The Emergence of Shared Leadership in Project-based Integrated Design Teams

A case study on the way interpersonal skills can influence team functioning

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COLOPHON

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PREFACE

This report is the result of my graduation research for the Master Management in the Built Environment at Delft University of Technology. This research focuses on the influence of soft skills and the management of teams in a dynamic environment, with the aim to gain insight in the way managers can influence team functioning within project-based integrated teams which apply shared leadership.

During my study abroad at KTH Royal Institute of Technology Stockholm in August 2017, I studied concepts of Management & Leadership and Project Communication, involving personal, interpersonal and group skills, and determined the importance of communication.

Team interaction influences outcome.

One of the courses was constructed by executing a case study project while actively providing each other peer-to peer-feedback on the way we work together, with the help of concepts such as Belbin roles and four stages of room. In groups of five we had to come up with creative solutions and an implementation strategy for one of the major banks in Sweden. It was very interesting due to the fact that our team consisted of four exchange students in an unknown country and team members did not know each other beforehand. The kick-off of this project was very personal, we introduced ourselves to one another and also shared our strengths, weaknesses, expectations and ambitions for this project and in general life. During the process, personalities, character traits and sense of responsibility of each team member shaped the dynamics of the team. My study abroad was an eye-opener and has made me more aware of the way behaviours can influence outcome. This has been lacking during my previous course work at the university. Thus, I seek to better understand the way teams work and collaborate.

Acknowledgements
First of all, I would like to thank my parents for their eternal support and always believing in me. Special thanks to my supervisors Jelle Koolwijk and Clarine van Oel, for their encouragement, time and patience with me - without their knowledge, guidance and special team dynamic, I would not have been able to conduct this research. Furthermore, I would like to thank Daniël Schiffelers of the engineering company who provided the possibility to execute this research, keeping me grounded and taking a critical attitude. A big thanks to all the participants in this research and everyone who expressed their interest and enthusiasm. Finally, I would like to thank my family and friends for their good energy and motivation, which kept me going.

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ABSTRACT

Keywords: Integrated design team, interpersonal skills, project management, team functioning, shared leadership.

Aim: The aim of this research was to explore the soft side of project management, specifically the way process managers apply interpersonal skills to influence team functioning in project-based integrated design teams which apply shared leadership. This will provide insight within the context of shared leadership on the way project-based integrated design teams function, the role of the process manager, and the way interpersonal skills can be applied.

Research question: Considering interpersonal skills, how can process managers influence team functioning in project-based integrated design teams which apply shared leadership?

Methodology: The here described comparative case study uses an interpretive qualitative approach. Data was collected from two case studies, through context analysis, participant observations and interviews on behaviour, team interaction and communication.

Findings: This research highlighted the complexity of hospital design project organisations. The case studies address three managers: process manager, design manager and project controller – who each have their own responsibilities and focus. The emphasis of this research is with the process manager, who adapts to what the project team needs in that situation and can apply interpersonal skills by reflecting and ask questions (Why? What? When? Where? How?) to stimulate creative and critical thinking and engage project team members to interact with each other (trigger shared leadership). These skills can be applied to obtain organisational purposes, such as financial goals and to manage information which can contribute to project progress. Stagnation of project progress occurs when topics or problems are attempted to be solved at the wrong organisational level, thus “at the wrong table” (in Dutch: “het probleem wordt op de verkeerde tafel gelegd”). The different strategic levels influence each other, which in turn may alter the communication, and functioning within the team, as well as the project outcome. Furthermore, this research indicated that BIM is often seen as a goal in its own right, thus as a 3D Revit model, rather than a means to support shared understanding or shared mental model, and thus act as a boundary object. Findings indicated the need for a BIM to be dealt with as an information management system. Therefore, the outcomes of the study and it is recommended to involve a BIM coordinator to enact the use of BIM as a boundary object amongst project team members.

Limitations of the research: The limitation of this research is related to the fact interpersonal skills rely on the researcher’s interpretation of what goes on during project team meetings. There can be various reasons behind a person’s behaviour or actions, whereas there are also constraints on the amount of time to collect and analyse the data. The various formations of the project team members who are present during project meetings influences team functioning, which makes it sometimes challenging to compare the observations or case studies.

Practical implications: This research emphasizes on the importance of interpersonal skills and the importance of information sharing to team functioning. This can provide insight for project team composition, recruitment and training, and tendering processes.

Scientific relevance: This research indicates the way project managers in the built environment can apply interpersonal skills to manage project teams, but it also showed the importance of information sharing through BIM. The findings of this research can be useful for researches conducted on the temporal dynamics of shared leadership in integrated design teams. The outcome of this research could be useful for construction companies and project managers, to better understand the ways to effectively manage teams using soft skills and BIM.

Originality / value: This study is exceptional in using prospective data collection methods such as observations in addition to interviewing on two hospital design projects as a mean to investigate the way process managers apply soft skills to influence team functioning and shared leadership in project-based integrated design team.

GLOSSARY

Project management
Traditional project management involves that the project manager has the overall responsibility of the project for the initiation, planning, execution, monitoring, controlling, risks, costs, contract and scope.

Project-based integrated team
A project-based integrated team is a temporary group of people with different backgrounds who are interdependent in the tasks they perform, collaborate with each other, and see themselves as a unique entity to achieve a common goal (Kärrlander, 2017).

Leadership
Leadership describes the behaviour or action with the essence to influence others (Manheim, 2017).

Traditional vertical leadership
Traditional vertical or focussed leadership refers to one individual who is positioned hierarchically above to lead team members and has the overall responsibility of the project.

Shared leadership
Shared or distributed leadership is an emergent team property, in which to two or more individuals engage in the leadership of the team in an effort to influence and direct fellow team members to maximize team effectiveness (Bergman et al. 2012).

Interpersonal skills
Interpersonal or soft skills are the skills applied to communicate and interact with other people.

Team functioning
Team functioning refers to the activities *within* a team - how team members work together.

Team dynamics
Team dynamics refers to interaction *between* team members.

Team performance
Team performance or effectiveness refers to the extent to which a team achieves a goal or mission.

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1. INTRODUCTION

This chapter provides the background of the research by defining a problem statement, research aim and research question.

Construction projects are executed by a group of people.

1.1 Problem statement

Construction projects are becoming more complex and dynamic due to the competitive market on sustainability and innovation. The knowledge and expertise required to design and deliver a building is expanding and evolving rapidly (Hwang and Ng, 2013). In addition, this knowledge has become scattered amongst the more and more experts from different fields (Edmondson, 2009). Due to the low likelihood that the project manager can be an expert on all disciplines, this results in an increase of working in integrated teams. A project-based integrated team is a temporary group of people with different backgrounds who are interdependent in the tasks they perform, collaborate with each other, and see themselves as a unique entity to achieve a common goal (Kärrlander, 2017).

How can a project-based integrated team achieve a common goal?

Leadership describes the behaviour or action of certain individuals with the intention to influence others (Manheim, 2017) and is considered crucial to enable team effectiveness (Carson et al., 2007). Behaviours are relevant actions to achieve goals, whereas outcomes are the consequences or results of behaviours (Mathieu et al., 2008). Therefore, people can influence the project outcome. Leadership focuses on direction setting (to achieve a goal) and is exhibited during conditions of change or transformation, whereas management involves monitoring and is traditionally exhibited during conditions of stability. Studies indicate that integrated teams demand a shift from top-down team processes and traditional vertical leadership towards more bottom-up team processes and shared leadership (Vrijhoef & Koskela, 2000).

1.2 What is shared leadership?

Shared or distributed leadership is an emergent team property, in which two or more individuals engage in the leadership role in an effort to influence and direct fellow members to maximize team effectiveness (Bergman et al., 2012). This approach would be particularly relevant for construction projects, as the more complex the task, the more likely that shared leadership will be needed for optimal performance (Pearce & Manz, 2005). Most research on project management is focussed on a single enterprise and not the management of collaborative teams (Ollus et al., 2011; Webber & Webber, 2015), let alone the main activities which create self-managing teams that perform well and sustain their self-management over time.

People need to interact with one another.

1.3 Why focus on interpersonal skills?

To identify possible problems and select the best solutions, team members and other stakeholders need to work, interact with one another continually (Sasped et al., 2002). Interpersonal skills are activities, interaction and communication between people, and because these skills are expressed in the presences of others, these skills are not specific but context and situation dependent. Syed (2017) has addressed the main tasks in project teams which apply shared leadership and discovered that the presence of certain team members influences team functioning. This suggests that the way team members communicate and interact with each other may determine team functioning, and thus concerns a change in the (traditional) role of the project manager. Ultimately team members can use their interpersonal skills to influence team functioning and the outcome of the project.

1.4 Research aim

The aim of this thesis is to explore the influence of interpersonal skills on team functioning and shared leadership in project-based integrated design teams. During the present study the terminology of the case study project plan has been adopted, in which it became clear that previous research by Syed (2017) actually addressed the role of the process manager instead of the project manager. In the present research the data collection of the case studies from previous research was continued (case study 1 in Syed, 2017; case study 2 in Bel, 2018). In this study both the aim and the research question were rewritten, which has resulted that in the remaining of this report the emphasis is with the process manager instead of with the project manager. The main focus is to understand the way process managers apply interpersonal skills to influence team functioning. This will provide insight into the context of shared leadership by gaining understanding about the way project-based integrated design teams function; and enhancing insights into the way the process manager applied interpersonal skills to fulfil his or her role.

1.5 Research question

> Considering **interpersonal skills**, how can **process managers** influence **team functioning** in **project-based integrated design teams** which apply **shared leadership**?

To address the research question, two case studies are investigated by observing four project team meetings of each case study. Both case studies involve hospital projects in a foreign country and were executed by a consortium of architectural offices and an engineering company.

To answer the research question, the following structure is used: a theoretical framework is developed which describes applicable concepts to guide the data collection and analysis from the observations and interviews. The results from the data analysis identify the key-findings of the role of process managers and the way they can apply their interpersonal skills.

2. BACKGROUND

This chapter provides a literature review of the relevant concepts and theories from academic sources to generate a better understanding of the relation between interpersonal skills, team functioning and shared leadership. As described in the research aim, in the context of this research the emphasis is with the process manager instead of the project manager. The process manager leads the project process.

2.1 Shared leadership

The more complex the task (complex construction project), the lower the likelihood that any one individual (e.g. the process manager) can be an expert on all task components (multiple disciplines) demanding more bottom-up processes and shared leadership in which the *team leader* guides team members to lead themselves and engage in decision making. Shared leadership is an emergent team property (Carson et al., 2007) and involves mutual influence *between* team members which positively relates to higher team performance, as team members put in more resources to the task, share more information and experience higher commitment (D'innocenzo & Mathieu, 2016). An emergent team property refers to a property which is becoming visible in the team; is dynamic by nature and varies as a function of team context, inputs, processes, and outcomes (Marks et al., 2001). Carson et al. (2007) describe three team conditions that support shared leadership (illustrated in Table 1). Van Amelsvoort et al. (2003) describe three team characteristics of teams which apply shared leadership (illustrated in Table 2). Figure 1 illustrates the relation of the input (team conditions) and output (team characteristics) of shared leadership.Figure 1: Shared leadership

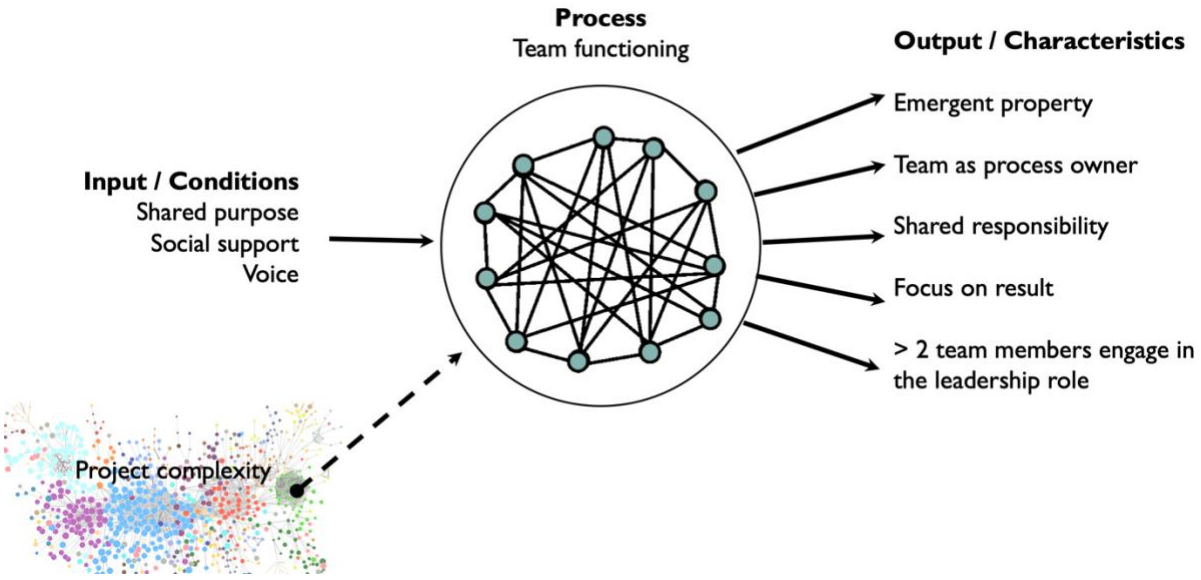

Figure 1: Shared leadership (based on Marks et al., 2001; Carson et al, 2007; Van Amelsvoort et al., 2003)

2.1.1. Team conditions

Conditions	Description
Internal team environment	Team members must offer and accept influence from fellow / multiple team members.
1. Shared purpose	Common understanding (shared mental model) of common goal which enhances motivation and commitment.
2. Social support	Team culture, an internal social network in which team members feel valued and appreciated by providing each other with emotional and psychological strength.
3. Voice	Interaction and engagement of team members in decision making and constructive discussions through trust and open communication (safe environment).
External team coaching	External team leaders who coach and help teams through direct interaction by: • Help develop internal team environment, e.g. create common understanding (shared mental model) • Supportive coaching, through encouragement and reward which enhances confidence and trust in the team. • Help build shared commitment among team members, which reduces free riding and demonstrates personal initiatives. • Functional approach, provides suggestions (on task strategies) which are aligned with requirements and demands.

Table 1: Team conditions to develop shared leadership (Carson et al., 2007).

2.1.2. Team characteristics

Characteristics	Description
Shared responsibility	Focus on team, not individuals.
The team is the 'process owner'	The team has the capacity to control the project process. Managers and staff services are there to support the team by creating requirements.
Focus on result	The team responsibility is not expressed in terms of tasks but result, namely a product or service with requirements set by the client.

Table 2: Team characteristics of shared leadership (Amelsvoort et al., 2003).

In order for project team members to lead themselves; engage in decision making and experience higher commitment, team members need to timely share more (accurate) information. Mathieu et al. (2005) refers to this as a shared mental model, which can be understood as an organised understanding or mental representation of knowledge shared by team members. Mathieu (2005) further makes a distinction between task mental models and team mental models. Task mental models refer to common arrangement among team members in terms of their tasks and the potential role that the broader environment can play. This affects processes and has an indirect effect on performance. In contrast, shared team mental models represent a shared understanding among team members about interaction with one another. It has a direct effect on performance.

2.1.3. Project-based integrated teams

Construction projects are becoming more complex and dynamic, as the required knowledge and expertise to design and deliver a building is expanding and rapidly evolving (Hwang and Ng, 2013). In addition, this knowledge has become scattered amongst the more and more experts from different fields (Edmondson, 2009). A project-based integrated team is a temporary group of people with different backgrounds (ranging from different disciplines, companies or different countries) who are interdependent in the tasks they perform, and therefore collaborate with each other, and see themselves as a unique entity to achieve a common goal (Kärrlander, 2017). This gives rise to a cross functional team context that can influence whether team members understand each other (due to different backgrounds) or not. Project team members are often bounded through an agreement or contract. This determines an organizational context, between companies referred to as inter-firm relations, which can influence team performance. Team performance or team effectiveness refers to the extent to which a team achieves a goal or mission (outcomes). Figure 2 illustrates that teams have a certain degree of independence set by a larger organisation (organisational context). The team *(*context*)*, a relatively fixed group members, is jointly responsible for the process in which products or services are delivered (outcomes) (Van Amelsvoort et al., 2003). The team members influence each other, are highly committed and engage in decision making without always calling on the manager (shared leadership).

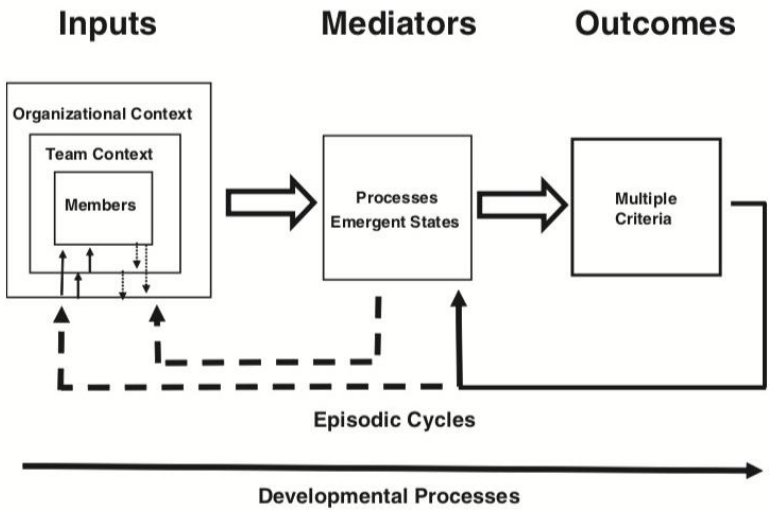

Figure 2: Input-Mediator-Outcome / Team effectiveness framework (Mathieu et al., 2008).

2.2 Role of the process manager

Traditionally the influence of the process manager is mostly seen in the leader role. Integrated teams demand more bottom-up processes with shared leadership over top-down processes with traditional focussed leadership, this suggests a change of the traditional role of the process manager to facilitating the team rather than (traditional) steering (Hackman & Wageman, 2005). Which raises the question: how can process managers facilitate project-based integrated design teams? Table 10 in Appendix A illustrates the contrast between traditional leadership (related to the traditional 'boss') and shared

leadership (related to team leader). Van Amelsvoort et al. (2003) argue that a project manager or in this study the process manager of a self-managing team demonstrates three roles: *leader* (focussed on engagement of people), *manager* (focussed on control) and *coach* (focussed on letting team members and project team learn).

2.2.1. The three main roles of a process manager

In practice it is difficult to separate the three roles: leader, manager and coach - as the related activities have a lot in common and are closely connected (Van Amelsvoort et al., 2003). However, the distinction between the roles is based on activities which clearly indicate what is expected of process managers (illustrated in Table 3). Also, how these activities are implemented or executed is determined by the manager. The tasks that the manager picks up must be in line with the development phase of the team and team members. Effective project management is also influenced by personal traits such as willingness, competence of employees, the need for management and development. The effectiveness of a process manager towards the team will increase, when the manager stays true to his / her own qualities in actions or personal strength. This refers to the authenticity of the manager, which requires the condition that managers are aware of their qualities.

Role description	**Characteristics**
Leader: a dominant or superior position with the ability to exercise a high degree of control or influence over the team.	• Has a vision and the ability to clearly put the vision into words. • Acts on that vision every day. • Courage and decisiveness. • Ability to reflect upon him / herself.
Manager: the management duties are complementary to those of the team.	• Arranges what the team does not (yet) arrange. • Result orientated. • Creates preconditions. • Focussed on improvements.
Coach: related to guiding, in the sense of guiding team members to engage and take initiatives.	• Guides team members in their individual development. • Supports by creating conditions. • Rewards desirable behaviour and corrects unwanted behaviour. • Recognizes cooperation patterns in the team and discusses them. • Focussed on both individual and team responsibility.

Table 3: Characteristics process manager roles (Van Amelsvoort et al., 2003)

2.2.2. Leadership skills of process managers across contexts

Mumford et al. (2007) identified the leadership skills of team leaders (process managers) which are related to the context (e.g. cross functional team context versus inter-firm organisational context). These can be grouped into four categories: cognitive, interpersonal (also referred to as soft skills), business and strategic skills. This highlights the importance of considering the context / level (in hierarchy) when researching the concept of leadership, suggesting that process managers at higher levels in the organisation have significantly greater overall leadership skills in which the required amount varied per skill category. Table 4 gives a description and the actions of different leadership skill categories.

