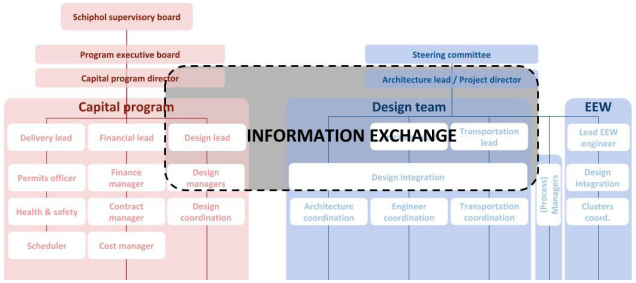


Figure 12: Composite organizational structure including the people involved with exchanging the information from one to the other, own figure, based on original charts of the client and the JV.

9.3. Client

The organization The official client is a big Dutch transportation organization with a big building portfolio. To manage this portfolio, the organization chose to split a part of their organization into an organization with the focus on portfolio management. Due to the wish to expand the portfolio with a couple of big construction projects, this organization also created a new organization, which is called capital program. This makes capital program the executive client of the JV. Due to the enormous impact that this particular construction project has on the building portfolio of the client, capital program gathered advisors to gain the needed advice. All together this creates an organizational scheme as showed in figure 11.

9.4. Combined structure

As a result of the two organizational structures, a simplified structure can be created, shown in figure 12. In this structure the information exchange between the main project team of the JV and the client is drawn. As shown in figures 10 and 11, the information exchange between the two organizations happens between the design lead and manager of the client and the design managers and leads of the JV.

05

Results

10. FINDINGS

10.1. INTER-ORGANIZATIONAL COLLABORATION

Starting a JV means working together with different companies with different backgrounds. When a project starts it is important to understand the ways of working of the new colleagues. Their manner of working is related to two types of aspects. The first relates to the equality of the different companies; size, importance of the project, finances and the contractual relationship. The second is the cultural background of the company, where is the company located and what is the origin of the company, which type of employees and how is the company structured?

Company equality

While examining the companies that form the JV, one of the major issues is the difference in size and ownership of the companies which causes an imbalance in the relationship. Three companies are of comparable size and privately owned, and one company is a much larger company and state owned. This results in a working environment where the project is of great importance for three of the four parties. As an example, one of the interviewees explains how the covering of risks works within the organization:

A2: *"At the start of the project, the four companies had to become one party, therefore a certain amount of insurance needed to be established. All the four companies had to cover an equal part of the insurance the three smaller companies wanted this to become a new shared insurance, because the amount was too high to cover it with their existing coverage. The bigger company did not want it due to the fact that they were able to cover the risks themselves. This was not possible, because we needed to have one solution for the four companies together, it was not possible that three companies bought off their own share and one company used their company insurance. We needed to become one company together."*

This is one example that shows the unbalanced ratio between the different companies, both for the risks that can be taken as the financial impact that the project has on the company. The three smaller companies can't take any risks, if the project fails or lacks behind, a huge part of the overall profit will be lost. Therefore, the project has the highest importance for these companies. Also, in relation to the bigger company this can be noticed in how the company deals with appointing personnel to the organization. Another interviewee from the Dutch engineering company mentions the strange collaboration that the organization has with the company in relation to the deployment of employees:

A2: *"We are trying to coordinate a lot of things together with the architects. The Spanish engineers are nowhere to be seen, the last three weeks they fly in a bunch of people and they wake up and start to do things. They then notice some things that they want to be adjusted. If they would have told it up front, we could have fixed some of it. Now they are not coordinating, they are steering, that is not how we want to work within this organization."*

This shows the importance of equality within the organization. When a company is taking the project less serious, this can result in irritations among the other employees of the organization, not consulting members of that company and over-ruling the employee's tasks and functions.

Cultural diversity

When multiple companies are becoming a new organization, the cultures of the different companies have to be taken into account. The companies will have to work together and need to cooperate as one team. But with the merging of the different companies comes merging different cultures. These cultures don't always fit in one team and therefore irritations may arise. Therefore, it is necessary to understand the culture of the other company and search for better ways of cooperation. To understand each other's culture is a huge job, there are a lot of cultural differences within different companies, as explained by one of the interviewees:

A1: *"Within such a project you can make a thesis only about cultural differences between the different*

companies."

But it will be worth the time to learn from each other. For instance, some differences that occur within the research project were that the project has to deal with different kind of cultural differences. On the one hand, the organization exists out of two Spanish and two Dutch companies and on the other hand, two architectural and two engineering firms.
The major differences can be determined between the different specialisms. According to an interviewee who explains the difference between architects and engineers. This is noticeable in the way of working of the different employees:

A3: *"We just need a lot more structure as team. But a lot of the employees of the Dutch engineering firm are very used to doing their own thing and then finally on a certain moment to be finished. These kinds of people are less used to work in a big team."*

Which results in a lack of organisation and integration of the Dutch and Spanish engineers in contrast to the well-organized collaboration between the two architectural firms which work as an integrated team. Besides this difference also a difference in work ethic is elaborated by the Dutch engineer:

A5: *"The dynamics in the different teams is different. How engineers, especially the Dutch engineers are used to work versus how the architectural team, they open a new can of foreigners and let them go their way. And let them work for 20 hours a day, well at least I have luckily not seen that yet. And a bit black and white, is that within the architectural firms is said we make 30 variants and the good one shall probably be one of them. We normally will first weigh which one is the best variant and work that one out […] I will not say that the engineering firms have a 9 till 5 mentality, but the extent to which overtime is normal within an architectural firm versus an engineering firm, that is a huge difference."*

Which is confirmed by an employee of the Dutch architectural firm:

K1: *"I also think, it is not a good thing, but certainly within the architectural team, we often result in going into overtime."*

And finally, the cultural differences in structure are elaborated by two other interviewees who both mention the difference in structure and how employees of another company would react on working in their structure:

A2, Engineer: *"They have their director, their chief boss, he has his second man beneath him, he is the design manager. Underneath him are three managers, below them a layer with a bunch of lead coordinators, each of a certain subarea and then finally the workpeople, so it is very hierarchical. We have a lead engineer, a project manager, a coordination team and the engineers […] the coordination team I sit in is not above the engineering team, on the contrary they are all seniors."*

K1, Architect: *"Now that the phases are becoming more detailed and we need to integrate more with the engineers […] I don't think that it would work as one of our managers would direct them."*

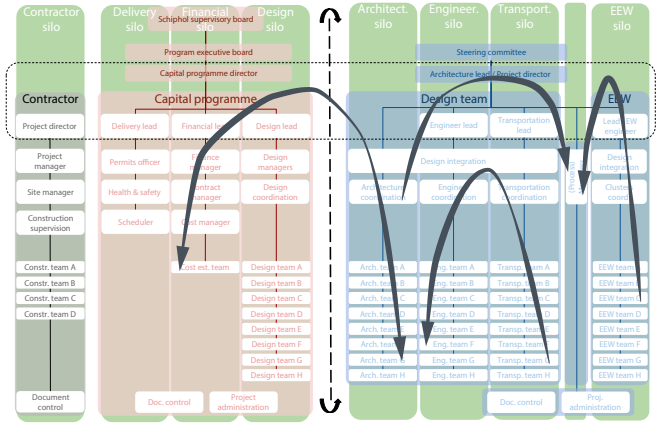


Figure 13: Organizational structure divided in design silo's. Due to this structure, information is exchanged through the management layers.

As long as these cultural differences are noticeable in the organization, a unity can never be established. The different employees of the different companies work in a different way. Whenever an integrated team has to be created from such different backgrounds, there will not be a good working environment. The different companies will have to create shared work ethics, same structure and have to take the project as serious as the other companies. What you see within the case study is that the architectural firms have the same cultural background and equality. They have a naturally shared way of working. Reflect this on the original structure of the organization, figure 14, these two companies work integrated on one of the three design silo's, where the other two engineering companies both work on their own silo.