Leadership skill categories				
	1. Cognitive skills	**2. Interpersonal skills**	**3. Business skills**	**4. Strategic skills**
Description	Mental capability of collecting, processing and disseminating information and learning. The study shows that cognitive skills are needed to the greatest degree across all levels in the organisation, they do not diminish at higher levels in the organisation, but rather increase. This is also supported by Heckman & Kautz (2012) who suggest that the importance of cognitive ability increases with the complexity of the task.	People skills to foster inter and intra organisational relationships amongst all types of people associated with the project (Kirsch, 2000; Lee et al., 1995). They are mostly intangible, context and situation dependent, employed without the use of tools, and not associated with a concrete output.	Functional area related skills which create the work context.	Highly conceptual skills required to take on perspectives to understand complexity, deal with uncertainty and influence in the organisation.
Actions	Investigating, monitoring and information gathering and dissemination.	Guiding, negotiating, leading, managing expectations, influencing, motivating, negotiating and resolving conflicts.	Coordinating, technical know-how, managing resources, managing financial resources / cost control and operations analysis.	Planning, evaluating, spokesperson, decision making, identifying and solving problems.
Mumford et al. (2007)	In conclusion, cognitive skills are needed to the greatest degree across all levels in the organisation, they do not diminish at higher levels in the organisation, but rather increase. This is also supported by Heckman & Kautz (2012) who suggest that the importance of cognitive ability increases with the complexity of the task.	In conclusion, interpersonal skills are required to a greater degree than business and strategic.	In conclusion, strategic and business skills are more dependent on organisational level than interpersonal and cognitive skill requirements. This suggests the importance of strategic and business skills for process managers grows at a greater rate with organisational level than interpersonal and cognitive skills.	

Table 4: Leadership skill categories of process managers (Mumford et al., 2007; Marando, 2012).

2.3. Interpersonal skills affect team functioning

Goleman (1998) indicates that the best-performing managers excel in emotional competencies and have good people relationship skills. Understanding feelings and emotions of people better will help predict likely future behaviours of team members, which can help plan ahead to, for example: avoid conflicts much earlier (Fisher, 2011). Various aspects, such as the composition of the team, team roles, responsibilities and personalities can have a (in)direct effect on team functioning and project outcome. Team functioning refers to how team members work together, the activities *within* a team (*intra*) to achieve a common goal. These activities often involve *behavioural responses* to internal and external stimuli. The following illustrates human behavioural responses:

1. A person's behaviour changes in different situations, e.g. normal circumstances versus under stress.
2. Two people can act different in the same situation, e.g. in the same project meeting, two people can have a different response to the same topic.

Syed (2017) discovered that team members show different behaviour in the presence of the process manager, which indicates that leadership style, actions and behaviour (relationships) influence the team dynamics (refers to *inter*action *between* team members). This is supported by Van Amelsvoort et al. (2003) who suggest three important aspects in group or team dynamics:

1. Interrelations and positions (power, influence, status and popularity among team members).
2. Group norms and values.
3. Typical behavioural-patterns (habits).

This research will mainly focus on how the process manager uses interpersonal skills to create team conditions. Figure 3 illustrates the relation between the different theories and concepts applicable for this research. This research aims to understand the way project-based integrated design teams apply shared leadership and the way team members interact with each other. The main focus of this research is to understand the way process managers (input) can apply interpersonal skills to influence project progress and team effectiveness (output).

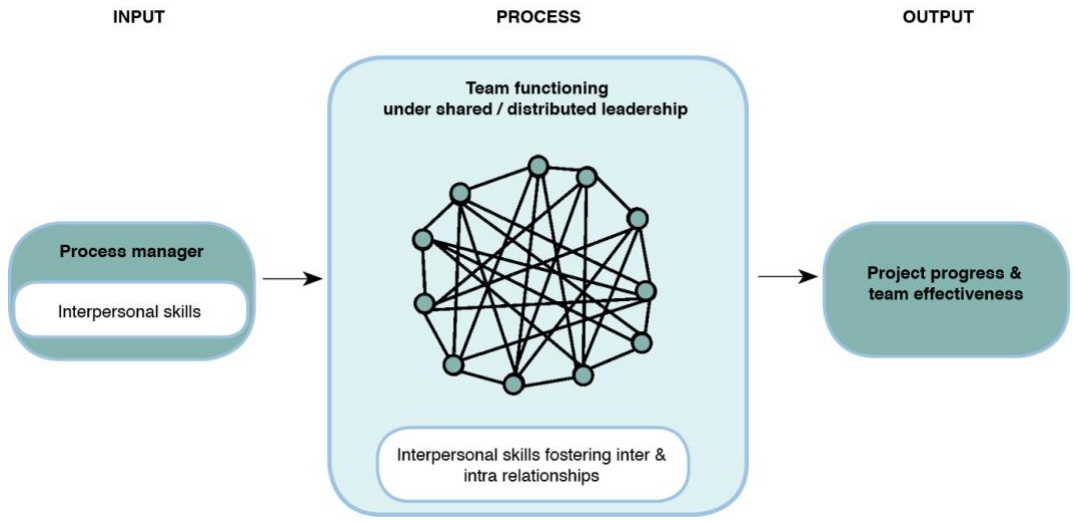

Figure 3: Conceptual framework.

2.4. Conclusions from the literature

Shared leadership in project-based integrated teams

Construction projects executed by integrated teams involve complex processes that can influence each other and effect project progress and outcomes (team effectiveness). The way project team members work with each other (team functioning) is determined by the team's dynamics, which in turn is influenced by members' interpersonal skills. To achieve shared leadership in project-based integrated teams, the team must meet team conditions which are influenced by team characteristics.

The role of the process manager

The process manager has three main roles:

1. Leader
2. Manager
3. Coach

The balance between the three roles changes, as it is largely determined by the development of the team. In conclusion the process manager's effectiveness is determined by what the team requires and to what extent he or she is able to respond to that. Furthermore, leadership skills of process managers are related to organisational contexts and can be grouped into four categories:

1. Cognitive
2. Interpersonal
3. Business
4. Strategic

Behaviours drive outcomes. Facilitating an integrated design team involves creating team conditions by managing the (*inter*)relationships *between* team members. These relationships may develop over time, such depending on the intensity and quality of the relationships. *Interpersonal skills* can create team conditions, contribute to higher performance and enhanced leadership. They are required for building relationships, and contribute to understanding feelings and emotions. This will help them to understand what motivates people and the way they apply knowledge to achieve the best results. Thus, important skills of effective process managers are not only hard skills - quantifiable technical knowledge and abilities - but also behavioural or interpersonal skills, often referred to as "soft skills". Despite that the tasks associated with interpersonal skills are sometimes routine and can involve little serious communication and no important decision-making, they are important to smooth (team) functioning (Mintzberg, 1990). For example, the process manager helps to assure that team members from different disciplines understand each other by managing expectations through asking questions.

The aim of this research is to explore the way process managers can apply interpersonal skills in project-based integrated design teams to influence team functioning. The reviewed theory will also help to determine to what extent teams apply shared leadership and the role of process managers in project-based integrated design teams. Given the qualitative, and interpretative nature of the present study, this study will not be limited to the described theories and concepts. Insights arising throughout the execution of the research will be taken into account to generate a better understanding of the relation between interpersonal skills, shared leadership and team functioning.

3. RESEARCH DESIGN & METHODS

This chapter describes the interpretive qualitative research strategy, research methods and analysis techniques to collect and process data.

The aim of this research is to gain insight and understanding of the influence of interpersonal skills on team functioning and shared leadership with the main focus on the process manager. By attempting to understand the project team's activities and project team members' perspectives on collaboration, the project and the issues which occur during the project. This can potentially contribute to the improvement of team functioning or emphasize critical factors.

3.1 Interpretive qualitative research strategy

Qualitative research is a scientific method which inquires collecting non-numerical data (Bryman, 2012; Babbie, 2014). It involves developing exclusive themes for the exploration of specific experiences through text, narrative, or visual-based data to often understand human experience and behaviours (Given, 2008). To understand a phenomenon, situation or event, the totality of the situation needs to be explored. This research does not entirely rely on the Grounded Theory approach, as that would mean there is no previous understanding of team functioning. The literature review was done to increase understanding upfront. Grounded theory is based on inductive analysis which involves directly deriving patterns, themes, and categories from data; this is an alternative to the classical which requires defining clear categories and hypotheses prior to data collection (Kelle, 2007). To acknowledge the value of doing the literature review before and throughout data collection, the qualitative research strategy follows the approach referred to as *sensitizing concepts (Kelle, 2007). This refers to* the ability to reflect upon relevant data, involving important new features which provide a direction (inductive reasoning) (Bowen 2006; Bryman, 2012) with the support of theoretical terms from the literature review (deductive reasoning).

A part of the data collection will take place by observing project team meetings. As I stayed over a prolonged time as an intern at the engineering company, I became 'one of them'. The inevitable consequence is that the this introduces subjectivity into the research. Due to my background and internship at the firm, my frame of reference is coloured accordingly and my description of statements, behaviours and actions of the project team – reflect my interpretation. This refers to *interpretivism*. Together with the project teams and my supervisors I have developed and shared a joint socially constructed mental model to understand what this is about (the project) – which is also referred *constructionist learning* (Bryman, 2012).

In conclusion, to gain insight in these developments it is essential to witnesses team interaction between; this is possible through case study research. To justify the interpretive nature of what I consider the main findings, thick descriptions based on quotes will be provided and to further enhance transparency Atlas.ti was used as a tool for data analyses.

3.2 Comparative case study research design

Case study research takes the importance of context into account and helps to understand practice-based problems more in-depth. (Merschbrock et al., 2016). A comparative case study involves the comparison of two or more cases to have a critical and analytical view on existing theories or generate theoretical insights as a result of contrasting findings uncovered through comparison (Bryman, 2012).

Case selection

An engineering company provided the two cases for this research. A comparison between two case studies is made, which meeting the following case selection criteria:

1. The project team exists of various stakeholders with different backgrounds of expertise.
2. The project team has a process manager.
3. The project is on-going, and the project team meets at least once every two weeks.
4. The project team accepts the terms of data collection listed in the informed consent.
5. It is feasible to observe between 4 to 6 project team meetings within the graduation planning.

The collected data are analysed and compared with each other to identify patterns across the cases and key- findings.

Case description

The two case studies were selected because they are both on-going hospital design projects in the same foreign country executed by an integrated design team. The main focus of this research is at the project team level. Both projects are led by a consortium (Figure 4) consisting of architectural offices and an engineering company, which demonstrate complex organisational and contractual structures associated with the lengthy decision-making nature common to such complex design projects.

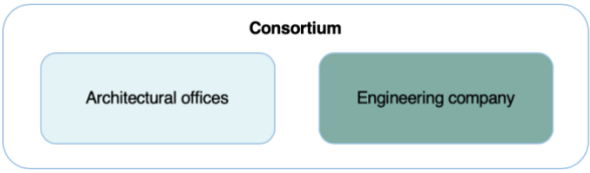

Figure 4: Consortium.

Case study 1 concerns the construction of an additional building of 30,000 m^2 to an existing hospital in a foreign country. In 2014, the University Hospital held a design competition. For the tender an engineering company and architectural office specialized in hospital design formed a consortium and were assigned to the project in 2016. The project involves patient-centred design which meets international standards and is able to facilitate over 35,000 patients a year. It consolidates and upgrades existing facilities, which will make it the largest hospital in the foreign country. Currently the project team is working on the design, part of preliminary design 2 phase. The project is delayed by 3-years and will be completed in 2021.

Case study 2 concerns the construction of a new hospital building complex of 130,000 m^2 with 950 beds, which will become one of the largest private hospitals in a foreign country. An engineering company and 2 (other) architectural offices formed a consortium. The project consists of six components which have clearly defined functions and will be constructed using a design & building approach. Currently the project team is working on the tender dossier, part of the specification phase. The project is delayed by 1 month and will be completed in 2023.

The main differences between the case studies are the project size, the contractual relations and the fixation of the design requirements. In case study 1, the design requirements (from the client) are not as fixated as in case study 2. In both projects the engineering company and architectural office have had long-term partnerships and are applying Building Information Modelling (BIM) from initiation until construction.

3.3 Research methods

For this research three techniques were applied to collect data: context analysis, in-depth interviews and participant observation. The data are treated with confidentiality and anonymity was assured.

3.3.1 Context analysis

A context analysis is the starting point and gives a detailed description of the history of the project, the involved stakeholders, the roles of the project team members within the project. This provides insight into the context in which the project team and the process manager operates and the relationships between the stakeholders, whether they have collaborated earlier in former projects; it is additional to understand the interaction and behaviours of team members. The context analysis of both cases includes a project description, consisting of a brief history and a time-line. Including important decision-making moments that influenced the process of the project and important events that which will take place later on. The organisational chart illustrates the relationships between the involved stakeholders. Information was either provided or collected by observing and contacting the involved stakeholders.

3.3.2 In-depth interviews

In-depth interviews are loosely structured interviews, which are conducted face to face or via telephone. This provides insight into a specific topic or answer to a specific question while making it easy to follow the thread. These interviews are conducted within a select group or limited participants (1 – 3 people), which engages the interviewee(s) to provide maximum input while the interviewer listens rather than talks.

3.3.3 Observations

During a period of three months, data was collected from two cases through 'participant' observations to determine team functioning. Participant observations on project team level involves observing the way team members behave, communicate and interact with each other during project team meetings. Although the researcher was frequently present during the project team meetings, it is not a pure kind of participant observation, as the researcher was not assigned a task in the project. For the purpose of data analyses, (the verbal communication of) the project meetings were recorded with an audio recorder and non-verbal communications and other behaviour (listening and body language) is documented with a modified observation checklist (Figure 5) adopted from a former checklist designed by Wijnstra (2016). This checklist is based on sensitizing concepts, which draws attention to important features of the social interaction between team members. The audio and observation checklist give a reconstruct of the project meetings to be able to process and analyse the data.

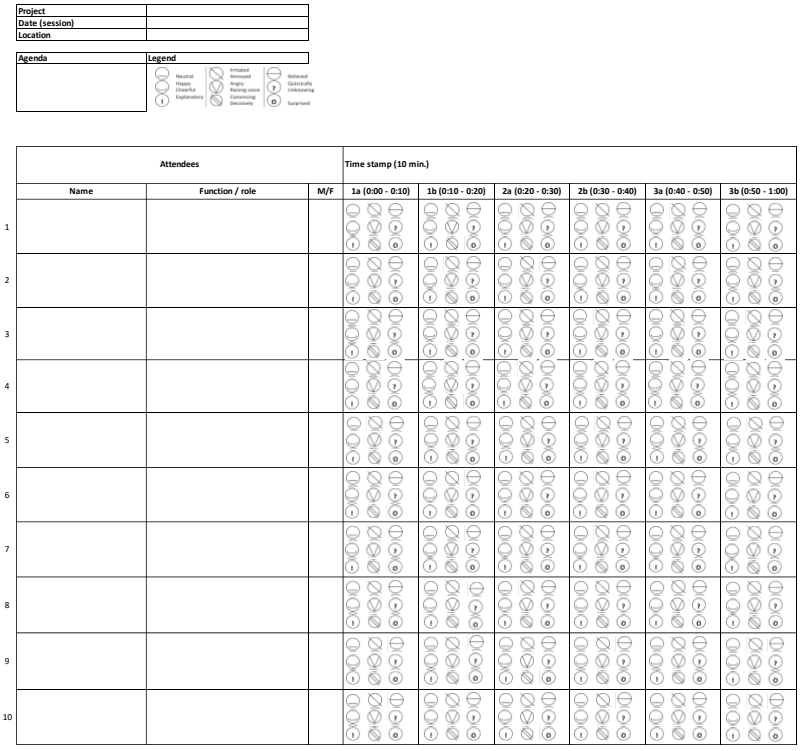

Figure 5: Modified observation checklist (based on Wijnstra, 2016).

3.4 Processing data

According to grounded theory, categories that are found in the data can be categorized by means of coding. In this research, audio is coded in the program Atlas TI, to count and group the codes to analyse as a whole, as well as to find co-occurrence connections between different codes and group codes (Byrant & Charmaz, 2007). The full analysis of codes (including the amount of code groups a code belongs to) can be found in Appendix D. Each observation is elaborated upon with a project meeting summary and data figures. The project meeting summary helps interpret the data. The findings per case study are elaborated upon in a case study summary and finally conclusions are drawn from the case study comparison.

Following the theoretical background, the following group codes are developed to determine team functioning:

- *Behaviour.* These codes involve the intonation of the verbal communication of team members, based on the concepts of the observation checklist to determine the atmosphere.
- *Actions.* Table 11 in Appendix C illustrate the communication labels developed by Syed (2017), which involve the main tasks which need to be addressed in project teams. In this research referred to as actions, involving the activities within the project team.
- *Project topics.* These codes are developed during the observations and determine critical project topics of project meetings.

An important inductive code is that of information management. This concerns a couple of code including:

- Lack of information
- Building Information Modelling (BIM)
- Boundary object
- BIM as a 3D Revit model
- BIM as an information management system

Other group codes which have been developed based on the theoretical background to support this research:

- *Traditional boss* versus *team leader.* These codes are based on the concepts of traditional boss versus team leader, to help determine the impact of the presence of the process manager and other team members.
- *Leadership skills.* These codes involve the process manager's different leadership skills: cognitive, interpersonal, business and strategic. These codes help determine the impact of the presence of the process manager and other team members.
- *Information gathering and dissemination.* These codes are developed during the observations and aspects the information management within the project team.
- *Characteristics of shared leadership.* These codes help determine to what extent teams apply shared leadership.
- *Collaboration.* These codes are developed during the observations and determine aspects of collaboration during the project meetings.

Furthermore, during the execution of the research it has become apparent that there are cross references and connections between codes and different group codes, e.g. planning belongs to group code actions as well as group code project topics.

3.5 Research process

Figure 6 illustrates the research process. After the data analyses conclusions can be drawn to answer the main research question. Finally, a reflection on the graduation and research process, including recommendations for future research.

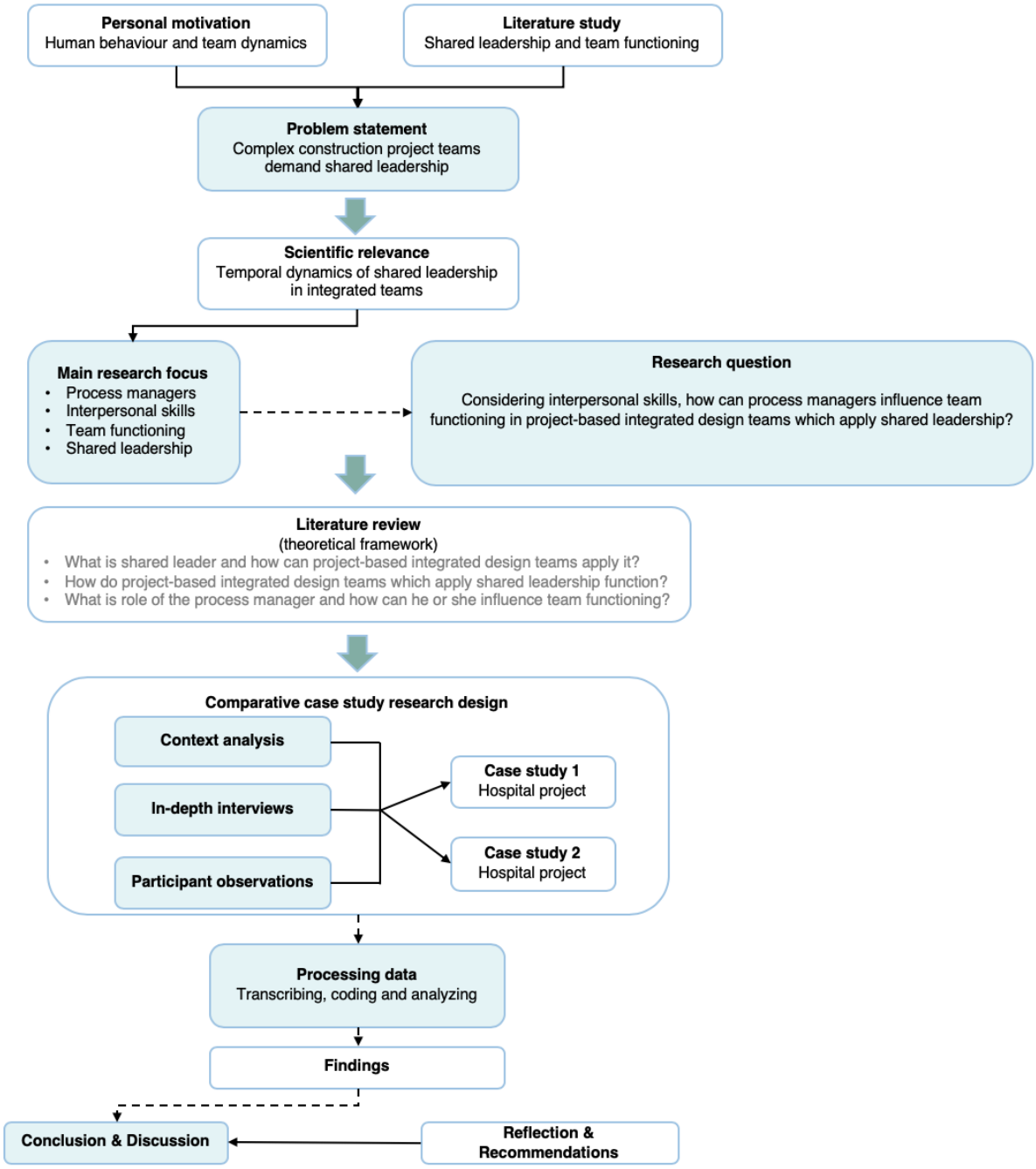

Figure 6: Research process.