10.2. Information exchange

One of the biggest issues with creating a new organization is arranging the information flow within the whole team. A company normally learns to improve

the information provision over time. However, a fast-growing new organization does not have the time to learn it over time, it has to have a structure from the start which positively enhances the information flow. As a result of the examined case two major areas for improvement came across. First of all, the use of a shared work floor for the whole organization. Instead of having four different offices where employees are located, the JV chose to make use of a principle called co-locating. This principle, often described as the solution for good communication and information transfer between different persons of a team, seemed not to work as hoped for. The second improvement lies with the involvement of all the employees, in a huge project like this case, a lot of people are involved. Without involving all the members of the team, irritations will start to arise among uninvolved employees.

Implementing co-locating

Co-locating is as said in the introduction a principle that is often described as the tool to improve communication and sharing information between members of the team. The reason for this lies with the idea that putting everyone in a room would automatically realize interpersonal connections. Through these connections informal communication would start to arise, and this would result in a higher level of information transmission, which lower the need to continuously engage in formal meetings for all different design problems. This would then result in a design that is more integrated, because the information would be passed back and forth more often between employees of all the different layers of the project.

A4: *"That means that the communication lines are super short, because almost the complete delegation of the team is in one room. Therefore, everybody is informed in a very informal way […] just like how it works in theory. Even without meetings, everybody will get all the information."*

However, the use of co-location within this project does not have the desired effect. To understand the reasons behind the ineffective use of this tool, a research is conducted to compare the use of co-location within this project with the use of it in two comparable cases. Different members that work for the main case and worked on or heard about the comparable cases have mentioned that the use of a shared office floor during the other projects worked better than the office floor of the main case.
The other cases were some of the first integral design cases of the Dutch engineering company. During these cases close cooperation with the architect was needed, the collaboration between the different companies were just like the main case in a shared office floor. They were both complex building projects, due to the fact that they were cinemas with multiple purposes, besides the primary function, the buildings had to give space to other types of use. For instance, they needed to have study areas, space for symposia and one of the buildings had to be able to accommodate a stock exchange. Finally, both the cases had the same project manager (PM) as the examined case.
However, the cases seem to be comparable, there were some big differences. The first big difference according to the interviewed PM was the size of the team:

A4: *"The main project is a project of enormous proportions, it is almost incomparable […] the team is 214 man, that is a company on its own […] the cinemas are the other side of the spectrum with only 20 man continuously working on the project."*

Besides the differences in size, the PM indicates the integral aspect of the team:

A4: *"We collaborated in the most ultimate form, because the client was also part of the team and therefore on the work floor, he could adjust on the spot. The whole design team, with architect and advisors and when the contractor was assigned, he also joined with a part of its work preparations, all working together in one room."*

Which is in comparison to how the collaboration works within the main project, a huge difference. The collaboration in the main project according to an employee of the Dutch architects works with a big detour:

K1: *"Often the architecture team creates something, they get some advice from advisors, then this will go to the client. They have a workshop with their stakeholders about the design, then after one or two weeks, we share the design within the team, then we consult with the Dutch engineers and after that we receive feedback on it. This takes quite a while for a process that could happen in-house."*

However, the difference between the possibility to involve the client within the project team for the cinemas and the main project is addressed by the PM:

A4: *"The client is capital program, they exist out of*

more or less 10 people, they are surrounded with a team of advisors […] existing out of four big engineering companies […] all these companies also exist out of 10/15 man. Therefore, the engineering advising team is also 40 to 50 men on average. This means that we have a client of around 60 man."

This in comparison to the client of the cinemas:

A4: *"There was one client and he was client/owner […] he had a team, that was him and a project manager who supported him and who was also qualified to take decisions, they could both take decisions on the spot."*

And finally, a big difference between the different cases is the use of the office space. The main project has an office space which can be divided into three parts. On one side of the floor there's an area with architects and a small area with Spanish engineers, the other side of the floor has two equal areas, one area with the Dutch engineers and an area with the members who work on Enabling works (EEW). The middle is mainly in use as small meeting, lunch and exposition space, however sometimes there are more Spanish engineers, who will use a small part of the middle area. This division is shown in figure 14.

Even though the office floor exists out of flexible workplaces, employees tend to continuously work in the areas where they are used to work. The only exception is the area where the enabling works teams are working. This is the only area where both architects and engineers work on one table.
This division of space is also in comparison to the cinema projects a huge difference, as the PM describes:

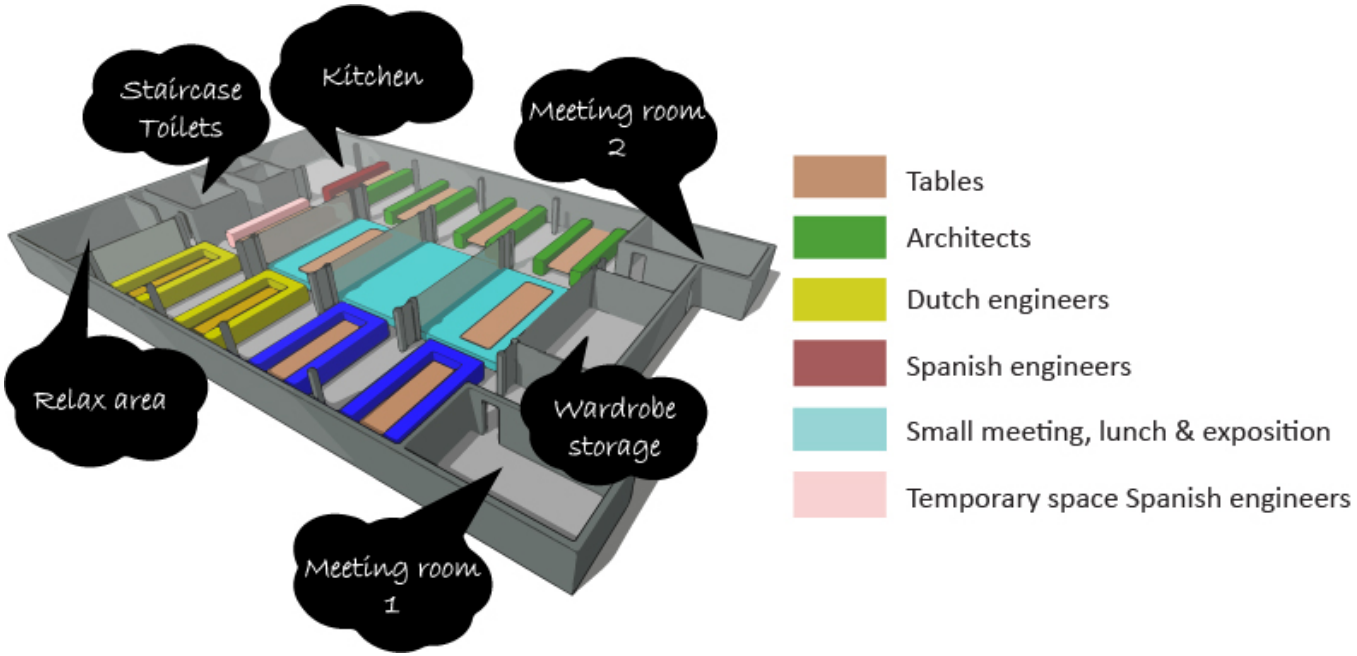


Figure 14: Work floor division on the shared office floor of the project team (own figure)

A4:*"We sat there with all advisors of the Dutch engineers and the architect, we worked together at one big long table with around 10 people fulltime and on average one day a week with the client […] there were two people from the architectural firm sitting at the table, the people who did architectural studies worked from their office."*

This shows the difference in daily informal consultation, when all different experts work together on one table, decisions can be made faster in comparison to working on different tables with a big open space in between. People less tend to go and ask for feedback when they have to make an extra effort out of it, they will wait till the next formal meeting to discuss the issues they have.

All together this shows that although it is a positive start to at least work in the same office, there are a lot of issues that have to be addressed before effectively using the shared office. The main issues are that the size of the project is too big, the client exists out of too many people and that the work areas are split. All these points can be traced back to the structure of the organization. As showed earlier in figure 13, from the start, the team was split into different silos. These silos are the area's which also can be determined on the work floor, just like the silo's, the connection between the areas is missing. The different silos were not in contact with each other, architects versus engineers, but also not in contact with their counterpart on the side of the client.
To breach this ineffective way of working, the structure has to shift from working in silos towards a way the

different experts have to work in teams where the different expertise is needed. These cross-functional teams, , have to be focused on a framed part of the building. Besides that, the gap towards the client has to be closed as well. This could be solved by dividing the client's experts, the same way as the cross-functional division that have to be established for the cross-functional teams. The clients experts will have to work similar as the client from the compared cases, they will join the cross-functional teams once or twice a week, in this way decisions can be taken or on the spot whenever the clients experts are authorized to do that and otherwise within a week, due to the fact that these sub-clients could have a shared meeting with the authorized client once a week for these issues. In this way decisions would be taken faster.