4. CASE STUDIES

This chapter describes the context and analysis of case study 1.

4.1 Case study 1

4.1.1 Context

Case study 1 involves the construction of a 30,000 m^2 additional building to an existing hospital in a foreign country. It is a patient-centred design which meets international standards and can facilitate over 35,000 patients a year. The design and engineering contract has been awarded to a consortium led by architectural office I and an engineering company, supported by three sub-contractors: external architectural office I, II & III. Both parties understand the challenges of the hospital environment and bring their considerable experience from the highly rated Dutch healthcare system. Architectural office I and the engineering company have previously worked together on three hospital projects, this is the latest project win for what has been a successful partnership between architectural office I and an engineering company.

Project description

The client awarded the contract to the consortium after winning an international design competition. Architectural office I is responsible for the architectural, landscape design and Building Information Modelling (BIM) and an engineering company for the structural design, building services, acoustics, fire safety and project management. This team has been strengthened by local design agency architectural office II. This hospital project consolidates and upgrades existing facilities, becoming the largest hospital in that foreign city. A single multidisciplinary unit will diagnose and treat patients from across the country, while also coordinating clinical research and prevention programmes. Currently the project team is working on the preliminary design 2. The initial project completion and building delivery was scheduled for December 2019 but is delayed to 2021 due to revisions of the program of requirements.

Organisation

The following actors are involved in the project meetings:

- Design manager
- Process manager (senior project manager)
- Project controller (senior project manager)
- Executive architects
- LEAD engineers: structural, mechanical, electricity & plumbing (MEP), building physics, fire & safety
- Cost manager
- Client

Figure 7 illustrates the project organisation (based on project plan) in which the client has a contract with the consortium. The design team is subdivided in a steering committee and project team. The steering committee consists of the managing director of architectural office I and the process manager, supported by the partner of external architectural office I. The project team members manage various organisation components of the project organisation and are responsible for the design and execution of the project. Some team members have collaborated with each other in other projects, while others have been involved since the design contest and others joined later on; new team members have been assigned to roles: project controller (in the project plan referred to as assistant project manager), lead engineers structural, building physics, fire & safety. Occasionally the project team is supported by representatives from other stakeholders, such as executive architect 1C, or advisors, such as an energy engineer.

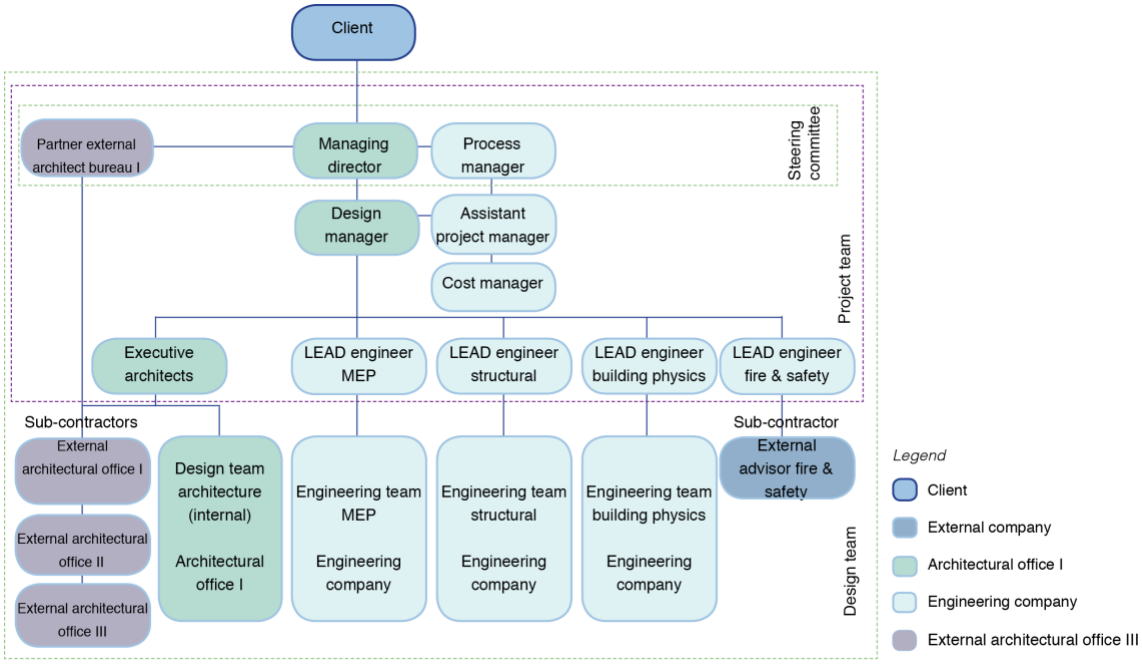

Figure 7: Project organisation case study 1 (based on project plan)

Project meeting structure

Table 5 illustrates the frequency of meetings of teams. This research focuses on the project team and process manager, therefore only the project team meetings have been taken into consideration for observations.

Meeting	**Frequency**
Steering committee	Once every two months / every phase transition
Project team	*Once every two weeks*
Design team architectural office I	Once every week
Design team with client	Once every two weeks
Engineering team engineering company	Once every week

Table 5: Meeting structure case study 1

4.1.2 Observations

This case study has been previously examined by Syed (2017) and discovered that the presence of a process manager influences the team functioning which was the motivation for this following research. A total of four project meetings are observed with one additional engineering team meeting, the agendas of these meetings are made up by the design manager and shared via e-mail. Table 6 illustrates the team members who were present during the observed project meetings, the spoken language is Dutch. The findings of each observation are elaborated upon and finally an overall summary of this case study to support the comparison between the two case studies.

Project team role	**M/F**	**Company**	**Spoken language**
Design manager	F	Architectural office I (Dutch)	Dutch
Executive architect 1A	M		
Executive architect 1B	M		
Executive architect 1C	F	External architectural office I (Foreign)	
Project controller	M	Engineering company (Dutch)	
Process manager	M		
LEAD engineer structural	M		
LEAD engineer mechanical, electricity & plumbing (MEP)	M		
LEAD engineer building physics	F		
LEAD engineer fire & safety	M		
Energy engineer	M		

Table 6: Observation participants case study 1

Case study 1 – Observation 1

General
Date: 15th of August 2018
Duration: 3 hours
Place: Engineering company office, The Netherlands

Attendees: design manager, process manager, lead engineer structural, lead engineer MEP, lead engineer building physics and executive architect 1A.

Agenda
- Contract
- Feedback on preliminary design from the client
- Planning
- Design
- Energy performance
- Building permit

Summary project meeting
This is the kick-off meeting after the construction holidays and hold period of the project. Prior to the start of the meeting team members socialize and talk about non-project related topics. The design manager opens the meeting by discussing the agenda topics and provides a recap and results of the former meeting, which involves changes in the contract and feedback on the preliminary design by the client. The design manager indicates that the client is satisfied, however she will request more extensive feedback. Following is a discussion about the shafts, walkway bridge and the entrance of the building, in which all team members participate. The process manager mainly initiates discussions on the costs. The lead engineer MEP indicates that an alternative solution for the shafts would be preferred, in which the lead structural engineer expresses his opinion about as well; this also involves the emergency exit routes which needs to be discussed with the lead engineer fire & safety. Executive architect 1A and lead engineer building physics engage in the discussion about the wind which can possibly affect the building, this is emphasized upon by the process manager who provides an example of a project executed by another company for which expensive measures had to be taken; thus, preventive actions and perhaps additional wind research should be taken into consideration. New discussions are initiated on how to tactically handle the elevator selection, plumbing, consequences for the structure, energy performance and environment impact report. Team members question whether certain components such as wind research and environment impact report are within the scope of the project; this needs to be clarified with the client. According to the adjusted planning the deadline for the building permit is coming up. However it is questionable whether this is in fact feasible, opening the discussion about what needs to be included in the building permit and what is additional. Most team members conclude that the planning is not feasible. The lead engineer MEP leaves half an hour before the closing of the meeting due another appointment but returns later after the meeting. The meeting is closed, and team members schedule separate appointments to further discuss overlapping topics between their disciplines.

Data project meeting
Figure 8, 9 and 10 show that project team members laugh and use humour through the project meeting (happy / cheerful behaviour). The meeting follows the project agenda, additionally the process manager addresses the financial pressure: budget / costs. This is due to contract changes which effect the scope. Team members are surprised but also irritated / annoyed when it becomes unclear what the deliverables are and conclude that the current planning to submit the building permit is not feasible. This adds pressure to the team collaboration and raises questions about the deliverables and scope. The shared conceptual model needs to be defined in which the deliverables and scope become clear to make project progress.

Quotations project meeting

"I do not understand, so what are the deliverables for the building permit? […] Is an additional wind research within our scope?" (Lead engineer Building physics)

"So how much time do we need for […] ? In conclusion, the planning is not feasible?" (Process manager)

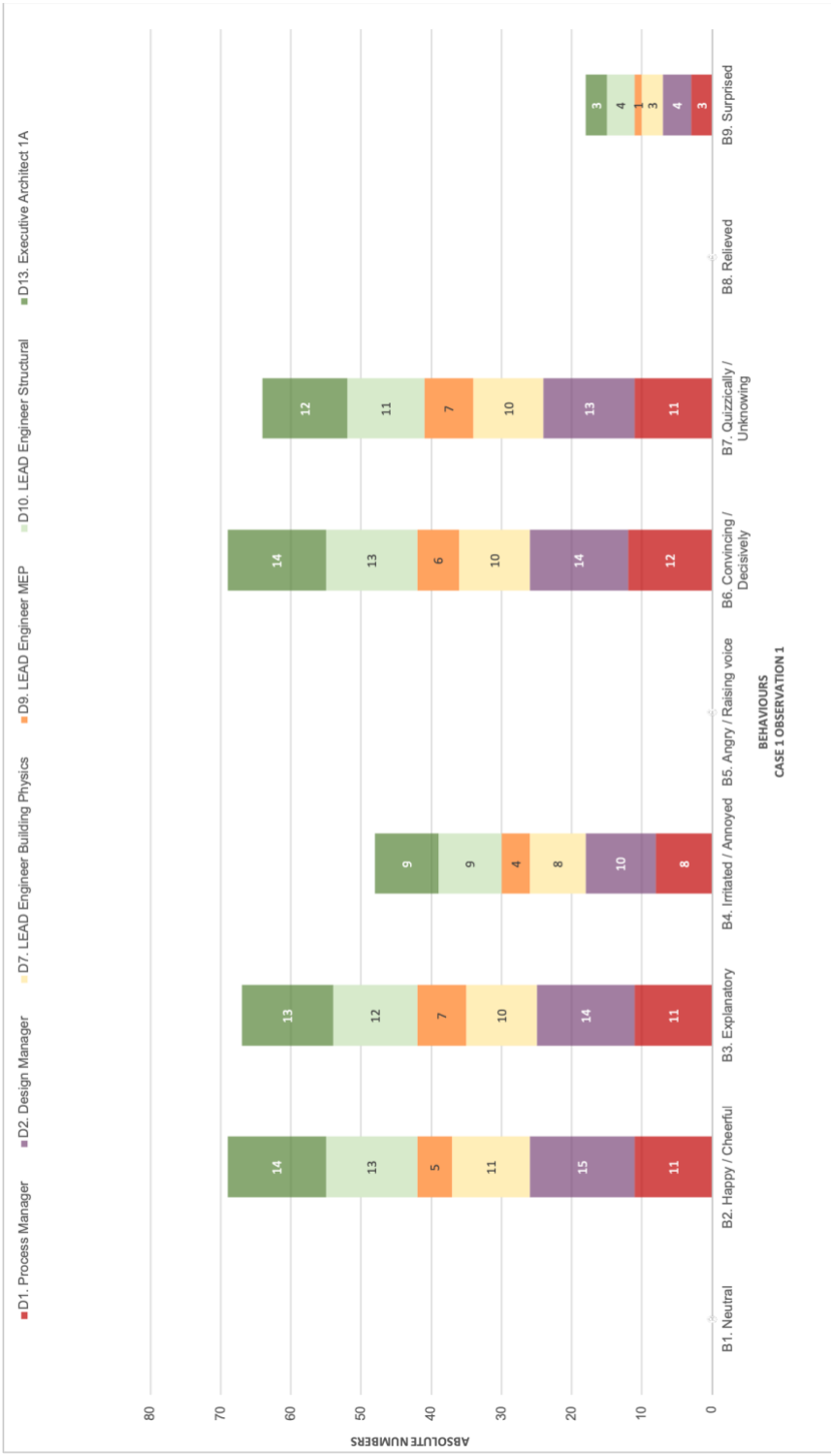

Figure 8: Behaviours, case study 1, observation 1

Figure 9: Actions, case study 1, observation 1

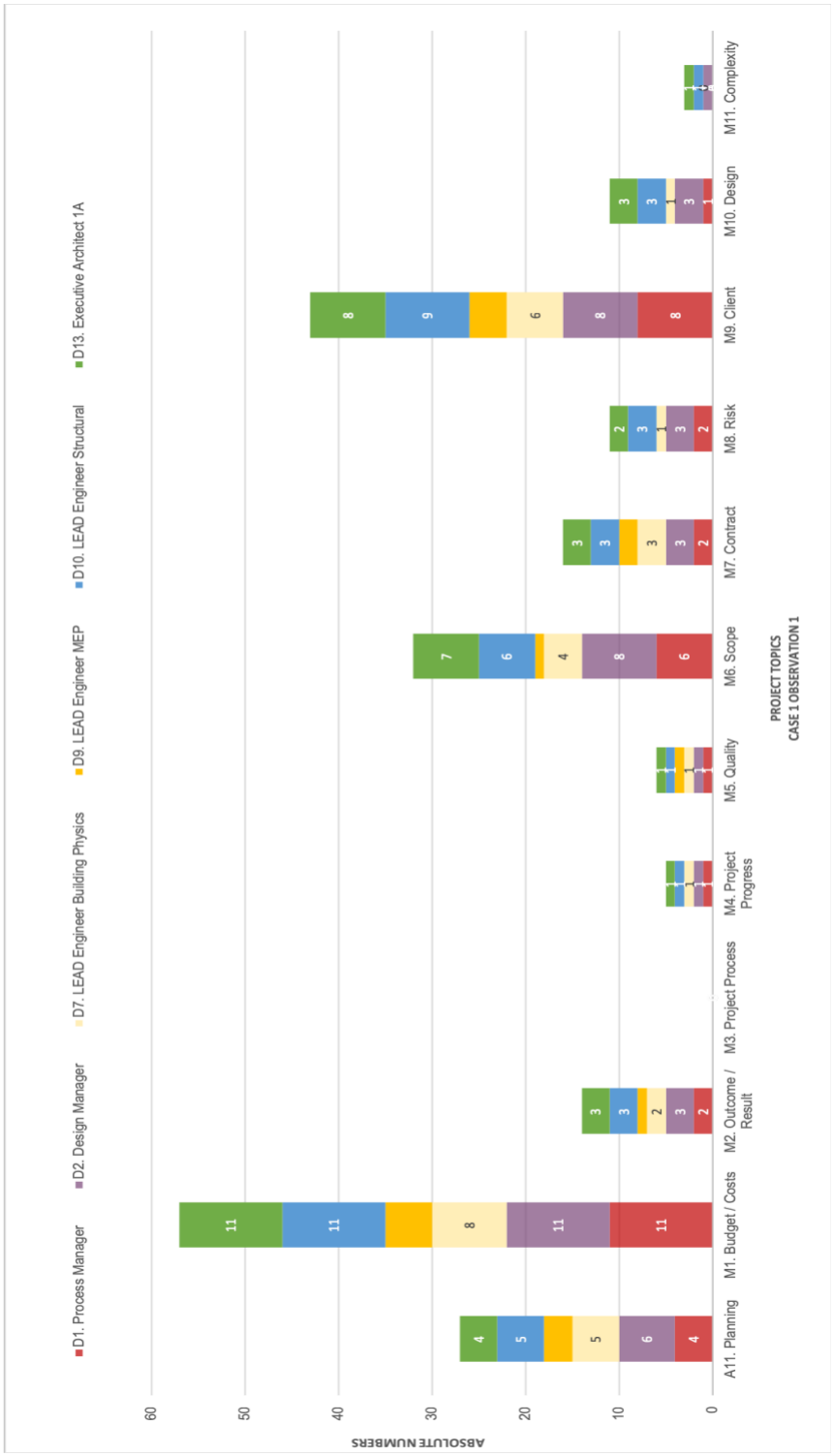

Figure 10: Project topics, case study 1, observation 1

Case study 1 – Observation 2

General
Date: 1st of October 2018
Duration: 1 hour and 55 minutes
Place: Engineering company office, The Netherlands

Attendees present: process manager, project controller and lead engineer structural.

Attendees via Skype: design manager, lead engineer MEP, lead engineer building physics, executive architect 1A and executive architect 1B.

Agenda
- Planning
- Entrance
- Progress hull construction

Summary project meeting
This project meeting takes place via Skype, technical difficulties lead to irritation among team members. The role of lead engineer building physics has been assigned to a new member. The design manager opens the meeting by discussing the agenda topics and provides a recap and results of the former meeting on modifications of the contract and building permit. Followed by an update on design changes and consultation of the lead engineer structural, whether these changes can affect the structural design. The project controller addresses and directs the focus of the meeting to the planning. The conclusion of the previous project meeting was that the current planning needs to be adjusted, and it was also unclear when project team members need to deliver products. This opens the discussion about what the deliverables are for the building permit and what the client wants. Each project team member gives an indication of the amount of time needed to complete and deliver products, of which the project controller sketches a rough planning and re-evaluates with the project team; the design manager will incorporate the alterations made to the planning. A follow-up on the design changes on the walk way bridges, entrance and how to handle the elevator selection; concluding that more input is needed from the client. Prior to closing the meeting, the project controller and process manager re-addresses the current planning issue and suggests the project team meets in person as soon as possible to resolve this with the support of a hard copy of the planning. Team members try to schedule a meeting prior to the regular project team meeting next week; this is not possible due to a lack of overlap between team member's schedules and instead separate appointments are made to discuss overlapping topics between their disciplines further. This leads to the disappointment of some team members.

Data project meeting
Figure 11, 12 and 13 show that project team members are mostly irritated / annoyed and angry / raising voices. The tension is a follow up from the previous project meeting when team members concluded that the planning is not feasible along with the technical difficulties. Via Skype the project team tries to create an overview of the deliverables (and thus defined a shared conceptual framework) and the planning that goes with it. While project team members ask questions related to the content and deliverables, the process manager emphasizes how severe (risk) the current situation is and asks questions to understand 'where the shoe pinches' (in terms of getting stuff done and project progress). Compared to the previous observation it was challenging to capture accurate behaviour and emotions from other project team members, due to the fact that the meeting took place via Skype.

Quotations project meeting

*"Is it working? Can you see it?" (*Design manager)

"We have to wait, there is a delay" (Project controller).

"But [addresses project team member] should we not… Oh, she cannot hear me…" (Project controller)

"I think meeting face to face is much better. Call me old fashioned but designing is done face to face with pencil and paper" (Process manager).