In essence, the team would be separated in smaller teams who could work exactly like the example cases. The problem of the large size of the team would be tackled due to the fact that the large amount of people is split into smaller more workable teams. The employees within these teams will share information more often in an informal way without the use of meetings, due to the fact that working together close to each other results that people to share knowledge and information.

Involving specialists

As another big issue of the information flow is providing the information to all the layers of the project team. Due to the vertical oriented layered structure of the project team, the information had to pass a lot of different people before ending at the level of specialists. Even though the specialists' layer is the layer that in the end has to design and engineer the building. As shown in figure 13, in the silo structured project team design, the information flow passes continuously through the coordination and management layer. Which results in an overflow of information that has to be processed by this layer, which results in incomplete or insufficient information exchange towards the specialists. For both the side of the client as the side of the project team, as showed in figure 15.

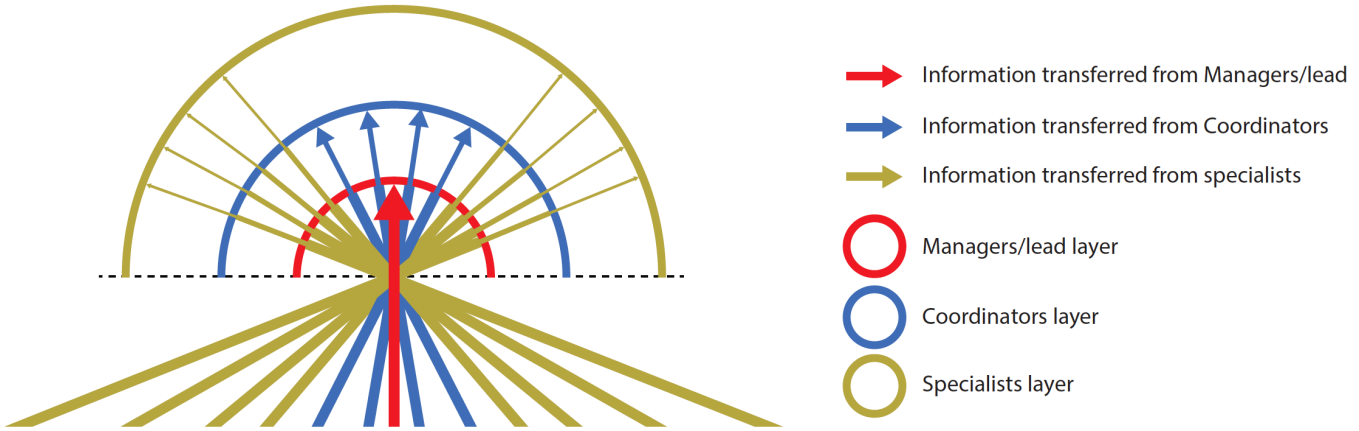


Figure 15: Schematic display of the loss of information during the old project team design structure (own illustration)

The picture shows the loss of information due to the need to process the information during meetings and by progressing it through the different layers. Every time the information has to be passed over from layer to layer or team to team a bit of the necessary information is lost. Therefore, this structure has multiple consequences, the first consequence is that the management layer is having a lot of information to process. Different teams and experts want to gain information from each other or from the client. This information needs to be transferred through the management layer. Therefore, managers get overthrown with information, which they will have to summarize towards an amount of information that they are able to transfer towards the team that need the information. As explained by an interviewee of the Dutch architectural firm:

K1: *"If all the information goes through a small group, then the group will get overloaded. So therefore, the information that they will pass on to you gets short and concise. Besides that, the information will get delayed because they have to process it."*

This results in ineffective use of the employees, while there are possibilities that an employee works on parts of the design that already have changed or will not get the right information to adapt the design in the desired way. Besides that, the members of this small group of managers will lose time for other important tasks they have to execute. As one of the major tasks of the managers is to give feedback on decisions that are made on higher levels. There are moments where specialists have worked on creating ideas for the project that in the end did not make it into the design. In this case there is a need for feedback, however, a lot of the management have no time left to explain

outcomes of certain decisions. This creates certain feelings within the team, as explained by a constructor of the Dutch engineering company:

A3: *"It is very bad for the morale, the team has to work as a machine and there are all gears […] when you are doing things while you don't know which relationship it has to the total it becomes more difficult, people are just going to do what they are instructed to do […] If you don't know why and they have told you, you have to do this, it becomes a bit more directive. […] The moment that it seems to be useless it gives a lot of frustrations."*

The interviewee rightly emphasizes the need of feedback for a project of this size. Because it is impossible to involve all the employees during all the decision moments. When there is no time to explain why decisions are taken or to show how far in the design process the project is this result in frustrations within the team.

Summarizing the issues of the employee involvement, on the one hand, the management of the project want to keep track on decisions and problems involved in the project. However, this results in an overload of information which transfers through the management layer. Which in the end results in a huge workload, which results in a lack of time for other important management related tasks, like giving feedback on design related decisions and progress. Without this feedback the specialists are kept in the dark, they have no idea how the project is continuing and why things are happening. This results in irritations, a loss of productivity and worse integration of different disciplines. Therefore, it is important to create a structure which lowers the workload on the management layer and creates an environment where the different experts involve each other in design related issues. By enhancing this environment, a better integration of different expertise will be created, and employees will have a better idea why they are doing their job without being directed to do their tasks.

10.3. Staffing

The third main issue this paper addresses is staffing. As explained in the previous chapters, it is important to think about cultures and backgrounds of collaboration partners, to obtain a good working environment. After which it is important to start and think about the structure of the team, without a good structure of the team, information will not be provided amongst all members of the team. Without this information, the team members will not work as optimal as possible. When the structure for the team is created it is important to think about filling in the structure, staffing. When organizing the staffing, there are some things to keep in mind. First of all, an organization that starts with signing in for a competition and has to end up with designing and constructing a big complex building project, will have to grow enormous in proportions. The team will have to expand in a very short amount of time. The second issue has to do with the issue that employees are often assigned to multiple projects or have not enough time for the tasks and projects where they are assigned to.

Fast size and structure growth

As explained, organizing the growth of a project team that is going to design a big complex building project is an important task. From the start it is important to think about a structure that can grow with the progression of the project. When the project evolves over time there are issues that have to be taken into account. While progressing, tasks and functions will be divided in multiple smaller more defined tasks and functions. This new division ensures more indistinctness among team members, the overlap between different functions will result in team members who don't know to whom to go for certain issues, as explained by one of the interviewees:

A2: *"In the beginning because there where less people, it was clear who was responsible for what and who was able to take decisions. We got to a point where that is the biggest confusion. There are so many different functions, everybody is responsible for something, but who takes the crucial decisions?"*

The second issue of a fast growth of the project team has to do with training a new member into the project team. New members will have to learn about existing information, documents and drawings. This pile of documents grows over time, where in the beginning it is possible to show a new team member where to find all these documents and explain the use of each one, over time it becomes harder to show all the information. With this uncertainty about which information is known, duplicate unnecessary information will be requested.

A2: *"I've been involved from the beginning of the project, in the beginning there was a very good image of which documents there where and what was in them. And in the beginning, we started with 8 now over 160. In the beginning you could talk someone into the project, here are the documents that are important*

for you. […] on a certain period, the team became so big and there was no separated document control or someone who kept an eye on what was in them. So new people came in the team but did not know what was known in the organisation. […] We often have therefore asked for information that was already known. […] now we have to search in a huge pile of information where nobody has a grip on."

The problem will keep growing as long as there are no measures taken. The examined case, after a while, took measures, document control was deployed, and team members had to go through the pile of information. In the end the problem is solved, however, using these measures from the beginning would save a lot of time.