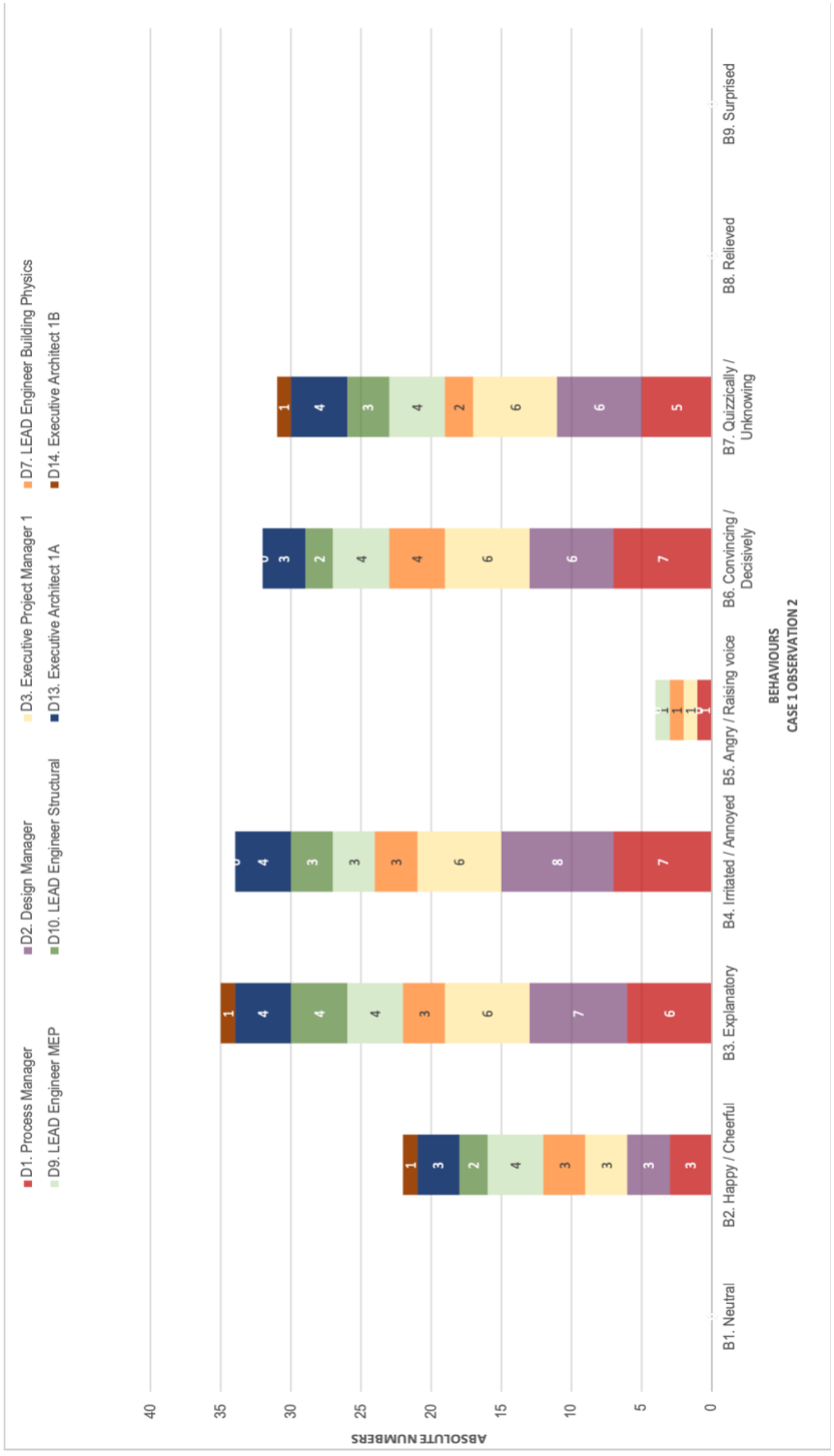

Figure 11: Behaviours, case study 1, observation 2

Figure 12: Actions, case study 1, observation 2

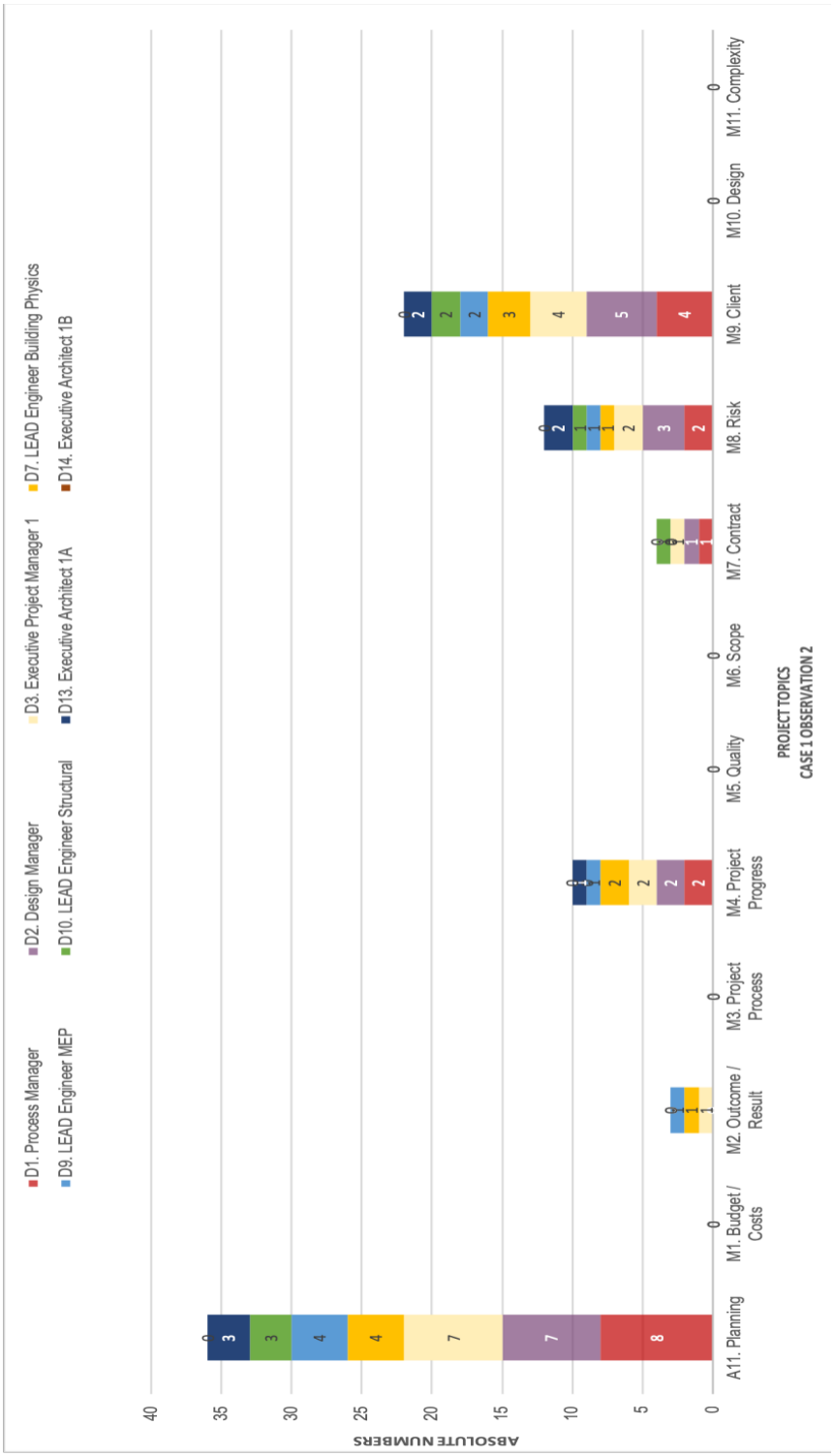

Figure 13: Project topics, case study 1, observation 2

Case study 1 – Observation 3

General
Date: 10th of October 2018
Duration: 1 hour and 15 minutes
Place: Engineering company office, The Netherlands

Attendees: design manager, project controller, lead engineer structural, lead engineer MEP, lead engineer building physics, executive architect 1A and executive architect 1C.

Agenda
- Planning
- Building order
- Entrance
- Walkway bridges
- Facade
- Building permit

Summary project meeting
Prior to the start of the meeting project members are discussing the deliverables of the project. Later the meeting is joined by executive architect 1C, who mainly provides insight and advise on the regulations in the foreign country. The design manager opens the meeting and brought a modified hard copy of the planning, suggesting discussing this in front of the whiteboard. There is more coherence among the project team as they go through the planning step by step, addressing all disciplines involved per step leading up to the deadline for the building permit. The executive architect 1A asks questions to better understand the tasks of other disciplines, in which the lead engineer building physics emphasizes that she would like to have sufficient time to complete and deliver her products, providing a description of her discipline and role responsibilities. At each alteration the project controller reflects and asks how this affects other disciplines, and the cost check. The design manager will incorporate the alterations made to the planning. The lead engineer structural addresses that team members can help each other out by indicating when and where changes are made, this will remind everyone to check if those alterations have consequences for their discipline - on which everyone agrees upon. The meeting is closed by scheduling an appointment to go the building site in the foreign country.

Data project meeting
Figure 14, 15 and 16 show that the process manager is absent. The project team members are less irritated / annoyed compared to the previous project meeting. In this meeting they fully focus on creating a feasible planning (set goals) together. Along with this they define the shared conceptual model, the deliverables for the building permit and requirements by the client, which involves better understanding the tasks (evaluation) and responsibilities of each discipline. They focus on what is needed to make project progress.

Quotations project meeting
"The floor plans are necessary for my calculations. That is my report and what my discipline is about" (Lead engineer building physics)

"I do not understand can you please explain" (Executive architect 1A)

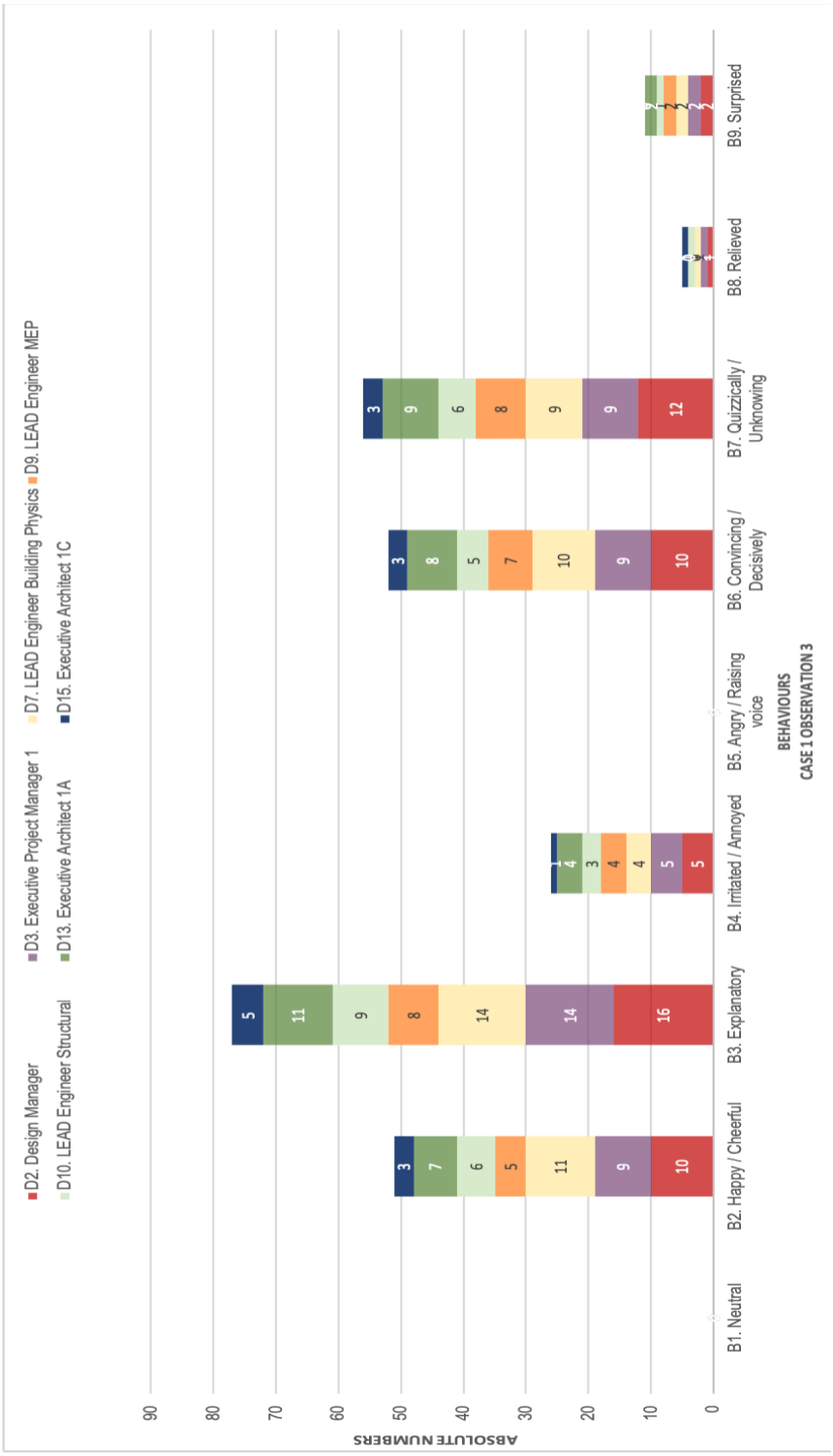

Figure 14: Behaviours, case study 1, observation 3

Figure 15: Actions, case study 1, observation 3

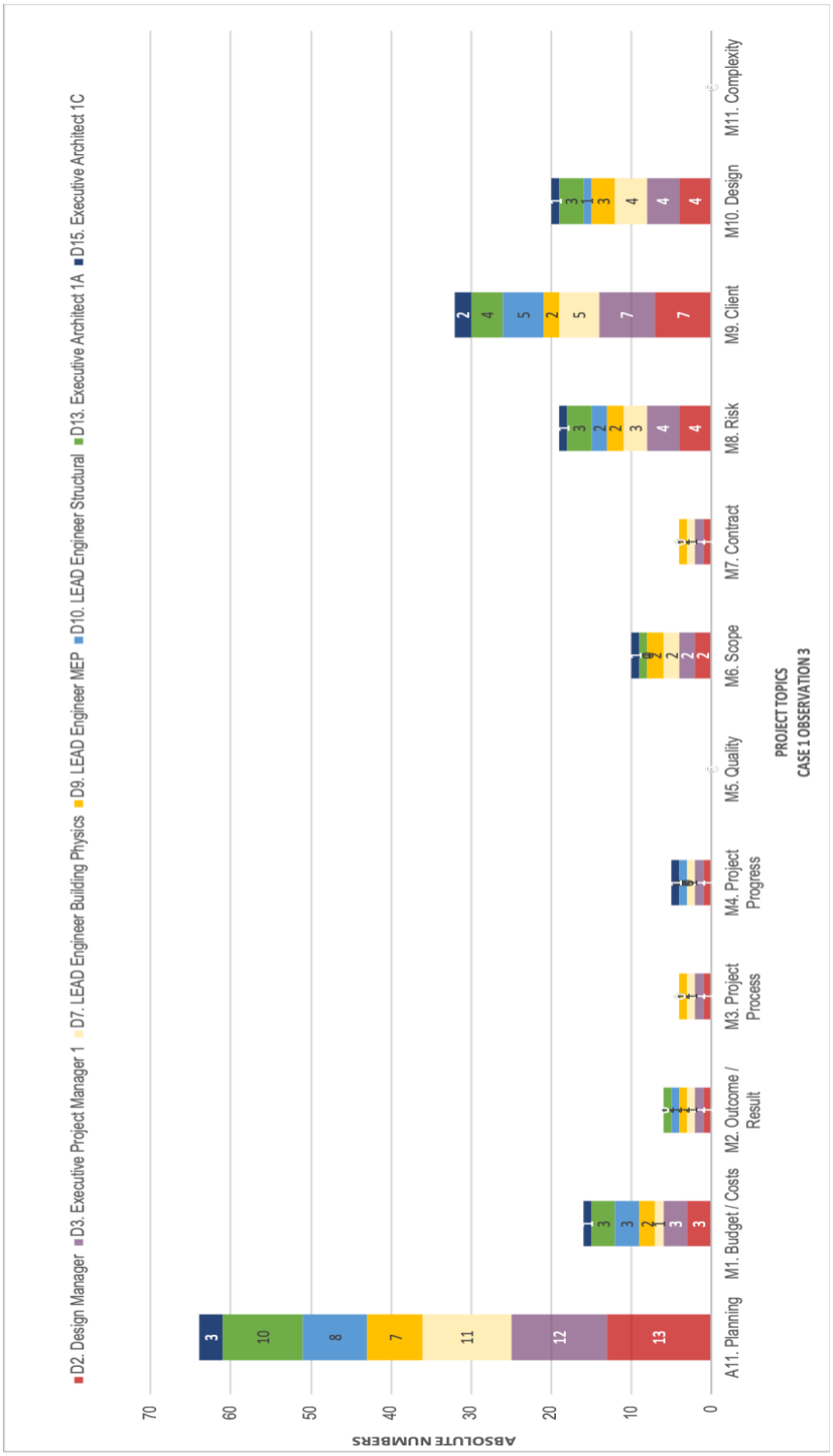

Figure 16: Project topics, case study 1, observation 3

Case study 1 – Observation 4

General
Date: 25th of October 2018
Duration: 2 hours and 20 minutes
Place: Engineering company office, The Netherlands

Attendees: design manager, lead engineer structural, lead engineer MEP, lead engineer fire & safety, lead engineer building physics, energy engineer, executive architect 1A and executive architect 1B.

Agenda
- Planning
- Preliminary design
- Installations
- Building physics
- Structural design
- Fire & safety
- Energy performance
- Building permit

Summary project meeting
The design manager opens the meeting with an update and recap of the activities of last week. This meeting is joined by the executive architect 1B and later lead engineer fire & safety, lead engineer building physics and energy engineer. The lead engineer MEP requested the energy engineer to attend this meeting to support the project team with the energy performance of the building. The design manager suggests that the team introduces themselves to the new attendees. The executive architect 1A supported by executive architect 1B, mainly address design changes, checking discipline by discipline whether these changes affect the structural design, installations, building climate and emergency exit routes. The meeting is closed with the discussion on the building order which needs to take future developments of the building into account.

Data project meeting
Figure 17, 18 and 19 show that the design manager is present, but the project controller and process manager are absent. During this project meeting, team members mostly focus on the design, making 'things happen' according to the requirements of the client (shared conceptual framework). Project team members are not irritated / annoyed nor angry.