So, all together, there are two main issues concerning the fast growth of the project team. Both the information as the human resources grow faster than the team is able to control. Therefore, there has to be a structure created upfront. Within this structure as explained earlier there has to be a predetermined growth approach. Some kind of tree that can grow with new branches. These branches have to be demarcated so that it will be clear what the role is of the branch in relation to the tree.
For a design project the growth could be established per phase, for instance, the focus has to lie with the different specialisms at the start of the project, this means that the focus lies on introducing specialists in the team who work in separated teams on their own subject. When the project evolves the teams have to be blended into sub-project teams, as explained earlier. The specialists will be divided over the sub-project teams. The focus will then lie in involving employees by the need of specialists within each team, if there's a gap that needs to be filled.

Human resource management

Besides the issue of the fast-growing project team, according to multiple team members, is the assigning of team members. According to the team members, there are two main issues that the team has to deal with it focusing on assigning team members.
The first has to do with the cultural nature of the different JV companies. As explained earlier, there are a lot of differences in the cultural background of engineering and architectural companies. One of the main issues was that architects had another working ethic than engineers, the architects are continuously working at the office, while the engineers seemed to have a lower working rate. This also has partly to do with assigning members of the company to multiple projects. Where architects have the focus on one project, they constantly focus on creating the best design of their project and can put all their effort in it, a part of the engineers is assigned to multiple projects. This has to do with their framed profession, while an architect is often multi-employable on different parts of the design, engineers are focused on their main profession and have the knowhow to deal with that specific profession. But besides their own profession, the engineering firm exist out of multiple professions.

A1: *"We have of course very specialized knowledge, we are one or two days here and the rest of the time we deal with other projects."*

Even from the moment that team members are completely assigned to the main project, there is still improvement to be made. One of the other big issues is the absence of a big part of the coordination and management layer during the project. The client is expecting feedback and therefore expects team members to work in their environment. In this way, the client keeps track on what is going on, however, the result of management near the client is a lack of management in the office.

A3: *"I can understand the reasons, it happens because the client is a difficult client, a very big organization, so arranging everything with them takes a lot of time. […] If you realize that you are working 40 hours and the time with the client already takes more than 40 hours of your time, you have to subdivide tasks more. They are going to deal with the client and other people, someone extra is going to keep the design process going."*

How a team deals with a lack of management depends on the team, however, during the project there was a difference notifiable between people and teams from different companies. As explained earlier, generally speaking, architects work more hierarchically than engineering companies. This could also be notified during the case, where the engineers where more familiar with management that was absent, the architects had more problems with their absence.

A3: *"Looking at the Dutch engineers, because it has grown over the years, you can notice that the people who are managing don't have to be 100% present but have to be present sufficient to get a feeling with what is going on without people having to send an email to speak to someone. […] The feeling at the JV was that there was no connection between the people in Rotterdam and the people who worked at the client."*

These two examples show that while assigning people to the project it is important to think about their function and task. For instance, even though the Dutch engineering company has assigned people from the company to the project, it is clear that they don't have enough time to work optimal. The people that are assigned are not always completely usable for their assigned task. This because on the one hand, the tasks that they have gotten are too big to do with the amount of people that are assigned for the job, or on the other hand because they are not completely employable due to multiple projects that they are working for. This results in tasks that are not executed properly.

If we reflect this back on the cross-functional team structure as proposed earlier, the team is depending on the knowhow and time of the specialist in their team. This can only work when each specialist or profession has his full attention with this task, without being interrupted by side tasks, which could negatively influence the rest of the sub-project team.

06

Conclusions & discussion

11. CONCLUSIONS

Fifteen months after starting up the joint venture, at the start of March 2019, a big organizational adjustment was implemented. The organizational scheme showed in figure 16 shifted. This huge organizational modification was implemented without the consultation of the assigned responsible managers. A delegation of the client in collaboration with leading members of the JV made the decision. This was done after disapproving the preliminary design and the added requirements of a major user of the building. With this adjustment, the responsible managers were overruled. This change was implemented in this way, to realize the adjustment in a fast and efficient way.

The implemented change to the organization was a shift from hierarchical to a flattened structure. The organizational information flow used as explained earlier to be arranged top-down (vertical). The new structure was created to shift this top-down structure to a more horizontal arranged scheme, as showed in figure 16. As a result the original information exchange between experts and managers needed to be breached to create an information exchange between experts cooperatively.

The implementation was created to benefit two priorities. The first priority was to create a better integrated design. The second priority was to lower the information transition through the management layers and with that the loss of information in the process. Thise loss occurred due to the hourglass shaped information exchange as explained earlier in figure 15.

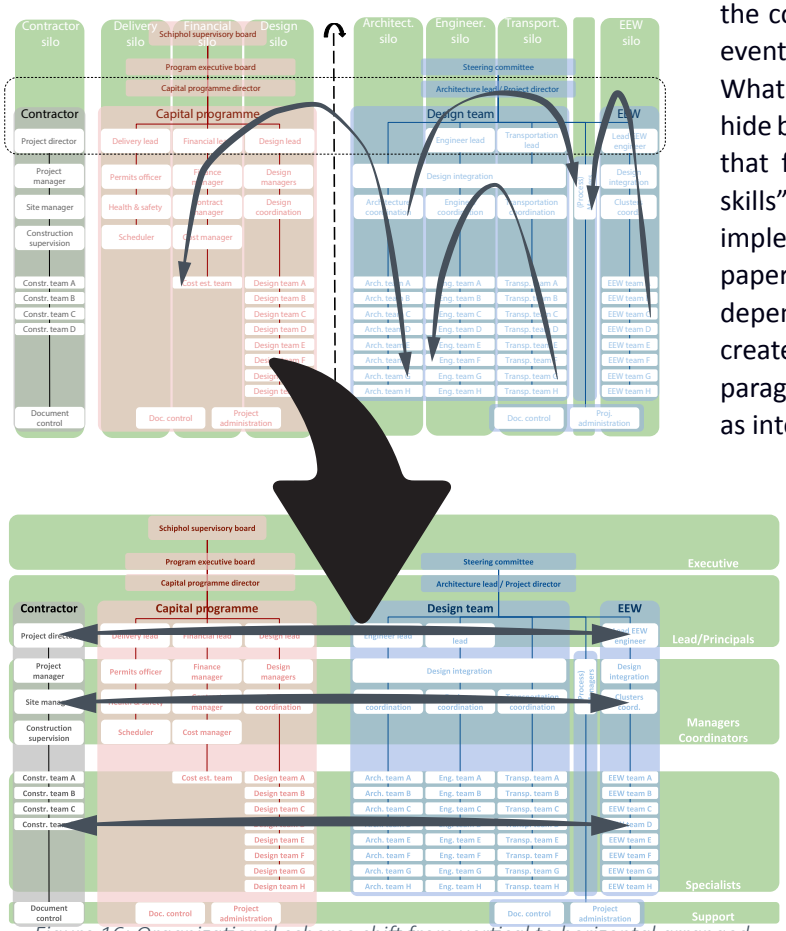


Figure 16: Organizational scheme shift from vertical to horizontal arranged

The following chapter exists out of three events, first, assembling the team, secondly, collaboration during the project, and finally, involving team members. It seems that these events led to the fact that the managers where passed with the introduction of this big change. To understand the reasons for this, the conclusion chapter will elaborate on the chain of events that led to this decision.

What can be noticed is that the employees of the JV hide behind organizational issues to deny the problems that focus on people oriented approaches, or “soft skills”. In other words, organizational, structural implementations an adjustments are easy to plan on paper, however the implementation and its effect depend on human factors and how management creates the desired work environment. Therefore, the paragraphs will both focus on organizational aspects as interpersonal aspects.

11.1. Assembling the team

From the start of the project it is important to create a team that has the possibility to collaborate in a desired way. When creating a team, it is important to consider the underlying motives and cultures of a company. Due to the difficult nature of complex building projects, employees are needed with different backgrounds and cultures. As explained by Hofhuis, van der Zee, & Otten (2015), such a team can enhance productivity. However, managing a team with a high amount of diversity appears, according to their research, to be difficult. Unsuccessful management of such a team results in negative team outcomes and resistance among employees. For successful management, the PM needs to have knowledge about backgrounds of different companies and their cultures, to create norms, attitudes and expectations for the whole team to overcome possible conflicts during the project (Wu, Zhao, & Zuo, 2017).