Quotations project meeting
"We have to take the building order also into account" (Design manager)

"Let us introduce ourselves to the new members who joined us, I will start […]" (Design manager)

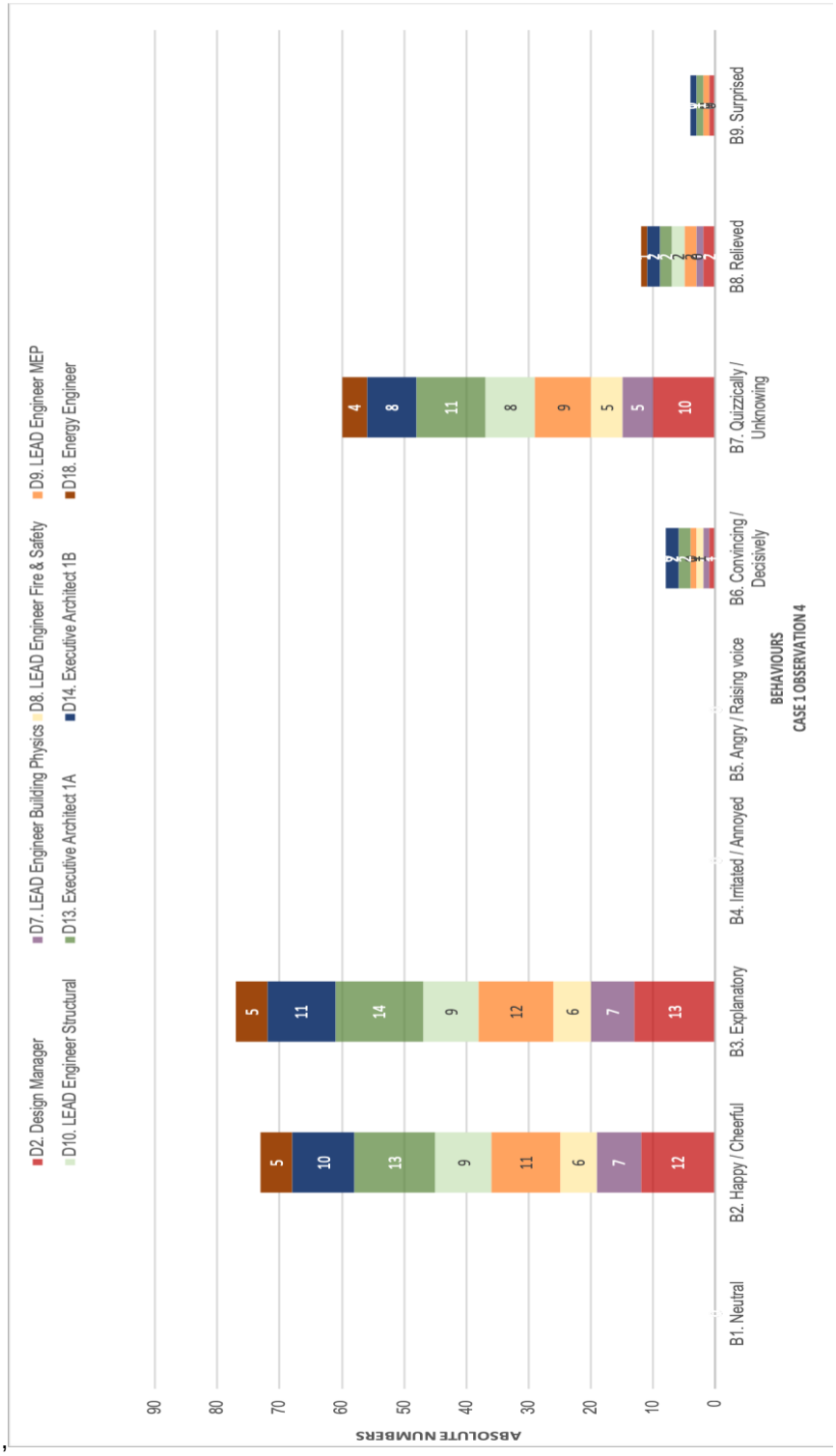

Figure 17: Behaviours, case study 1, observation 4

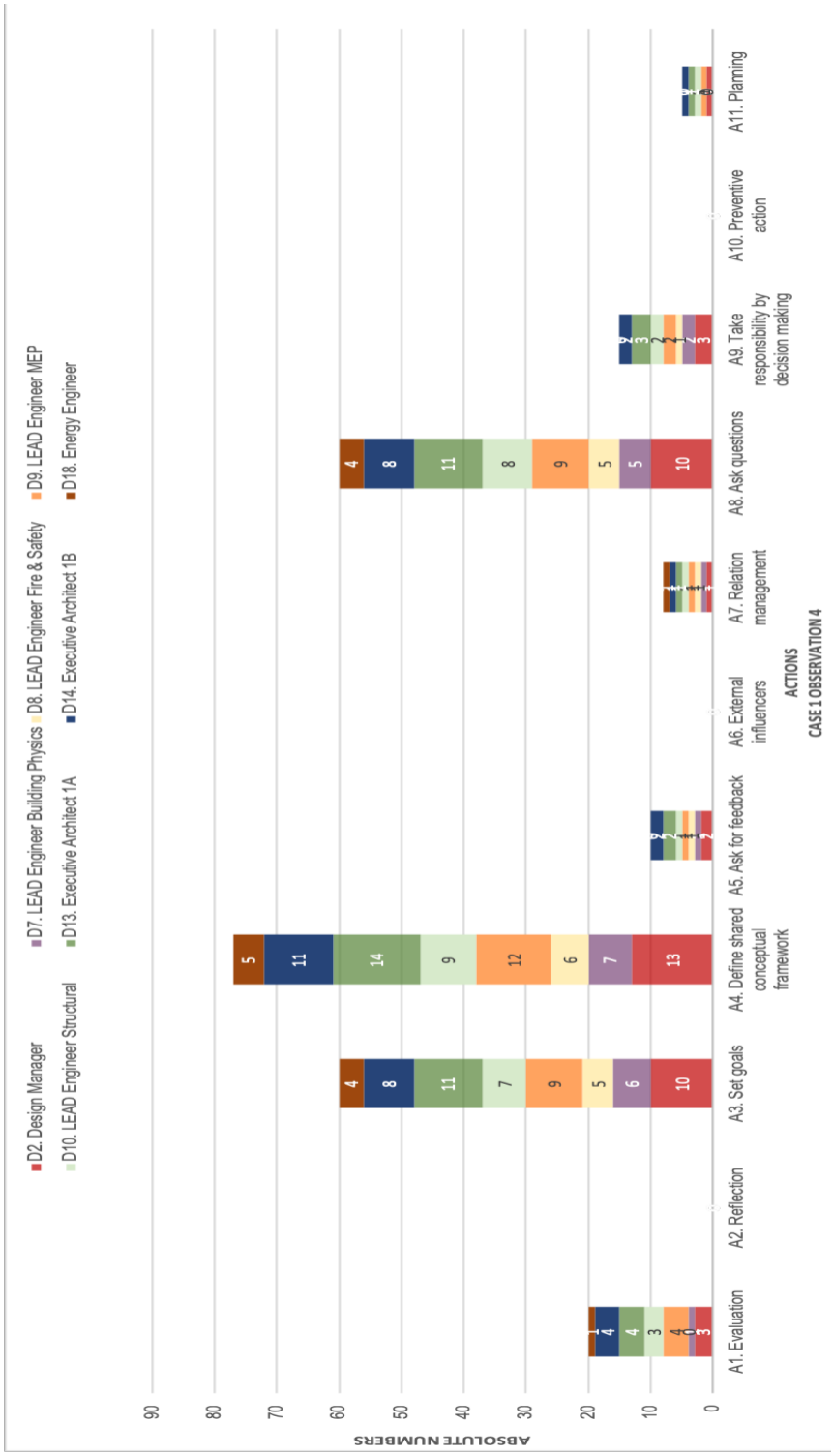

Figure 18: Actions, case study 1, observation 4

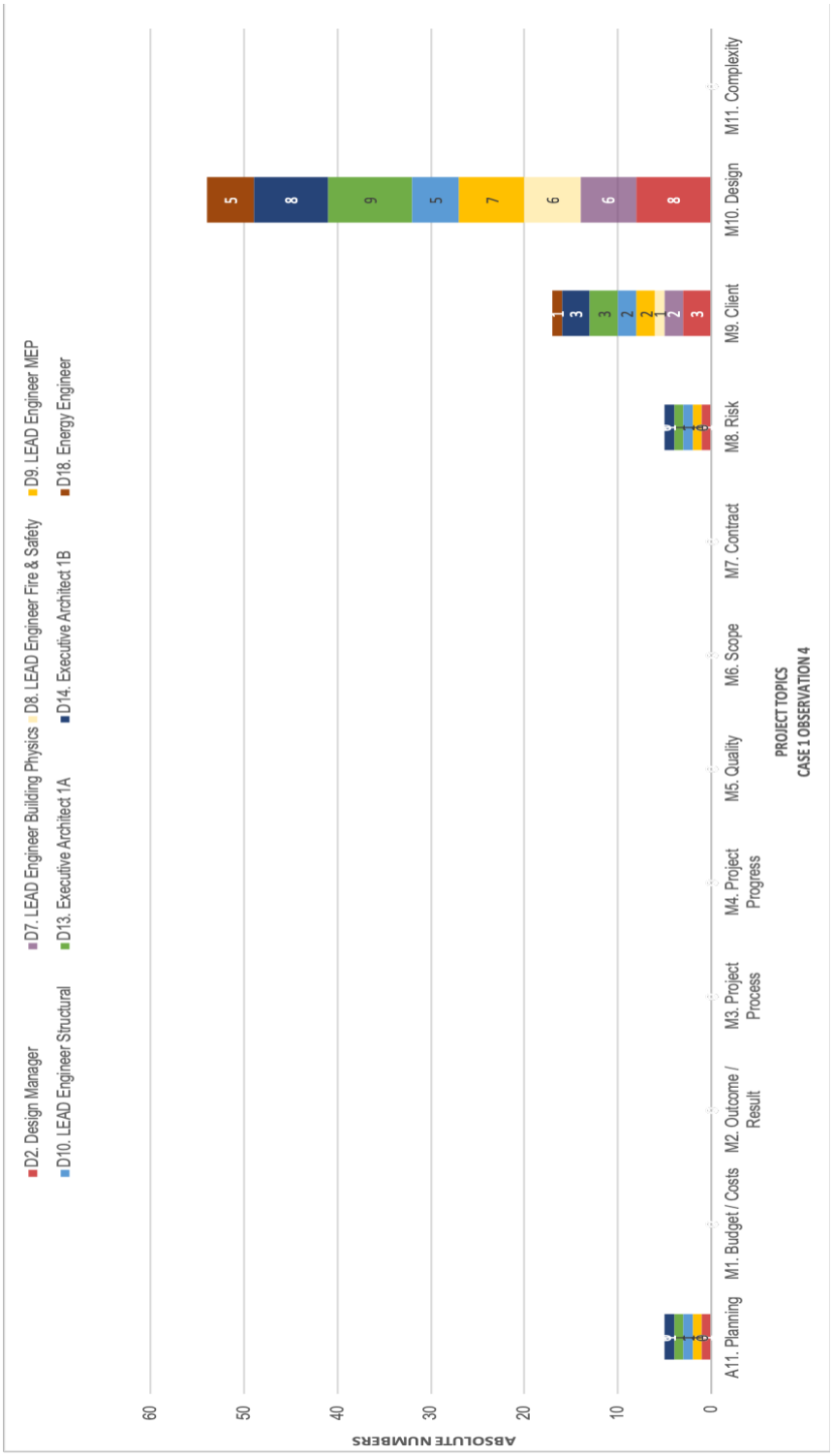

Figure 19: Project topics, case study 1, observation 4

Summary observations case study 1

The 4 project meetings can be divided in 2 parts based on behaviours of team members and focus of the meeting. In part A, team members are more irritated / annoyed, occupied with convincing and focus on project process, compared to part B where team members are more happy / cheerful and focus on project content and progress. Note that in response to the tension build up an additional meeting is held among the engineering team members, followed by a steering committee meeting as summarized in figure 20.

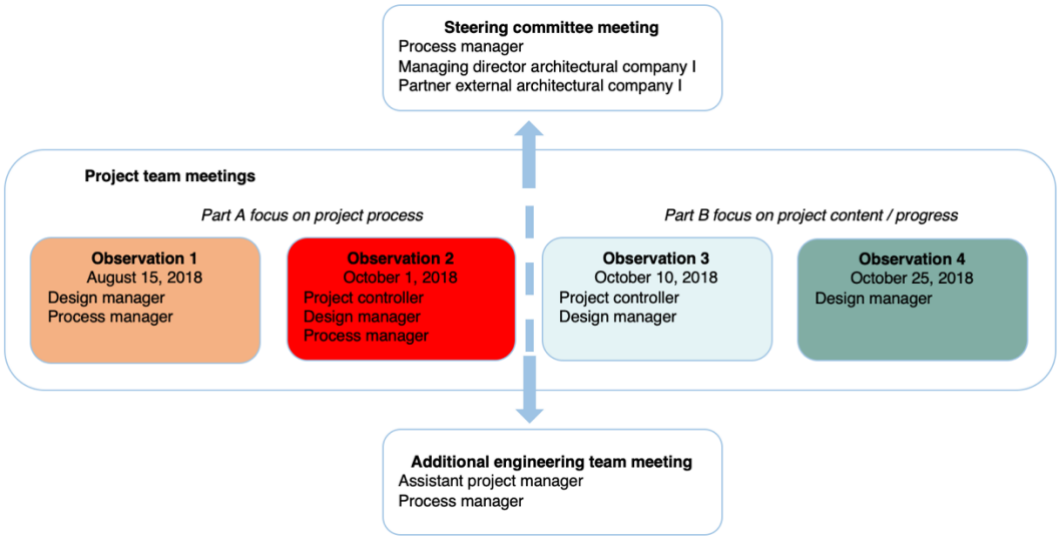

Figure 20: Summary project meetings case study 1

1. **Observation 1**: the process and design manager are present. Project team members are mostly happy / cheerful but also irritated / annoyed. The tension became apparent during the discussions about the planning, contract change, budget / cost control, project deliverables (associated with task ambiguity) and client requirements.
2. **Observation 2**: the process, project controller and design manager are present. Project team members are most irritated / annoyed during this project meeting, which relate to the discussions about planning, risks, contract and requirements of the client. Furthermore, this project meeting held via Skype in which technical difficulties led to even more tension.
   Examples:
   Even though the majority of the project team agrees with this statement, while they try to coordinate their agendas, they conclude that it is not possible to arrange a meeting prior to their meeting next week and suggest again a skype meeting.
3. **Observation 3**: project controller and design manager are present. Project team members are more happy / cheerful compared to previous project meetings. They mainly focussed on the planning, evaluating it step by step, discipline by discipline which resulted in better task cohesion or team commitment. For example:
4. **Observation 4**: only the design manager was present. Project team members are most happy / cheerful during this project meeting compared to previous project meetings. They mainly focussed on the project content and design. Information to make project progress, such as access to 3D Google Sketchup model and Revit model to use for calculations.

4.2 Case study 2

This chapter describes the context and analysis of case study 2.

4.2.1 Context

Case study 2 involves the construction of a 130,000 m^2 new hospital building complex in a foreign country. With 950 beds this hospital project will be one of the largest private hospitals in the foreign country and of the most important health care locations in southern part of the foreign country. An engineering company is partnering in a consortium with architectural office II & III and have previously worked together. By separating functional areas and phasing commissioning, an engineering company, architectural office II & III will ensure the hospital opens in record time.

Project description

The functional design created by architectural office II & III and an engineering company places patients centre stage, surrounded by the required medical services. The project consists of six components. Each building has clearly defined functions and will be constructed using a design and build approach. This means that the main structure can be delivered very fast and the market can be approached for subsequent phases of the building. Aimed at raising the quality of life for the local population, the new single-site hospital will replace five existing hospitals dispersed across the city.

As sub-contractor the engineering company also supports the consortium with installation design, cost control and Building Information Modelling (BIM). Dutch experience in cost control is particularly useful here. According to the process manager at the engineering company:

"With the health sector under pressure in The Netherlands, health care institutions have been focusing on finding ways to develop and exploit their real estate as efficiently as possible for many years. The Netherlands leads the way in terms of cost efficiency, which is hugely beneficial for the client in that foreign city" (*Process manager, online interview, October 25, 2015*).

In terms of the planning, the completion of the tender dossier part of the specification phase is delayed by one month.

Organisation

The following actors are involved in the project:

- LEAD project manager / design manager
- Project controller (senior project manager)
- Building Information Model (BIM) Coordinator
- Executive architects
- LEAD architects
- Engineers: mechanical, electricity & plumbing (MEP)
- Cost manager
- Client

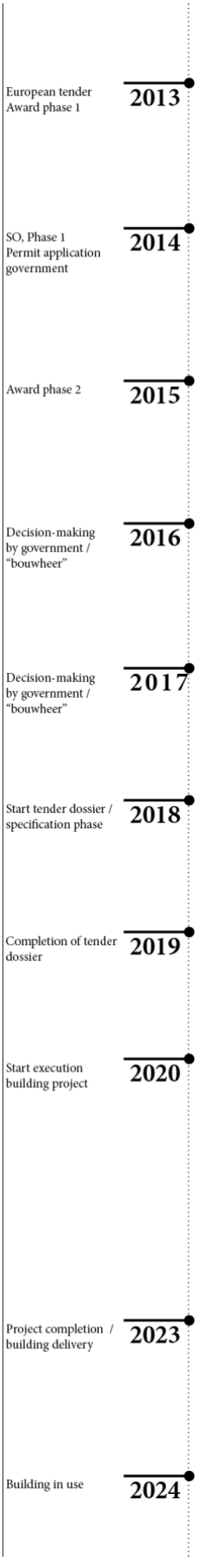

Figure 21 illustrates the project organisation (based on project plan) in which the client has a contract with the consortium. The design team is subdivided in a steering committee and project team. The steering committee consists of the managing director of architectural office I and the process manager. The project team members manage various organisation components of the project organisation and are responsible for the design and execution of the project. The lead project manager / lead architect's role is similar to the design manager role and the project controller is referred to as assistant project manager in the project plan. Some team members have been involved since the European tender and others joined later on.

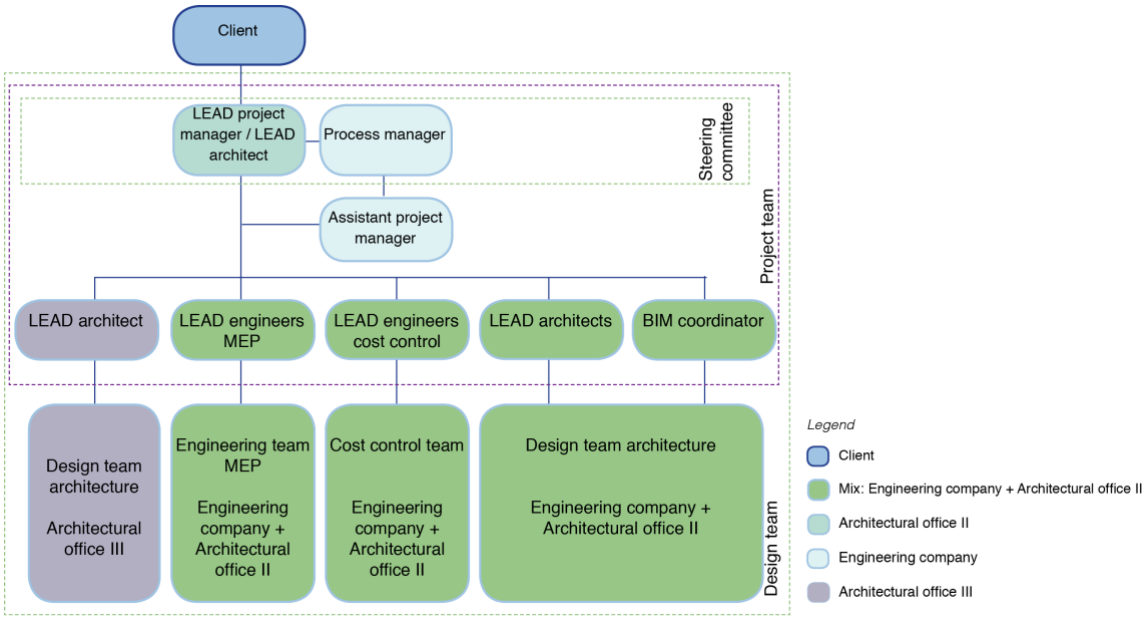

Figure 21: Project organisation case study 2 (based on project plan)

Project meeting structure

Table 7 illustrates the frequency of meetings of teams. This research focuses on the project team and project manager, therefore only the project team meetings have been taken into consideration for observations.

Meeting	**Frequency**
Steering committee	Every phase transition
Project team	*Once every week*
Design team architectural office III & IV	Once every week
Design team with client	Once every two weeks
Engineering team engineering company	Once every week

Table 7: Meeting structure case study 2

4.2.2 Observations

Table 8 illustrates the team members who were present during the observed project meetings, the spoken languages are Dutch, English and a foreign language. The current level of detail of the BIM model is “LOD 400”. A total of four project meetings are observed, of which the first meeting can be divided into two parts (A&B). The agendas of these meetings are incorporated as remarks on the drawings or on their shared information management system. The findings of each observation are elaborated upon and finally an overall summary of this case study to support the comparison between the two case studies.

Project team role	**M/F**	**Company**	**Spoken language**
Executive architect 2	F	Architectural office II (Foreign)	Dutch, English, foreign language
LEAD project manager / Design manager	M		
LEAD architect 2B	M	Architectural office III (Foreign)	English, foreign language
Executive junior architect	M	Engineering company (Dutch)	Dutch, English
LEAD architect 2A	M		Dutch, English
Building Information Model (BIM) Coordinator	M		Dutch
Project controller	M		Dutch

Table 8: Observation participants case study 2

Case study 2 – Observation 1 (part A)

General
Date: 29th of August 2018
Duration: 3 hours and 40 minutes
Place: Architectural office I, foreign country

Attendees: project controller, lead project manager / design manager, BIM coordinator, lead architect 2A, executive architect 2 and executive junior architect.

Summary project meeting
The lead project manager / design manager supported by the executive architect 2, opens the meeting and addresses that he will go through the composed checklist accordingly. The meeting is conducted in Dutch but throughout the meeting the executive architect 2 and lead project manager / design manager sometimes communicate in a foreign language. He addresses design changes and BIM code modifications which need to be made by the engineering's design team. The project controller reflects and asks what these changes mean for the floor area and the consequences in costs. After which it becomes apparent that the regulations and customs of the foreign country differ from Dutch regulations. During the lunch break team members socialize and talk about non project related topics. Resuming the meeting the lead project manager / design manager asks how the team can handle changes in the model which will be beneficial for both parties. The lead architect 2A, executive architect 2 and executive junior architect leave for the next meeting (part B) with lead architect 2B, while the lead project manager / design manager, project controller and BIM coordinator continue their meeting.