Commitment to the project

The results of the research suggests that one of the main reasons for a disturbed collaboration within a team is the differences between companies in regard to their expertise and localization. As showed in the results, architectural firms seem to have a better integration in the project . The architects have a higher commitment with the project over all, than both the Dutch and Spanish engineers. The lower level of commitment of the engineering organizations is shown by their regular absence in the project office. On the one hand, the Dutch engineers have comments on the absence of the Spanish engineers. According to them they should continuously have a bigger delegation within the office instead of only during the end of each design phase. However, the Dutch engineers are not continuously dedicated to the project either. They are often assigned to multiple projects and besides that, the company expects that their employees also work at their own office instead of the project office.

This way of working results in an environment that loses cohesion in the project team. Cohesion is created by a team that has the commitment of all the team members to the overall tasks and each other. By creating an environment where not all employees have the same commitment to the project or each other, the cohesion of the team will decrease, according to the research of Beal et al. (2003). In the same research, they conclude that a decrease of cohesion has a significantly negative effect on team performance. Therefore it is the task of the PM to create an environment where the different companies have the same commitment to the project.

Architectural versus engineering culture

The case study results also suggest that besides the commitment of the different companies, also differences in other cultural aspects influence the team collaboration. For instance, big differences occur in the familiar way of working of the different professions. What the results show is that architects are used to work in a group, ending up in lots of overtime to create multiple possible design outcomes, while engineers are more used to work on their own, during more strictly fixed work hours, while weighing different outcomes before implementing them in the design. The work environment with different cultures in the project team creates an environment where trust is negatively influenced. The negative influence on trust has, according to Hakanen and Soudunsaari (2012), as a result team members become unwilling to help others and voice their opinions, questions and improvement ideas between the different professions. Therefore, if a team with different cultures want to learn and grow in effectiveness, it is important to create a work environment that is based on high trust (Kirkman et al., 2006). Establishing this trust is one of the major tasks of the management layer of the organization. It is a critical component to create effective team leadership, when the trust is compromised, mutual relationships deteriorate, which makes collaboration more difficult or even impossible (Decker, 2015).

Conclusion and IMOI reflection

To overcome the negative outcome of the company cultures, the PM together with the rest of the management layer should act from the start of the project, during the creation of the team. It is important to understand the underlying cultures of different stakeholders, both within as outside of the team. Focusing on creating a team, the most important factors are the different companies and their employees. As a PM it is important to know possible future obstacles in regard of the different cultures within the team. According to Sultana and Aleem (2018) it is important to recognize and understand viewpoints and cultures to create better teamwork and better support. Ultimately understanding motives and cultures should lead to a higher level of collaboration.

The task of the PM is to create an environment where everyone does understand and respect each other's motives and cultures, but also gives an example how to adapt towards a company that shares a culture and therefore feels as a new company. To change the culture, according to Winch (2010), there are a few factors that have to be kept in mind. There is a need for training, performance incentives and commitment

of senior management in the organization. With these factors the PM is able to change the culture, he has to give the right example, set the right norms, attitudes and expectations for the team. By aligning these for the whole team, cohesion will arise over time. Team members will get a feeling of unity with the team more than the feeling of being assigned to the project. To implement the adaptations in the team, the PM will have to set the right example, he'll have to be the person who shows how to work collaboratively, to trust others, to show vulnerabilities, ask for help and give feedback to others. By doing this others will be encouraged to follow its lead.

Reflecting this paragraph on the IMOI model, it shows that the environmental context, "cultural influences on teams" has an influence on the team level factors by influencing the "interdependence" of the team, which results in an inefficient use of the team member characteristics "diversity" and "competencies" in the organization. Besides that, the performance of the team will negatively be influenced by "cultural influences on teams", due to lowered presence of the mediating factors "cohesion" and "trust", which have a positive effect on team performance.

11.2. Collaboration during the project

With the assembling of the new team, an organization is created that has to learn to collaborate through the different barriers of their mother companies. To organize the collaboration, there is a need to create an environment that increases the mutual knowledge exchange between team members with different backgrounds. To do so, a working environment is needed which supports the high amount of mutual tuning between teams and employees. This tuning is needed to coordinate alterations in such a complex team that has to create an integrated design (Terwiesch, Loch, & Meyer, 2002). To create this environment choices were made concerning collocating the combined teams, structure and information transmission.

Structure

The choice of structure is very important in a newly formed organization. The organization grows to a "flat" or "hierarchical" structure, the "flat" structure is focused on responsibility of each member within the organization, while the "hierarchical" structure focuses on top-down management. The responsibilities lie with the management and leaders of the organization. The chosen structure for a JV of this size is very important. The case showed that the designed working structure is one of the key factors that influence the amount of information exchange. In the examined case, the organization chose to create an environment where there was a separation between different disciplines. The organization chose to create functional silo's; homogeneous teams with members consisting out of the same disciplines, instead of cross-functional; heterogeneous teams, consisting out of members with different disciplines. This is shown by the departmentalized divisions in the organizational scheme, shown in figure 16. The two architectural firms together in the architecture silo and the two engineering firms separated, in two engineering silo's, focused on their own expertise. It seems that this structure is chosen to have a clear demarcation in tasks and responsibilities. The departmentalized structure shows more clear which company in the organization gets to have rewards for their tasks. However this division, as mentioned by Edmondson and Nembhard (2009), is not the desired structure, focusing on optimal use of teamwork. They mention that in the ideal form of teamwork, the contributions of individuals or departments, in this case; companies, are all but indistinguishable in the final product. The PM should therefore create the ideal work environment to support this ideal form of teamwork. There is a need to formulate a strategy that encourages the companies to refrain from a framed working environment and convince to create a structure that enables better teamwork.

Processing information

As explained in the structure paragraph, the case study organization was created in a departmentalized silo structure. As a result, the departments were top-down coordinated, information generated in one of the teams in the silo have to pass different layers in the structure to be transferred from one team to another. This type of information exchange results in high loss of information during the process of transferring from one team or member to another team or member. Due to the fact that the management layer has to process the information it gets from one specialist and transfer it to another, while often not having all the knowledge and time to explain the information correctly. As a result a part of the information gets lost, the management in between gets overloaded with extra work and as a result management loses time for other tasks that have to be done. As said in the introduction, the PM has to focus on creating an environment where mutual tuning between teams and members happens as often as possible, according to Terwiesch et al. (2002), this results in the best integrated design. However, the PM should steer the team members both through the creation of the correct structure as through coaching on using the collective knowledge and resources

within the team. By generating awareness about the knowledge within the organization and creating the matching environment for information exchange, the team would work towards a better integration of the design.

Collocating

During the start of the project a choice was made to create a shared office. The office was created to increase the mutual knowledge exchange between the different specialists in the team. By creating an area where people were forced to work together the organization thought to create an environment where information would be transferred automatically from one team member to the other, as studied by Kahn and McDonough (1997). Their research concludes that introducing collocating in the organization enables a better collaboration between departments in the organization. Collocating increases the amount of communication and information exchange among the different teams and employees (Kahn & McDonough, 1997). However, as the case study shows, only the use of collocating does not automatically generate a higher information exchange.

To optimize the use of a shared office space, the PM should show leadership towards the team. There is a need to coach the team in making use of the collective resources within the team. The PM should coordinate the use of each other's knowledge by creating environments where different team members with different expertise are encouraged to work together. This will not happen automatically, due to the natural behavior of people in working environments, people are tend to interact with team members with the same interests, knowledge and background (Edmondson & Nembhard, 2009).

Conclusion and IMOI reflection

Concluding the current collaboration within the studied project based team, key factors can be determined. Important improvements can be implemented, both organizational as interpersonal. But all these factors come down to formulating a strategy upfront, there is enough knowledge and resources available in the team, however, these have to be used correctly.

As explained, the initial thought of working in a shared office is well-founded, earlier studies showed the benefits of creating an environment that stimulates knowledge and information transfer amongst different experts. However, to make optimal use of the office floor, there is a need for incentivizing team members to benefit from the shared office. As described, the structure needs to shift from functional departments to cross-functional teams. Creating these teams would create a more flattened working structure, not all the information that has to be shared is shared through the management layer. As a result the management team has more time to coach the team members in making use of each other's knowledge. Coaching could be managed through asking questions, giving feedback, discussing problems and reflecting on outcomes. By coaching the team with these actions, the team will start to learn to interact more over time (Edmondson & Harvey, 2018). Which will result in a better collaborative cross-functional team.

Reflecting this paragraph on the IMOI model, it shows that the main team-level factor "structure" is used ineffective. This factor could have been improved by the mediating factor of "strategy formulation", if the structure would have been created to strengthen the effect of the shared office space. The optimal use of the structure and office floor in combination "coaching" of the PM and the management layer would have created a higher "interdependence" of the team members, which would have positively affect the performance of the team.

11.3. Involving team members

The final event to be discussed is the optimal use of team members. By creating guidelines for the desired collaboration during the project, described in the former paragraph, the organization created a framework for team members to work in an optimal way. During the project life cycle, the organization is continuously growing and shrinking in team member size. This variable amount of people have to become and stay involved during the entire life cycle of the project. There is according to Winch (2010), a particular project, the terminal 5 project of London Heathrow, which is comparable to the studied case but a lot bigger. This project can, according to Winch (2010) be seen as an exemplary project on how to create conformance of the team members to the project. For the case, the leaders chose to share aspirations through the use of training, induction, workshops, management forums and an own tabloid. For training and workshops, the organization appointed 150 in-house trainers who with the use of these tools, could reach and inform all 50.000 team members. The case study showed that even for a case of much smaller proportions, there is not always thought about how to involve the team members during the project life cycle.

Fluid memberships

For a complex organization like the case organization, the results show that it is an environment that is continuously adapting. What the results of the case show is that the organization keeps growing and

shrinking, depending on the type and amount of work, design phase and personal circumstances. This is shown by the fact that the company grew from eight to over 160 members in a bit more than a year. As a result difficult conditions for team collaboration arise. New members have to get integrated in the team, as explained by Edmondson and Harvey (2018), they have to get onboard, learn the organizations' culture; their norms, behaviors and expectations. The organization structure, colleagues and project specific information; like for instance, documents, task divisions and responsibilities. At the same time members are leaving the organization, in this case for instance because they are needed in another projects, or personal motivations. The knowledge and even more important tacit knowledge that these members have gained over time about the project have to be documented and transferred to other team members, to maintain within the team. These results of the case correspond to the study of Edmondson and Harvey (2018), their research explains that these so called "fluid memberships" ensure a difficult team membership in the team. Members have to be on- and offboarded in the team comparable to a "solid" organization like a company, but a lot faster. As a result of a high amount of "fluid memberships", the team learning will be negatively influenced, which results in a negative relationship with task performance and quality of intrateam relations (Zellmer-Bruhn & Gibson, 2006).

Fluid teams

Adding on to the negative influence of a high amount of "fluid memberships" for team learning. To counter the negative influence it would be recommended to create a part of the organization as solid workforce on the office floor. Currently, the case study showed that the needed solid base was missing. Due to the fact that management was missing due to their obligations to the client and senior specialists due to the fact that they were assigned to multiple projects. This resulted in uncertainties concerning responsibilities, tasks and decision power. Besides that, management and senior specialists were overloaded with work. The management had to deal with both the client as the project team, while the senior specialist were overthrown with work due to their multiple projects. As a result, other responsibilities like feedback were more or less neglected and team members felt that they were not taken seriously. This result is in line with the reasoning of Zika-Viktorsson, Sundström and Engwall (2006), their findings suggest that perceiving project overload is partly explained by commitment to too many projects at the same time, few opportunities for recuperation, inadequate work procedures and too much time pressure within the organization. As a result, project overload is associated with impaired performance, higher levels of psychological stress and a decrease of competence development (Zika-Viktorsson et al., 2006).

As a result, the JV needs to create an environment with less project overload. This can be realized by assigning more and different types of managers. Managers dealing with client, others process and others management of the team. Also, senior specialists should be trained to oversee a wider area of expertise, this way these more all-round senior specialist could all be assigned to one project. Within the project they will become the overseeing expert who can help where needed and has an overview of the performed tasks.

Feedback

As explained earlier, feedback is one of the actions that must be performed to influence team member interactions and emergent states in cross-boundary teaming. By providing feedback on meeting expectations and rewarding if done so, the management can reinforce the behavior that they expect from team members (Edmondson & Harvey, 2018). The case study results show, that within the case, the amount of feedback was minimal due to, as explained in the previous paragraph, an overload of work for the management and senior specialists. As a result, as explained by interviewee A3, team members lose morale. The members are only doing what they are directed to do without knowledge about the bigger picture. This creates an environment where instructions of management become directive, which creates a lot of frustrations when in a later stage the task seemed useless.

Reflecting the case on the Terminal 5 case from Winch (2010), there is a lot to learn about informing and involving the team members. Even though the case is completely incomparable in relation to team member size, the management of the case could implement ideas of trainings, workshops or even an office wide forum, where once a week all the members are invited to share some ideas or remarks. By creating a team climate, where everybody feels heard and involved, job related frustrations will be kept to a minimum. By creating the climate, the cohesion within the team will grow, which will result in an increase in team performance (Beal et al., 2003).

Conclusion and IMOI reflection

Concluding the current team member involvement within the studied project based team there are some

factors that influence the potential outcome of the team. What we can notice is that due to the nature of a project based team, there is a high amount of “fluid memberships”. These memberships have a negative influence on team learning. This negative influence could be minimalized by creating a solid core of members within each team. This core has to be created out of a manager and one or two senior specialists per team. This will create a base of knowledge and competencies like a coat rack, where the other team members could add and gain information and knowledge to complete the project. For the overall involvement and mutual coordination between the teams, there is a need for extra workshops and feedback sessions like for instance a forum as used for terminal 5 of London Heathrow and explained in Winch (2010). By creating better feedback to the whole organization, a better climate is created where everybody feels involved in the whole project. By doing this, team members will have a better overview of all the work that is performed and will therefore have a better feeling with the project. This creates a better cohesion of the members with the project which affects the performance of the entire team.

Reflecting this paragraph on the IMOI model, it shows that nature of a project base teams’ human resource system has a negative influence on team collaboration. By creating a structure created out of core members within the team, there are always enough diverse competencies, which predict the teams performance, within the different teams. These core members are used as a coat rack for other more “fluid members” who come and go during the project. By creating the coat rack structure, the ongoing process of acquiring, sharing and combining knowledge through team learning will not be disturbed and therefore have a positive influence on task performance. By creating a better cohesion through the use of feedback principles, the mediating effect of task cohesion will increase which results in a better team performance.

12. DISCUSSION

In the discussion chapter, a critical eye will be cast on the structure change implemented by client in combination with the leading members of the JV. After that, the conclusions from the interviews are discussed with the use of “fly on the wall” observations, this are a combination of observations and lunch/coffee machine conversations about the conclusions as described the chapter before. Followed by limitations of the research and generalizability of the results. Finally, the chapter will end with recommendations for further research.

12.1. Discussion on the implemented change

The proposed adjustment focused on shifting from a hierarchical to a more flattened structure. As explained in the earlier chapters, the initial structure resulted in a top-down information exchange and meeting structure, where the client contact was only possible through management interactions, as shown in figure 12.