Data project meeting
Figure 22, 23 and 24 show that project team members are mostly happy / cheerful but also irritated / annoyed due to that the project meeting is progressing slowly according to the checklist. The project meeting focuses on the design and in lesser capacity on the budget / costs, planning and scope. The program of requirements is already fixed and creates a clear overview of the tasks which need to be done. The questions which are asked to define the shared conceptual model are mostly related to the design. The project controller asks the lead project manager / design manager questions about to the budget / costs and scope.

Quotations project meeting
The project controller asks a question about extra work to identify in which way this will influence the project budget.

"So, what does that mean extra work? What does that mean according to [country] regulations?"
(Project controller)

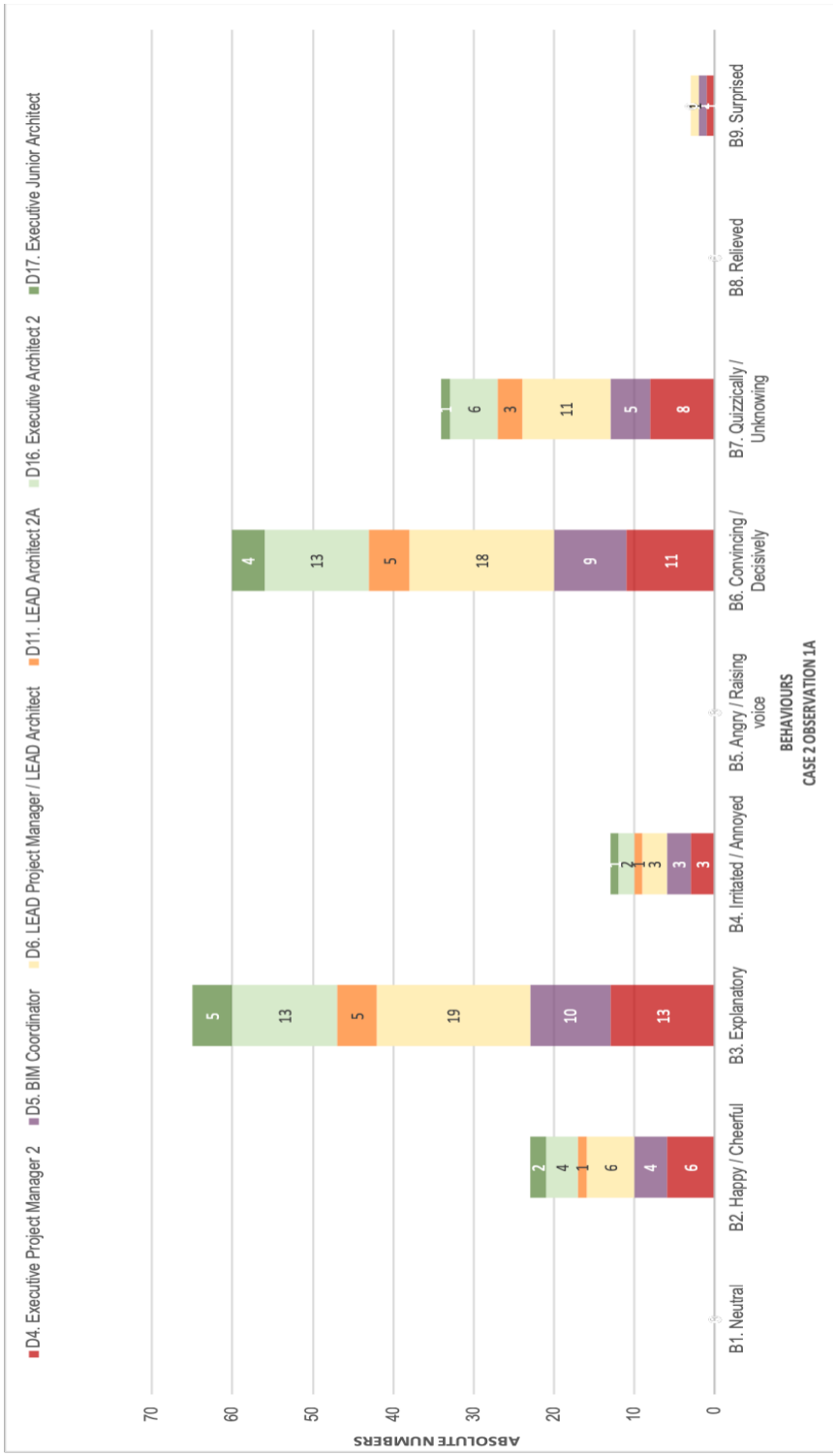

Figure 22: Behaviours, case study 2, observation 1A

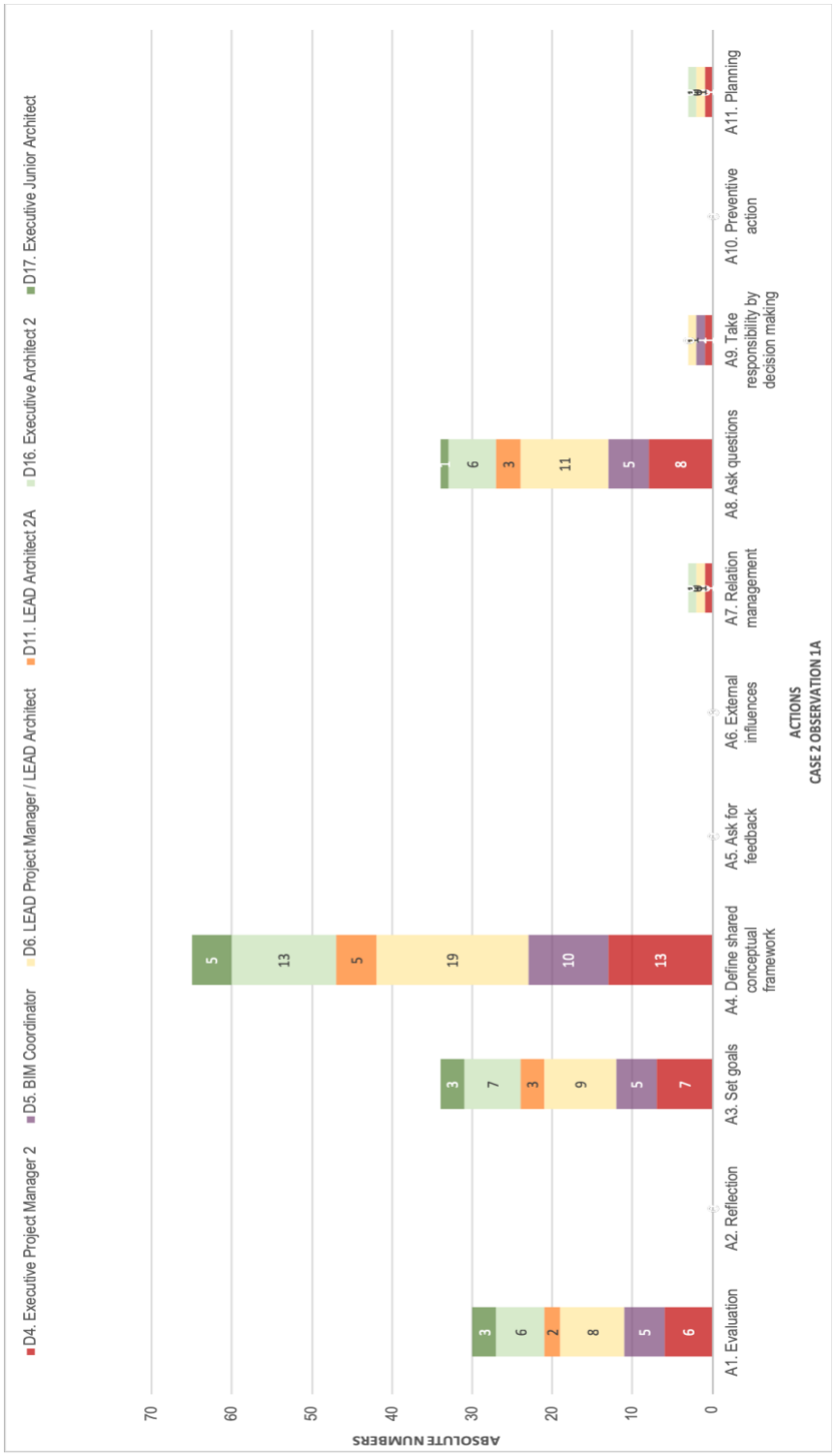

Figure 23: Actions, case study 2, observation 1A

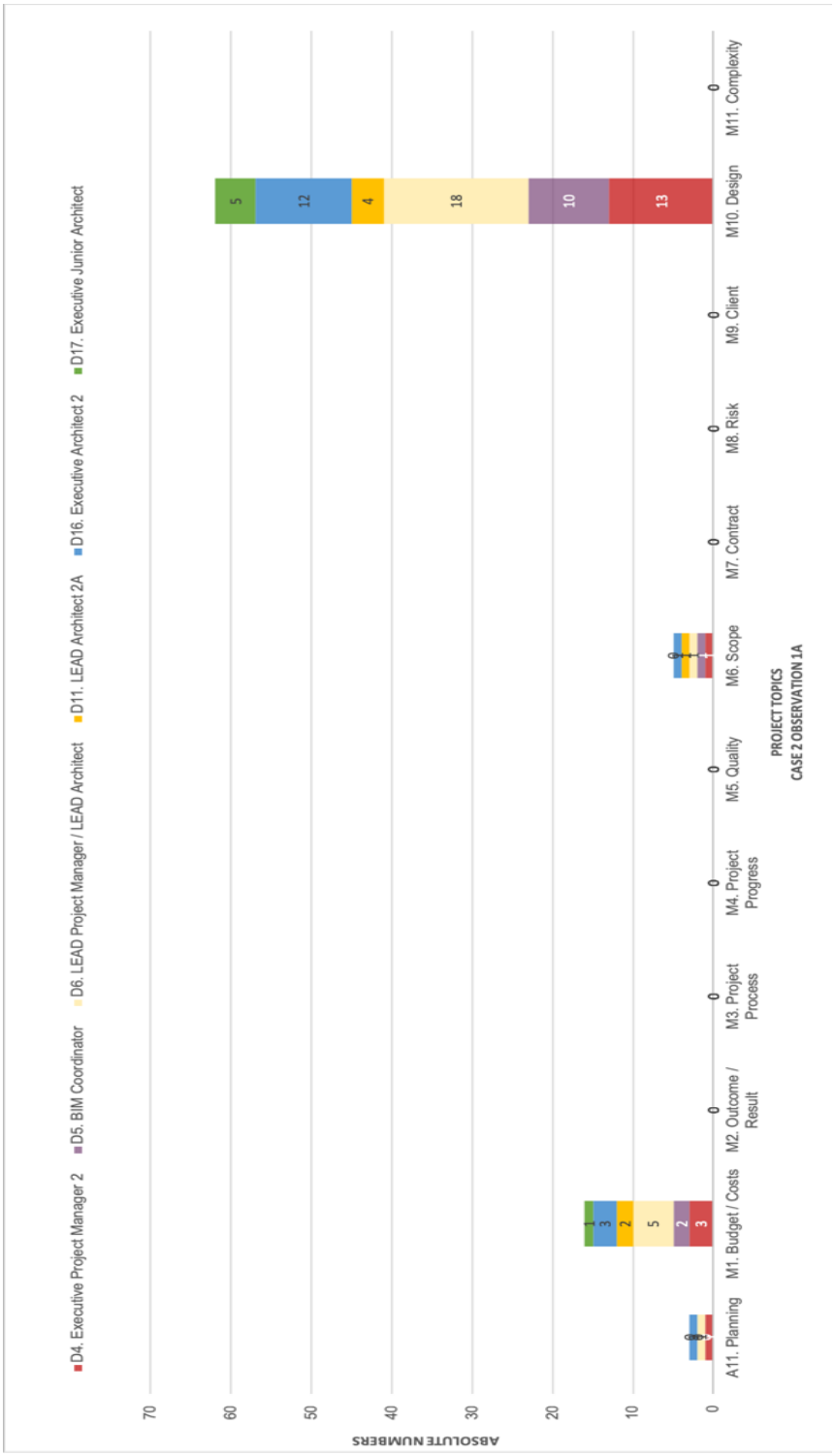

Figure 24: Project topics, case study 2, observation 1A

Case study 2 – Observation 1 (part B)

General
Date: 29th of August 2018
Duration: 2 hours
Place: Architectural office I, foreign country

Attendees: lead architect 2A, lead architect 2B, executive junior architect and executive architect 2.

Summary project meeting
Prior to the meeting the executive architect 2 and lead architect 2B prepared questions and remarks supported by floor plans. The meeting is conducted in English but throughout the meeting the executive architect 2 and lead architect 2B sometimes communicate in a foreign language and the lead architect 2A, executive junior architect and executive architect 2 sometimes communicate in Dutch. The questions and remarks are mostly design related and remarks for the modification of the BIM codes. The project controller and lead project manager / design manager disrupt the meeting twice to ask questions to the executive junior architect and executive architect 2, to make mutual arrangements.

Data project meeting
Figure 25, 26 and 27 show that the project controller and lead project manager / design manager are mostly absent. The project team members are mostly happy / cheerful but also slightly irritated / annoyed. The project meeting focuses on the design and in lesser capacity on the planning and requirements of the client, by resolving BIM comments (= project progress).

Quotations project meeting
"Where is this? Wait I have the plan right here" (Lead architect 2B)

The project controller interrupts the meeting to ask the executive junior architect a question:
"When are you able to do […] I do not want to make promises I cannot keep" (Project controller)

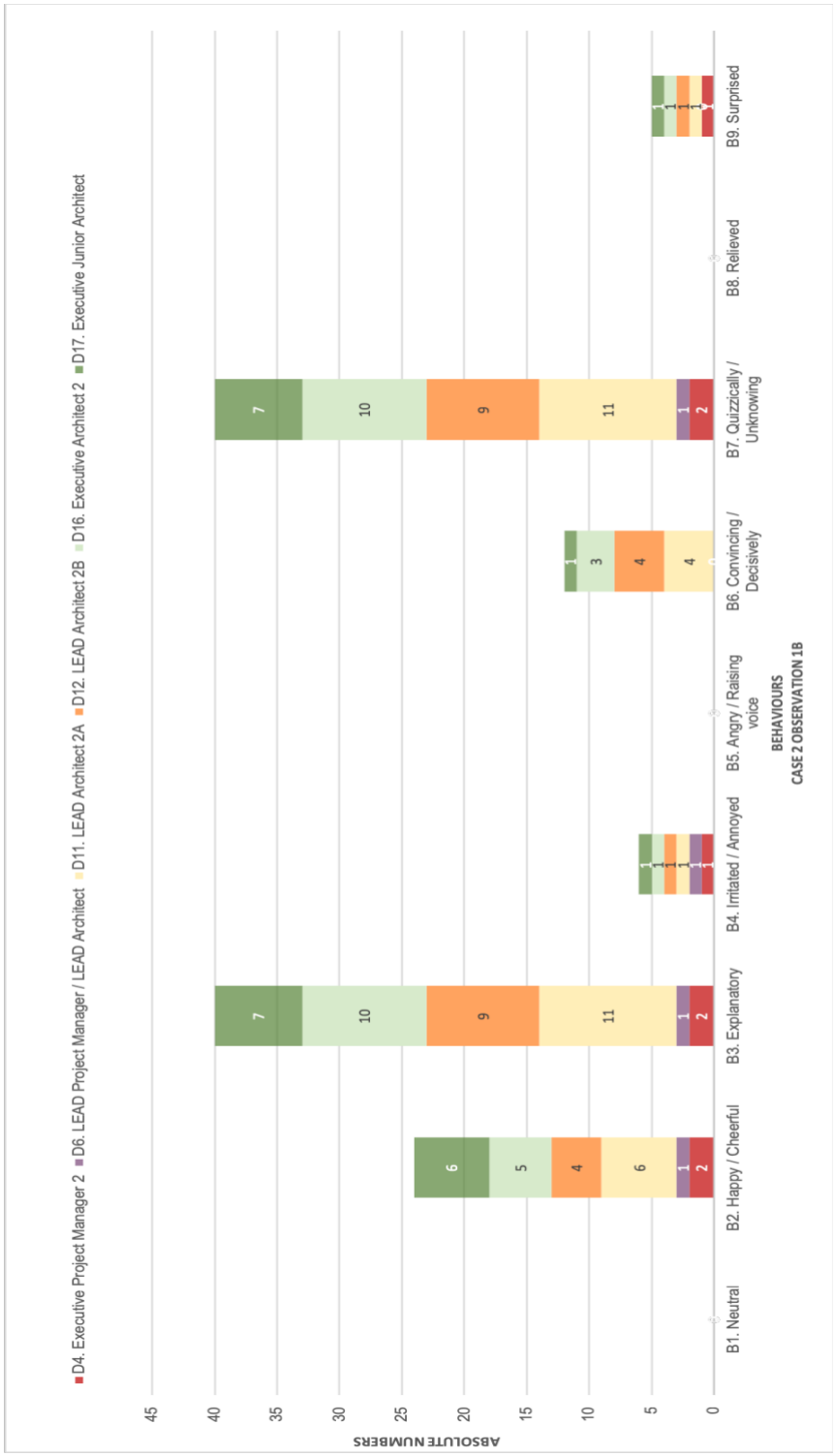

Figure 25: Behaviours, case study 2, observation 1B

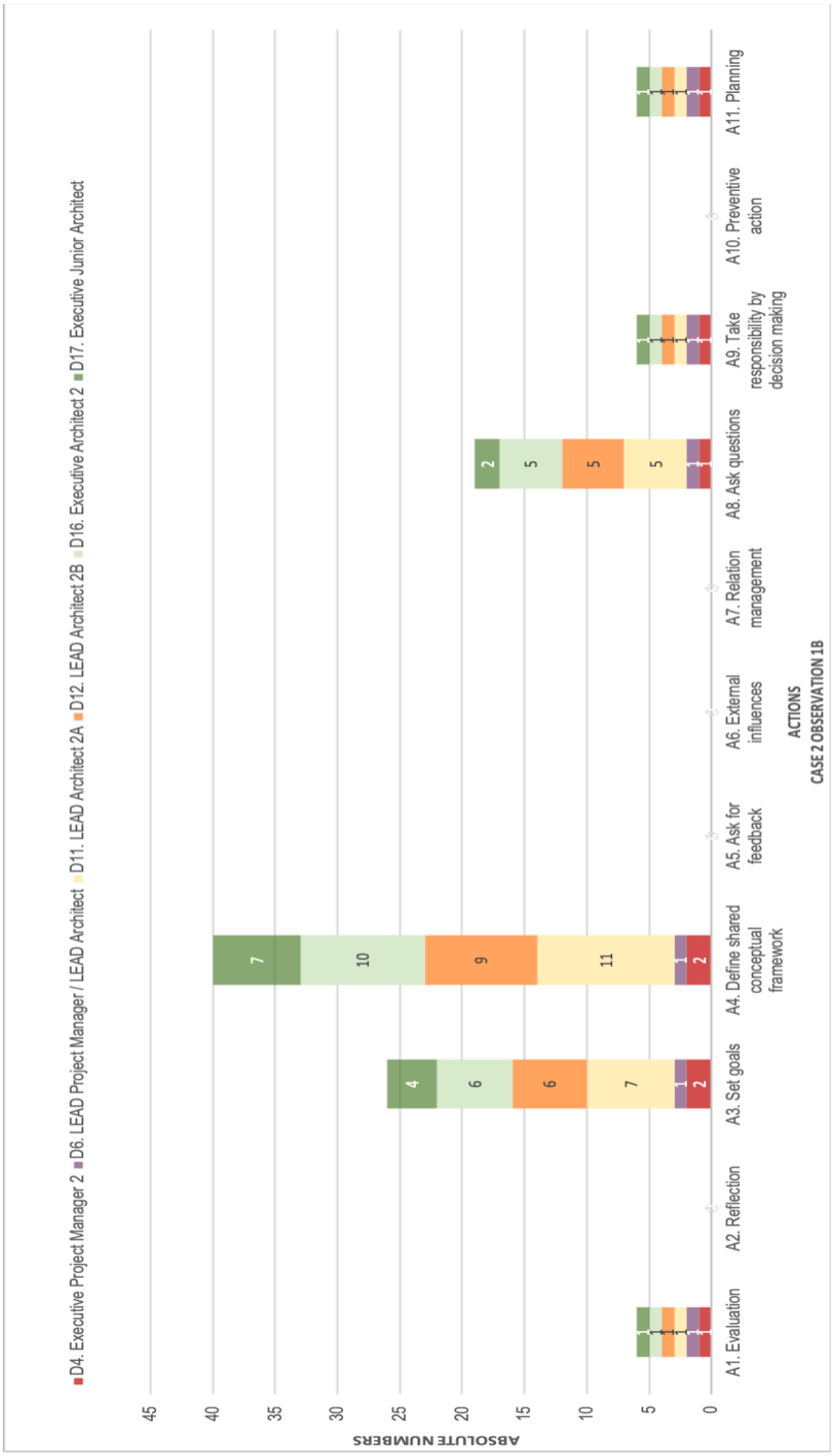

Figure 26: Actions, case study 2, observation 1B

Figure 27: Project topics, case study 2, observation 1B

Case study 2 – Observation 2

General
Date: 27th of September 2018
Duration: 2 hours and 20 minutes
Place: Architectural office I, foreign country

Attendees: lead project manager / design manager, lead architect 2A and lead architect 2B.

Summary project meeting
Prior to the start of the meeting it has become apparent that the project team missed a deadline for the emergency exit routes, causing a lot of stress and tension. The entire project team is remotely working together on still submitting the drawings today. The meeting is conducted in English but throughout the meeting the lead project manager / design manager and lead architect 2B sometimes communicate in a foreign language and the lead architect 2A and lead project manager / design manager sometimes communicate in Dutch. The meeting is mostly a dialogue between lead architect 2A and lead architect 2B, discussing and suggesting design solutions together and coming up with the presentation content for the client.

Data project meeting
Figure 28, 29 and 30 show that the project controller is absent. The lead project manager / design manager is mostly absent. The project team members are happy / cheerful but also slightly irritated / annoyed and relieved. The project meeting focuses on the design and in lesser capacity on the planning by resolving BIM comments (= project progress).

Quotations project meeting
Dialogue between lead architect 2A and lead architect 2B:

Lead architect 2B: *"If we start with the image, we need to do it everywhere. The problem with the volume is, that the space is too short. So, the idea for the image is that we make something current and different than white, which is the question. If we propose that in the phases, that is enough for me. Here you can find a picture like that (points to a picture on the wall in the meeting room). The idea is that you can change this each month, like the four seasons. I like it"*

Lead architect 2A: *"Yes that is nice, it is never out of date, it is always new."*

Lead architect 2B: *"Maybe it is the communication department who takes the pictures for the personal.*
Maybe it can be a competition for them. I like this idea, I can write a letter to the department of Human Resources that they should not put anything on the walls"

Lead architect 2A: *"Did the client ask for such a panel?"*

Lead architect 2B: *"No we have not discussed it but I think it will be okay if we explain it like that. And they will understand the potential of it"*

Lead architect 2A: "So what we do, if we find a good wall to place this..."

Lead architect 2B: *"Yes it can be wherever we want"*

Lead architect 2A: *"Okay wherever we want but this is why I wanted to discuss this concept, because sometimes it works and sometimes it does not. So if we test this idea"*

Figure 28: Behaviours, case study 2, observation 2

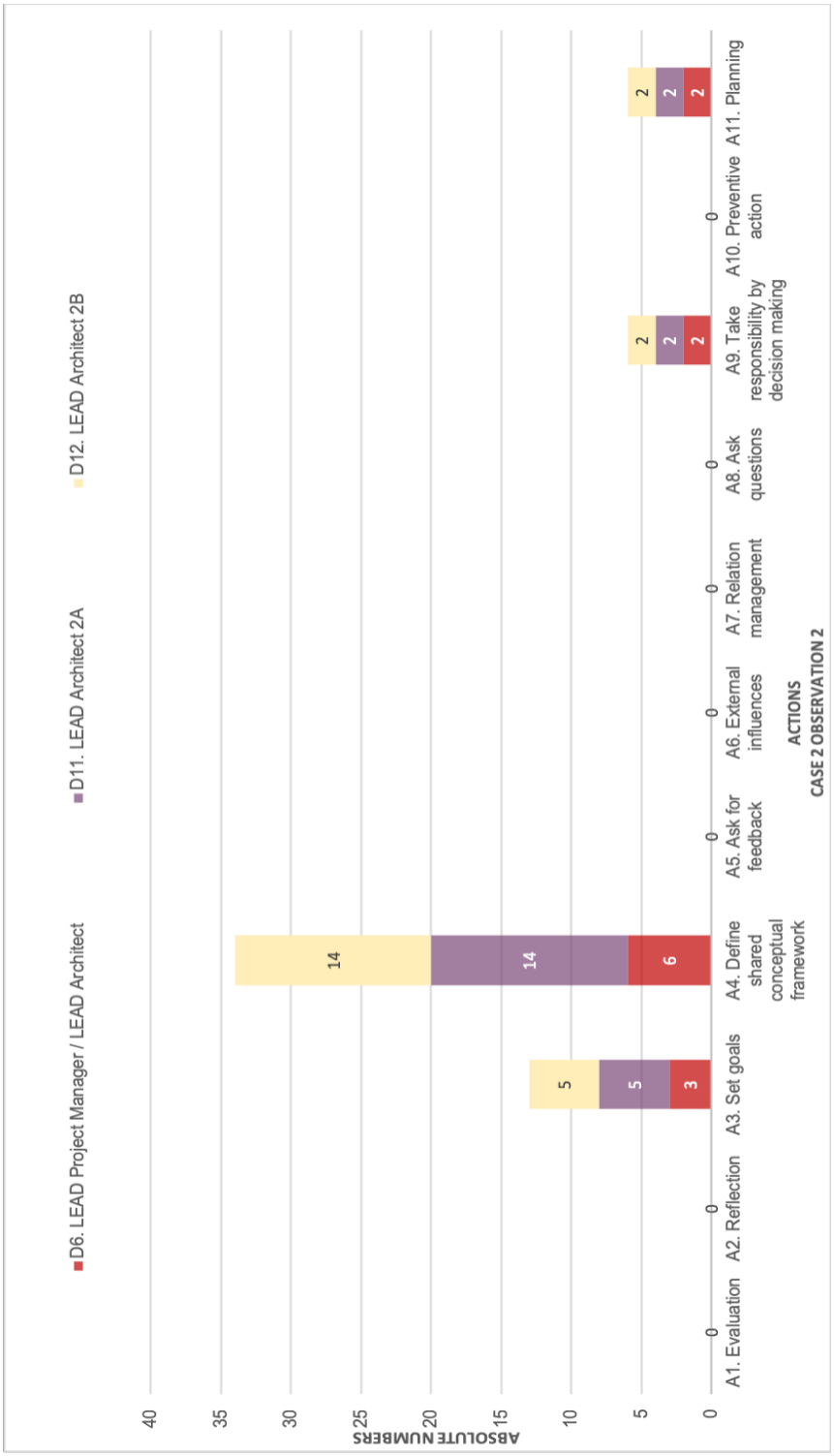

Figure 29: Actions, case study 2, observation 2

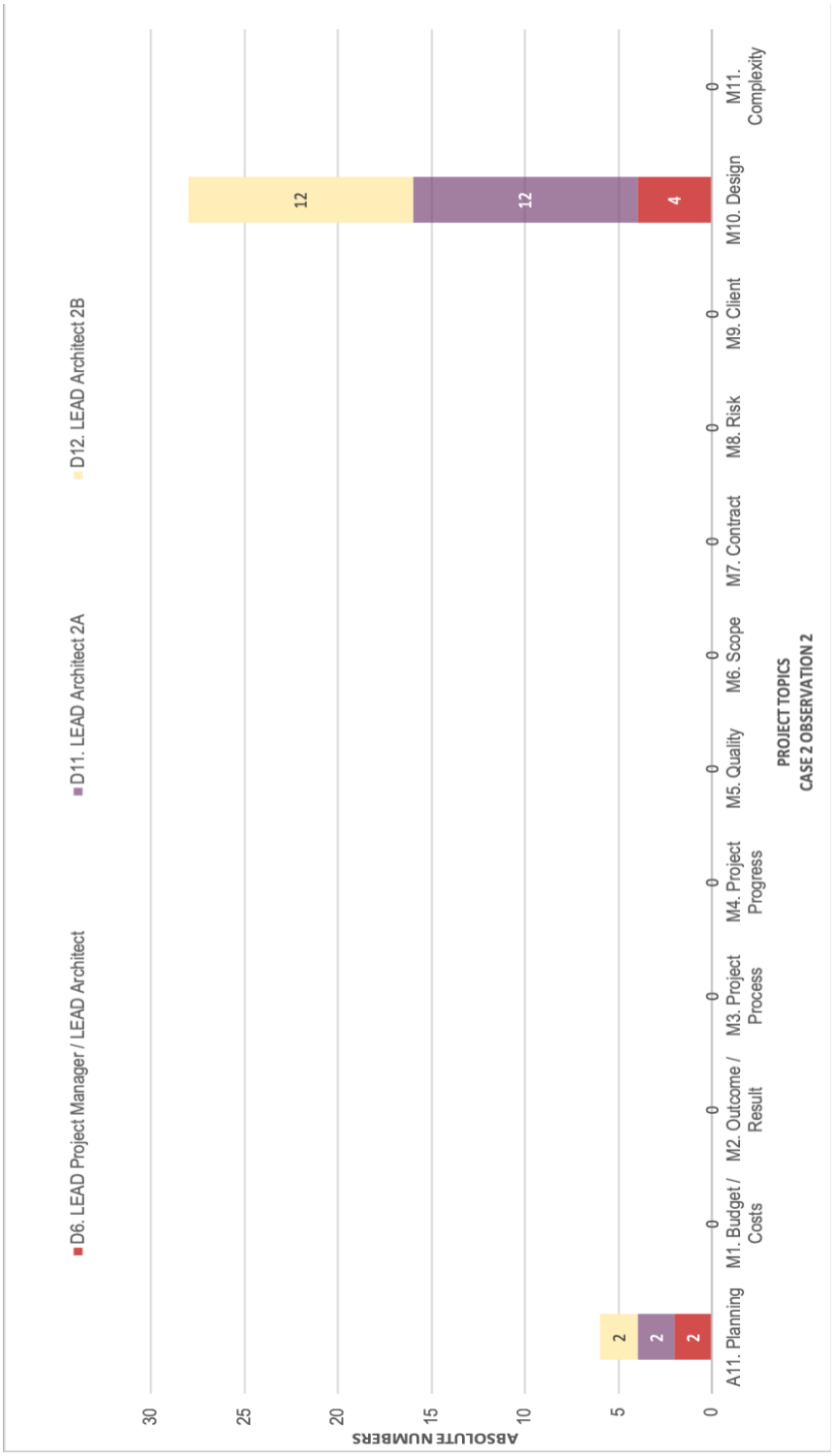

Figure 30: Project topics, case study 2, observation 2

Case study 2 – Observation 3

General
Date: 17th of October 2018
Duration: 2 hours
Place: Architectural office I, foreign country

Attendees: executive junior architect, executive architect 2 and lead architect 2B.

Summary project meeting
Prior to the meeting executive architect 2 and executive junior architect resolve remarks made in their shared information management system. The meeting has a work floor setting and is conducted in English but throughout the meeting the executive architect 2 and lead architect 2B sometimes communicate in a foreign language and the executive junior architect and executive architect 2 sometimes communicate in Dutch. The questions and remarks are mostly design related and remarks for the modification of the BIM codes.

Data project meeting
Figure 31, 32 and 33 show that the project controller and lead project manager / design manager are absent. The project team members are happy / cheerful. The project meeting focuses on the design and in lesser capacity on the planning by resolving BIM comments (= project progress).

Quotations project meeting
"I have prepared some questions and made some remarks. So, let us have a look" (Executive architect 2)

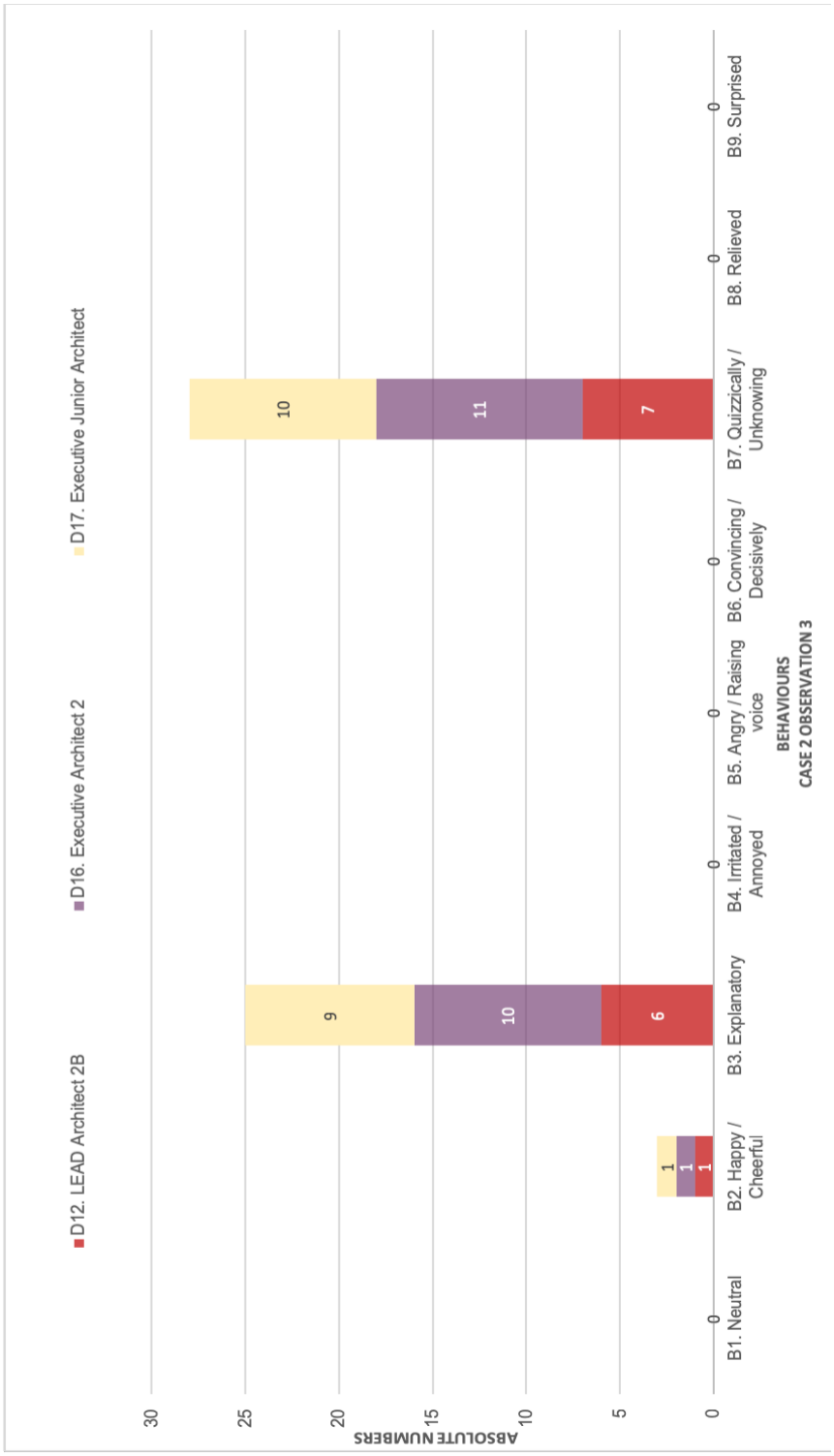

Figure 31: Behaviours, case study 2, observation 3

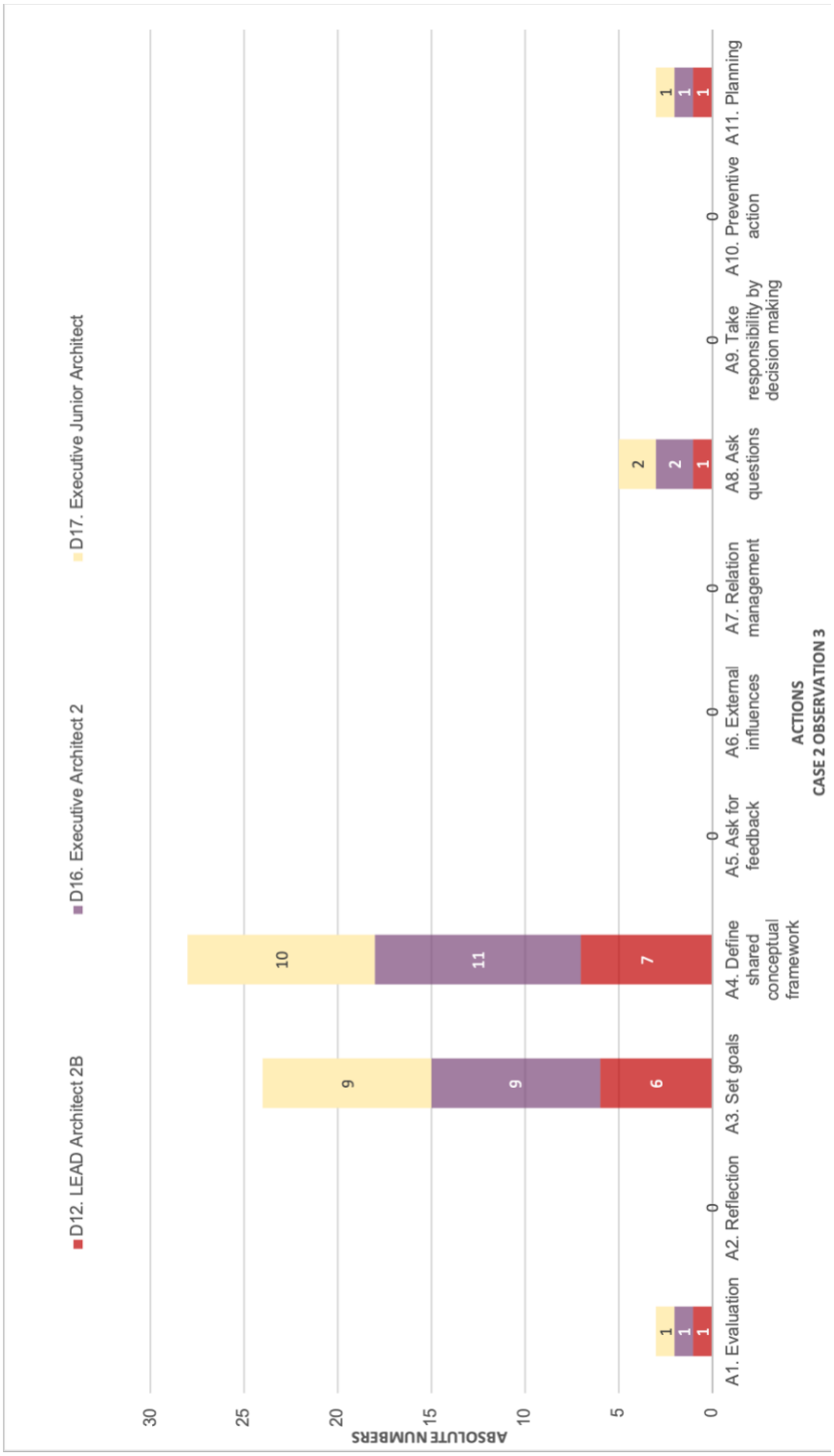

Figure 32: Actions, case study 2, observation 3

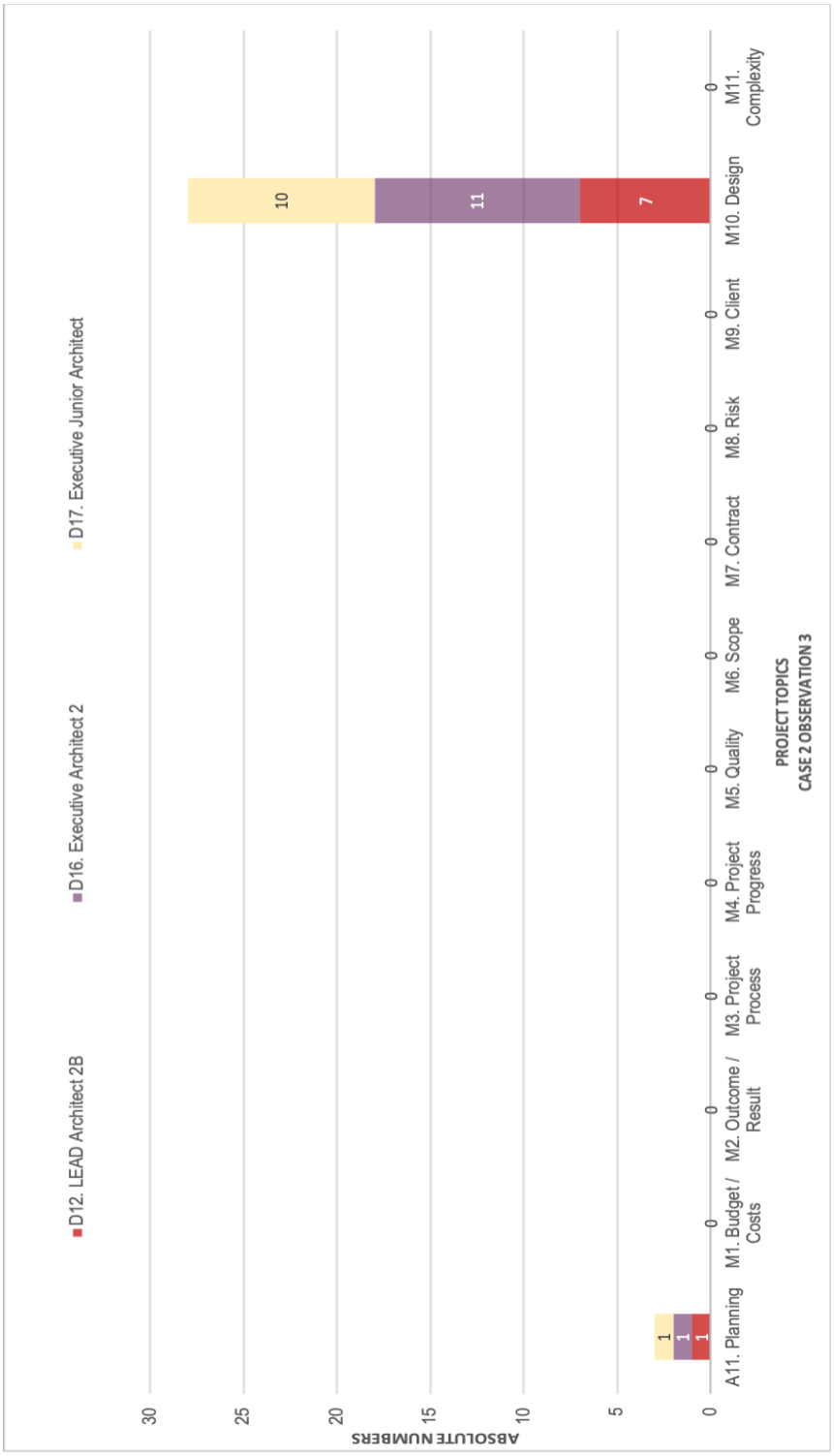

Figure 33: Project topics, case study 2, observation 3

Case study 2 – Observation 4

General
Date: 24th of October 2018
Duration: 50 minutes
Place: Architectural office I, foreign country

Attendees: executive junior architect, executive architect 2 and lead architect 2B.