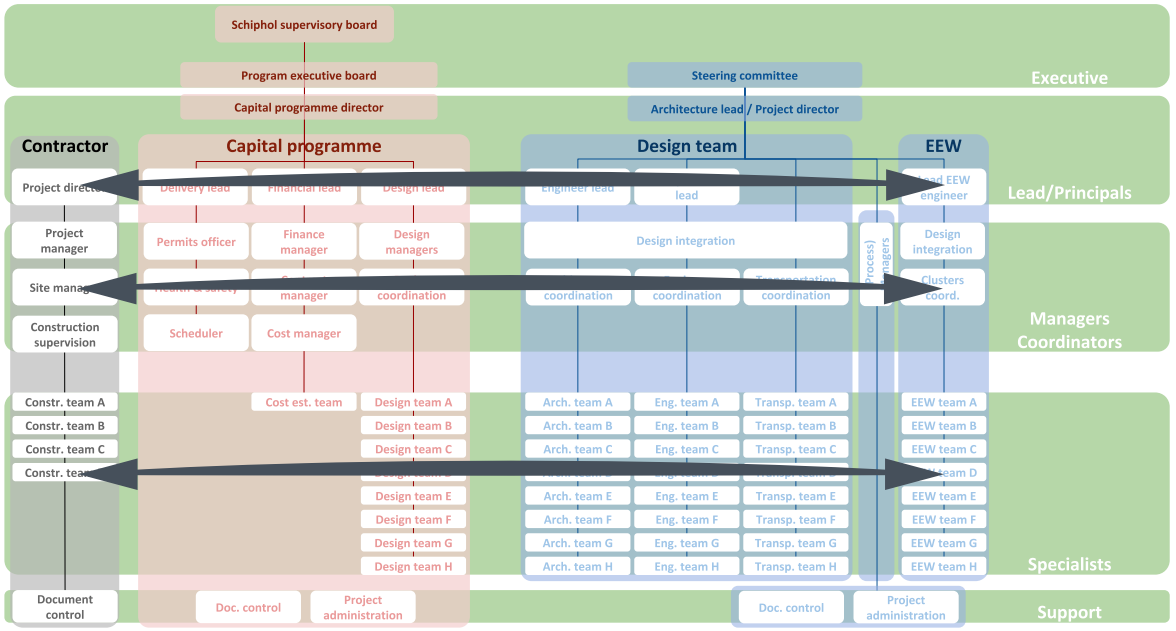


Figure 17: Own figure, layered structured design of the project team.

Even though these alterations were implemented, after two and a halve months in the project it seems like there has not changed a lot. The shift was implemented to assure more two-way consultation between different specialisms, however, on the work floor the change stays unnoticed. The four companies are still divided in the original division, teams are still structured around their expertise and finally, the client’s experts that were supposed to join the office floor for faster idea exchange are not to be seen in the office.

This results from the fact that the imposed structure change is only a change focused on tilting the decision-making structure from vertical to horizontal. This could be a good first step towards a better integration of the design and less pressure on the management layers, but this will not change the main feature of persons. People are known to search for things they know, familiar workplaces, familiar colleagues and people with same knowledge as explained by Edmondson and Nembhard (2009), it is difficult to automatically start communicating across functions. This relates to the conclusion from the collaboration during the project paragraph from the former chapter. As a result this research concluded in that chapter that there is a need for incentivizing the team members to benefit from the shared office. The structure needs to shift from functional departments to a combination of cross-functional with functional teams in a matrix structure.

12.2. Matrix structure

The new proposed matrix structure should foster this through the creation of cross-functional teams, as showed in figure 18.

This matrix structure fosters information exchange in two ways, horizontally the departmentalization in divisions, the cross-functional design teams, they realize an integrated design. On the vertical axis, the functional departmentalization, functional teams, assure integration of the different designs through information exchange between the experts. As explained by Ellis et al. (2003), neither of the two departmentalization's offer the best solution, there has to be an optimal balance between these two, a compromise structure is needed to experience significantly more learning, the compromise structure is the matrix structure.

Besides that, the proposed structure creates a better possibility to create a structure that fosters a core team with "fluid members" for the needed extra expertise or work. As explained earlier, a project-based team is subject to team member change. During the project, the workforce grows and shrinks according to the amount of work that has to be conducted. The matrix structure fosters the possibility to grow and shrink within the structure. As showed in figure 18, the teams could estimate the amount of work for each discipline. In this way the organization could assign team members to the desired teams. Also, the size of the teams could be adapted with increasing or shrinking the size of the design area. For instance, in the example figure, one of the design area's is plateau, this could be reshaped to for instance a leisure and a customs area, when the size of the team grows to large or could be fused with another design area when there is not enough work to cover.

Actually, the project team already implemented this desired way of working within a different department of the project. The project is split in two main teams, the main project team, which is responsible for the design of the main building. As a second team later enabling works was created. This team is focusing on a couple of smaller extra work that is supportive to the construction of the building. Due to the fact that the design projects of this team can be separated in a bundle of small projects the organization chose to create cross-functional teams, over which different experts from the different companies were divided. As a result, enabling works, is an example of the proposed matrix structure.

The common answer while proposing the structure change in regard of enabling works was that enabling works has the possibility to work in this way because of their small project teams for smaller design issues, while this idea is too big for the project team that designs the main building. By splitting the project team of the main building into smaller teams as proposed, this issue would be prevented. The biggest problem with splitting the whole project into smaller projects is the overlap that will be created between the different smaller design teams. This overlap should be the discussion point within the functional departmentalization, during these meetings, the problems occurring in the overlapping areas should come to light, in this way the possible problems in between the different project teams will be solved.

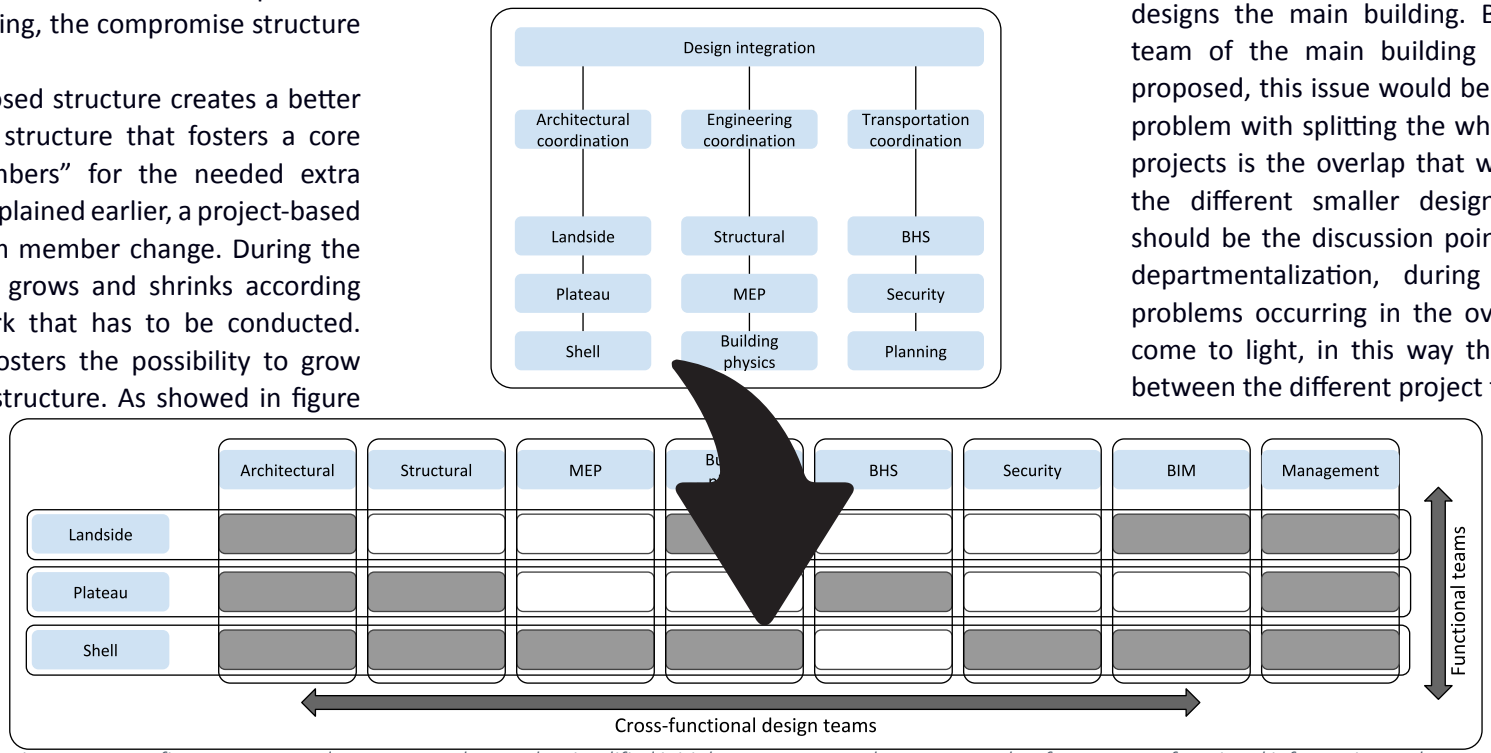


Figure 18: Own figure, a proposed structure to change the simplified initial structure towards a structure that fosters cross-functional information exchange.

12.3. Limitations and generalizability

Every research deals with limitations, these limitations are created by choices that are made in relation to the methods, the case or through limitations set by time and size of the research. For this research three main limitations towards the research could be determined.

Comparing multiple cases

The best methods for a case study like this would be to be able to compare multiple cases. The method as used for this research was a single case study. The case study resulted into a few factors that came out of the studied case, however, this does not guarantee the same result in comparable cases. Following the literature there are a lot of more possible factors which influence the team collaboration and effectiveness. Therefore, it could be certainly possible that other cases give other outcomes.

Limited amount of time

As a graduation research this study was limited to a certain time period. Therefore, in the case of a case study it is important to find a case that completely spans this period. Therefore, the research is a fragment of the entire process. When there would have been a possibility to be part of the entire process, from start till end, the research could go more in depth about implemented changes and the results following of these changes. Besides that, it would have been very useful if the conclusions of this research would be implemented to gain knowledge about the effects that these changes would result in.

Openness climate

Finally, the case study could have been more useful when there would have been a bit more openness. Due to the fact that the organization consisted out of multiple different companies and the research was conducted with the agreement of one of these four it was difficult to get complete openness. Therefore, the gathered interview data mainly exists out of information from employees of one company. Besides that, for other studies it could also be useful to gain full access of all companies because that would give easier access to for instance combined meetings. These meetings were for this research not the highest priority but could be important for other studies in this field.

Generalizability of the results

To conclude, these limitations create uncertainty about the generalizability of the results. Due to the fact that the research existed out of a single case study and could therefore not be compared to other cases. In a limited time period, which prevented the outcomes to be tested within the case. This results that the conclusions of this research are difficult to prove for other cases. However, the research suggests the most influential factors that came to light during this research, this does not mean that these are also the most influential factors for comparable cases but can be assumed to have a certain influence and are therefore important to take in account.

12.4. Recommendations for further research

As explained in the preceding paragraph, there are a lot of limitations to this research. But these limitations are recommendations for further research. This study can be seen as a starting point for more in-depth studies towards these factors. The follow-up studies could use information from this research and build their research upon it.

Redo with multiple comparable cases

A first recommendation would therefore be to conduct the same research with one or multiple comparable cases. The outcome of that research could give new insights on different influential factors which together with this research create a better overview of factors that influence the team effectiveness.

Implement results in comparable case(s)

A second follow-up research could be to take these results and implement them in comparable cases, by studying these cases, the validity of this research could be better studied, and the study would go more in depth in these different factors instead of more superficial study like this one.

13. REFLECTION

The last chapter of this graduation research focuses on the reflection on the research and process. The first part will reflect the research on the graduation laboratory and after that the research methods and the lessons learned from the graduation process will be discussed.

13.1. Position of the research within the grad lab

In design and construction management we focus on the “hard” skills in project management. When I started with this research my general idea was to create a study that completely focused on the “soft” skills in project management. However, even though that I wanted to focus on the “soft” side, I realized half way through the research that not all the problems can be solved with only “soft” skills. The research steared for a part to the “hard” solutions, with the biggest impact the structure change. Besides these hard solutions, the “soft” skills can be found in things like bringing together cultures, steering teams to work together and steering on feedback giving. These conclusions are all created to meet “soft” problems dealing with communication, leadership and teamwork. As a result the conclusions of this research share the ideas of the design and construction management course by focusing on hard solutions, however the research included the soft skills within these hard solutions.

13.2. Reflection on research methods

Literature study

Starting with the literature review of Mathieu et al. (2008) helped to conduct a good literature framework to start with from the beginning. From this starting point on it was easier to find literature to enlarge my knowledge concerning team effectiveness. The knowledge obtained from different studies could easily be summarized into an overview in the tables, which helped to define results and conclusions towards the end of the research.

In depth interviews

For this research two types of interviews were conducted. From the start, explorative interviews were held to gain insights in how the project team was functioning. After these interviews there was a first impression on influential issues that played a factor in this project team. With this knowledge more in depth interviews were held towards these factors, which in combination with the earlier interviews gave the data for the results of this research.

The interviews were held with different employees of the project team. Al with different tasks and responsibilities. The interviewees were interviewed without earlier knowledge about the research topic to create honest and natural answers.

Case study observations

During the entire graduation research, the research could be conducted in the office of the project team. By being able to work in the office as “a fly on the wall” more knowledge was gained. Through spontaneous conversations, observations and internal documents more data could be obtained. This data is used to fortify conclusions and input for discussions, but could not be used as result material due to the fact that this information could not be recorded. Besides that, sharing internal documents was strictly forbidden and could therefore only be used to create initial thoughts, but could not be shared as material.

Data processing (Atlas.ti)

Processing the gathered data was more challenging than expected from the beginning. The starting point of processing was through ordering the conducted interviews by hand without the use of a program. This gave first ideas, but was not enough to create a substantiated outcome, therefore the program Atlas.ti was used. By coding all the recorded audio an overview could be created of the main codes that came to light during the interviews. By searching for co-occurrences between these codes the main topics could be filtered out of the interviews, which resulted in the main factors of this research.

13.3. Lessons learned from the graduation process

Looking back on the past year of research I found out a couple of things about myself as well as my research skills. I will start with a short reflection on the process

concerning personal qualities, before reflecting on the research process and things that in retrospective could have been conducted in a better way.

Personal reflection

When reflecting on personal qualities concerning the conducting of a research there are two main issues that I learned which I would try to do different when conducting a same kind of research again.

Being reserved: This is a factor that I already knew of myself, but I noticed during the research that I was hesitant to ask other people for input or help, because I did not want to be a burden for them. This was mainly in the beginning, after a while I noticed that people were willing to help with everything that I asked, the people within the organization found it often just interesting to talk about the research that I was doing and were willing to spend a lot of time to explain their problems or findings concerning the topic.

Structured writing: I am more familiar with writing stories instead of research reports. This was something that was clearly visible during the writing of my paper. I found out that structuring the chapters works a lot better for research papers than just start writing and only thinking about how to connect one paragraph to another. I noticed myself that it makes it very hard to find back statements that are made in earlier chapters.

Process reflection

If I look back to the past graduation period, I could think of some of the steps that could have been executed better. The next paragraph will elaborate on these issues.

Taking time instead of taking the next step: From the start of the graduation I was always focused on going to the next step. Later on I often noticed that there were problems that could have been solved if I would have thought about them upfront. This eventually could lead to redoing the complete step again. If I would have taken the time in the beginning to really structure the research I think this would have saved time at the end.

Data analysis: Building on the first issue, the data, in retrospect, could have been analysed more objective. After the interviews I started to create results by making connections without the use of an analysation tool. In the end, after conducting the research with the use of Atlas.ti, the initial connections seem to be accurate, but maybe would have given a slightly different result if I would have started with analysing with Atlas.ti. If I would have done it in that way I would be 100% sure that the results and conclusions would be completely objective.

Connecting the literature study with Atlas.ti: After completing the whole research I think that there could have been a better connection between the conducted literature study and the end result. This could have been better if from the start of using Atlas.ti I would have used the different results from the literature study as codes for the program. Now I got results which in the end I needed to relink with the literature study, while if I would have used the literature study as input this would be a more solid result of coding the interviews.

07

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APPENDIX

CODE OCCURRENCE LIST

Collaboration	90

Topics:	
Info. provision	85
Structure	83
Communication	44
Culture	40
Complexity	32
Fast growth	31
Integrate	30
BIM	28
Collocating	26
Uncertainty	24
Training	17
Hierarchy	17

Progress	16
Team spirit	15
Mushrooms	13
Absence	12
Decision auth.	12
Chaos	12
Doc. control	12
Inexperience	12
Feedback	11
Narrowing	10
Planning	10
Pyramid	9

Delays	9
Monitoring	8
Attent. division	7
High pressure	7
Positivity	7
Scope change	7
Establishment	6
Hourglasstructure	6
Trust	5
External influence	4
Idea implement.	4
Informal contact	4

Town hall	4
Homogeneous	3
Coat rack	3
Travel distance	2
Independency	2

Stakeholders:	
Management	42
Moth. comp.	36
Client	35
Employees	17
Specialists	15