Summary project meeting
In the last moment the executive junior architect substitutes for the lead architect 2A in the meeting. The meeting is conducted in English but throughout the meeting the executive architect 2 and lead architect 2B sometimes communicate in a foreign language and the executive junior architect and executive architect 2 sometimes communicate in Dutch. They mainly resolve remarks made in their shared information management system which are design related or for the modification of the BIM codes. Throughout the meeting the executive junior architect indicates that he has no information on certain addressed remarks and asks the remote help of other engineer team members to resolve them.

Data project meeting
Figure 34, 35 and 36 show that the project controller and lead project manager / design manager are absent. The project team members are irritated / annoyed and surprised, that due to last minute changes the junior architect was not being well prepared for the meeting. The project meeting focuses on the design and resolving BIM comments (= project progress).

Quotations project meeting
"I received last minute instructions to take [lead architect]'s place in today's meeting. Due to the short amount I had little time to prepare" (Executive junior architect, informal conversation).

Due to this the executive junior architect was not aware of certain aspects addressed in the meeting:
"I am not aware of this, I have not been informed about this. I will give him a call right now for an explanation. […] Hmmm… Unfortunately, I cannot reach him by phone" (Executive junior architect).

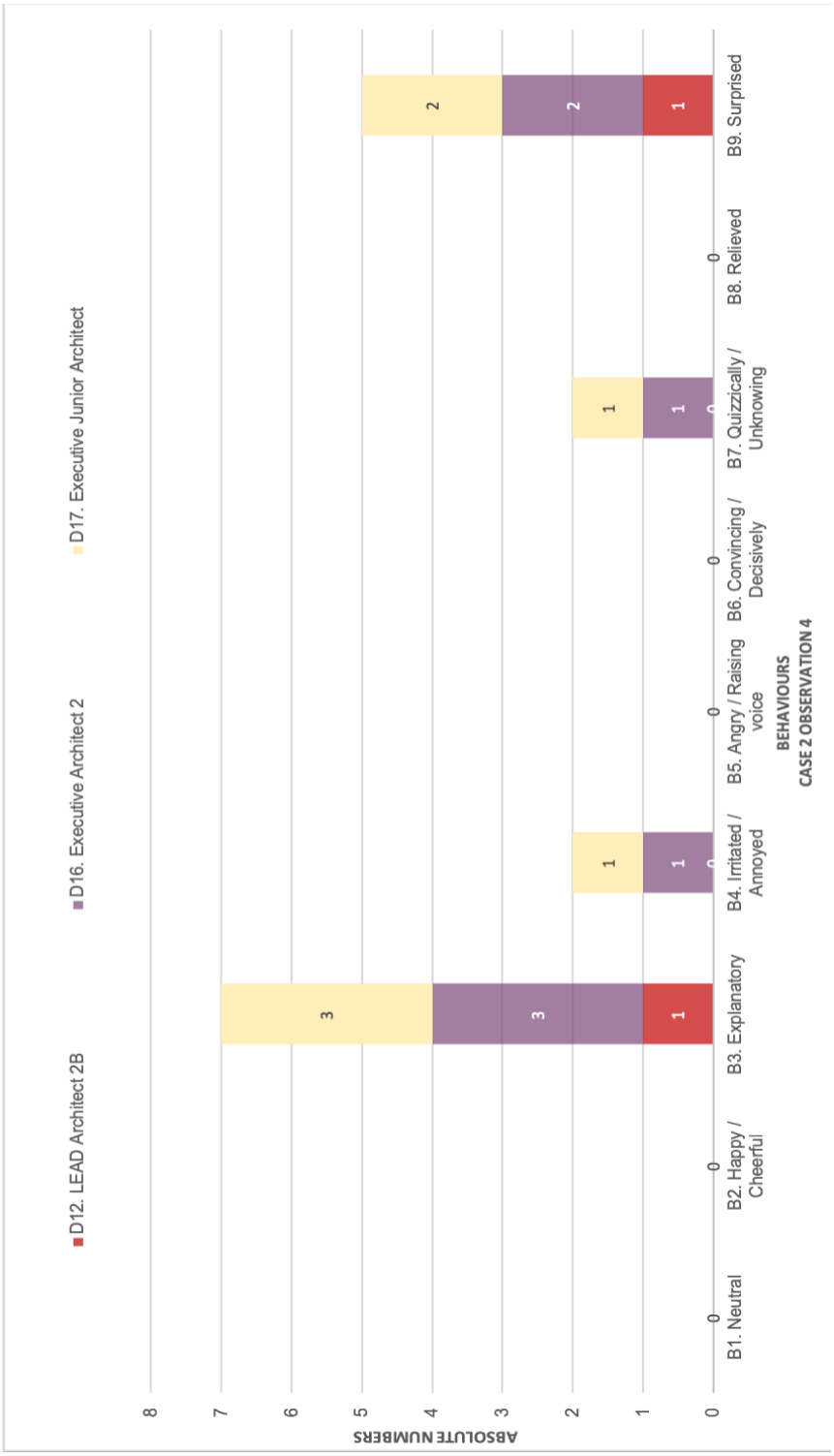

Figure 34: Behaviours, case study 2, observation 4

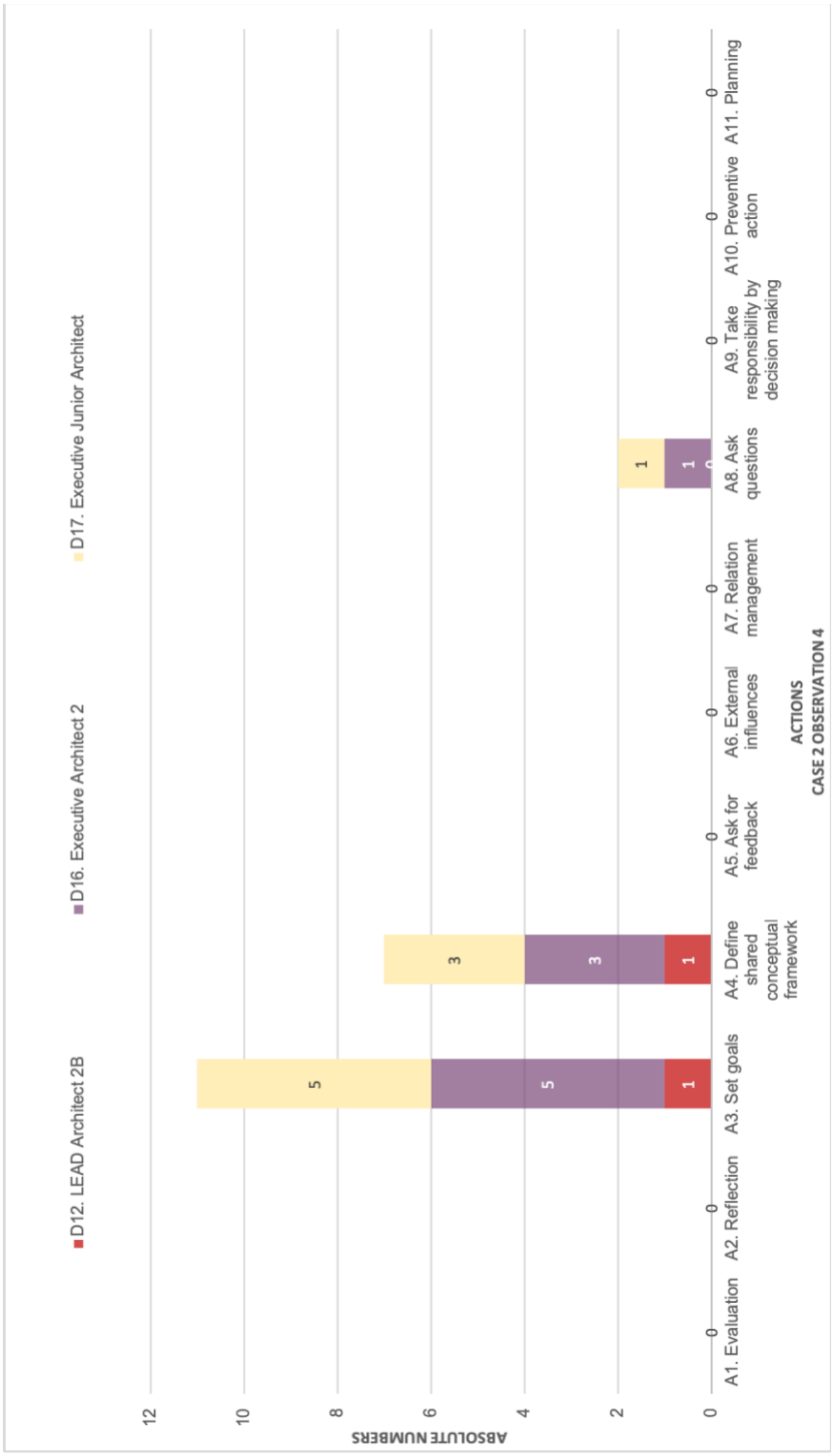

Figure 35: Actions, case study 2, observation 4

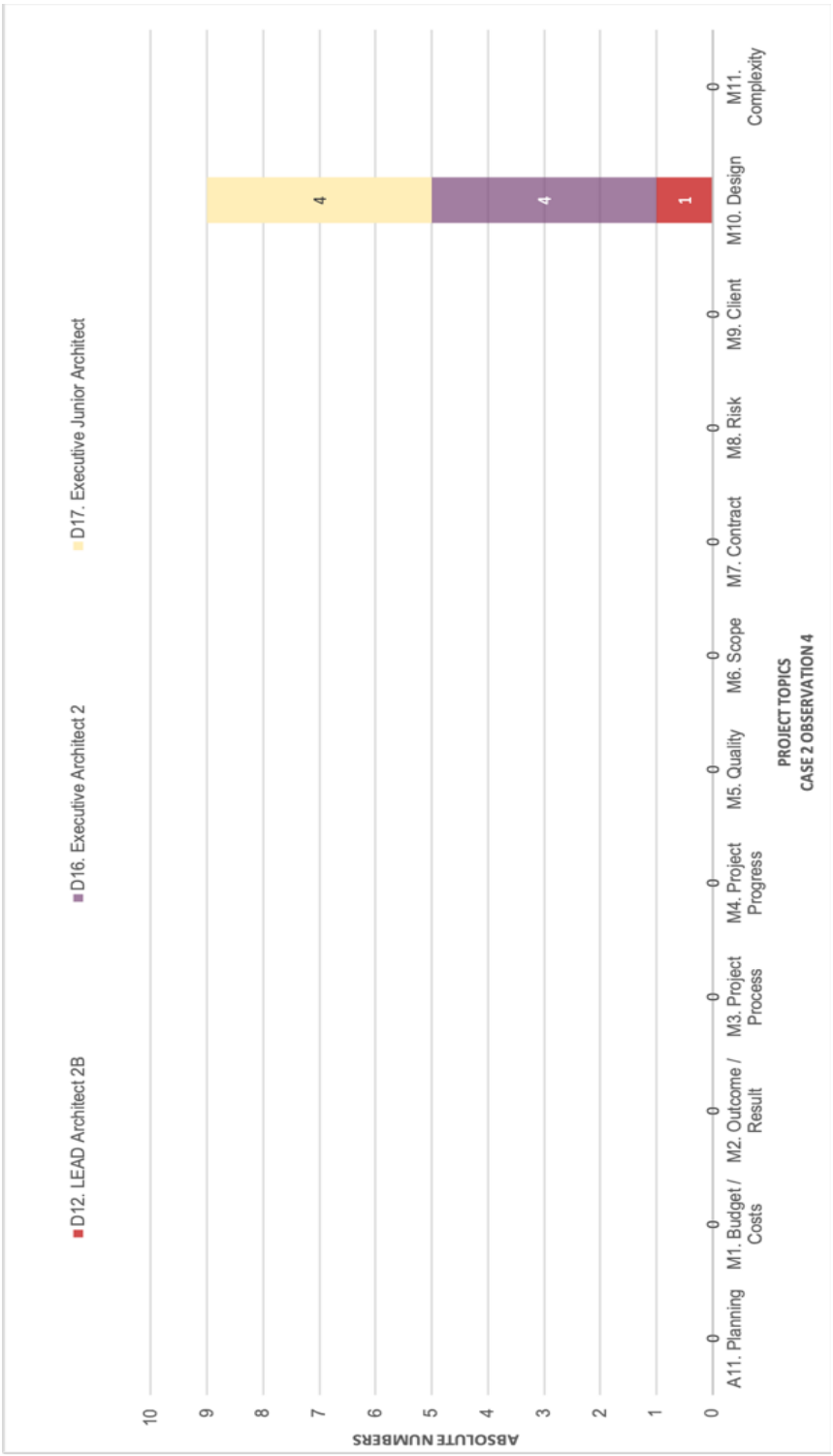

Figure 36: Project topics, case study 2, observation 4

Summary observations case study 2

Figure 37 suggests that the 4 project meetings can be divided in 2 parts based on the focus and nature of the meeting. In part A, the presence of the project controller is associated with more convincing behaviour compared to part B.

Examples part A:

"So what does that mean extra work? What does that mean according to [country] regulations?" (Project controller, case study 2, observation 1A, August 29, 2018)

"Is there a way for you (referring to the engineers) to do this like […] That would benefit us greatly" (Design manager, case study 2, observation 1A, August 29, 2018)

Examples part B:

"I have prepared some questions and have some remarks. So let us have a look" (Executive architect 2, observation 3, October 17, 2018)

Also, the nature of project meetings 2 – 4 are informal on work floor level in contrast to the formal meeting 1. Note absence of the project controller after project meeting 1, separate meetings among the project controller and lead project manager / lead project architect are arranged to discuss the project process, which includes planning and budget / costs.

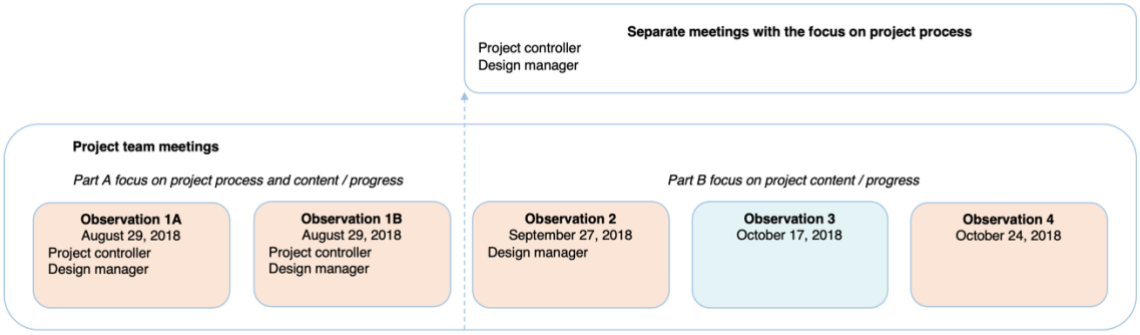

Figure 37: Summary project meetings case study 2

- **Observation 1**: This project meeting can be divided into 2 parts. Part 1A is attended by project controller and lead project manager / lead project architect. Project team members are mostly happy / cheerful but also irritated / annoyed. The project meeting focuses on resolving remarks for BIM codes associated with the design, sorting out regulations, scope, planning and budget / costs. While the project controller, lead project manager / lead project architect and BIM coordinator continue their meeting, other team members attend another meeting (part 1B). In part 1B, project team members are mostly happy / cheerful but also irritated / annoyed when they are interrupted by the project controller and lead project manager / lead project architect. This part of the meeting focuses on resolving design / BIM related problems.
- **Observation 2**: lead project manager / lead project architect was partly present. Project team members are happy / cheerful but also slightly irritated / annoyed due to the stress and tension of a missed deadline. However, in this situation time pressure led to higher team cohesion as the entire project team is remotely working together to still submit the drawings (associated with relieved behaviour). The project meeting focuses on design solutions and presentation content for the client.
- **Observation 3**: Project team members are most happy / cheerful. The project meeting focuses on resolving remarks for BIM codes associated with the design. Comments are directly documented in a shared information management system.
- **Observation 4**: Project team members are irritated / annoyed and surprised which is caused by limited preparation time. The project meeting focuses on resolving remarks for BIM codes associated with the design. Comments are documented in a shared information management system.

4.3 Case study comparison

The aim of the research is to explore the relation between interpersonal skills and shared leadership in project based integrated teams. In this chapter the two case studies and managers are compared with each other to determine the similarities, differences and critical aspects of each case. To answer the research question two case studies have been investigated. Table 9 illustrates a comparison of the context of the case studies, to help determine the similarities, differences and key-findings.

4.3.1 Project context

	Case study 1	**Case study 2**
Type	Foreign hospital design project Additional building to an existing hospital	Foreign hospital design project New hospital building complex
Size	30,000 m^2	130,000 m^2
Area context	Urban	Non-urban
Initiation	2004	2013
Completion	2021	2023
Delay	3-years	1 month
Current phase	Preliminary design 2	Specification phase
Share percentage	Approximately even distribution	Uneven distribution
Background information	The consortium of this hospital project is led by architectural office I and the engineering company, supported by three sub-contractors: external architectural office I, II & III. Architectural office I and the engineering company have previously worked together on three hospital projects and some team members have collaborated with each other in other projects. Some team members have been involved since the design contest and others joined later on; new team members have been assigned to roles: project controller, lead engineers structural, building physics, fire & safety. Occasionally the project team is supported by representatives from other stakeholders, such as executive architect 1C, or advisors, such as an energy engineer. The design team is subdivided in a steering committee and project team. The steering committee consists of the managing director of architectural office I and the process manager, supported by the partner of external architectural office I. The project team is responsible for the design and execution of the project.	The consortium of this hospital project is led by architectural office II & III and the engineering company. Architectural office II is partnering with architectural office III, and has previously worked together with the engineering company, some team members have collaborated with each other in other projects. Some team members have been involved since the European tender and others joined later on. The design team is subdivided in a steering committee and project team. The steering committee consists of the managing director of architectural office I and the process manager, supported by the partner of external architectural office I. The project team is responsible for the design and execution of the project.

Project actors	• Design manager • Process manager (senior project manager) • Project controller (senior project manager) • Executive architects • LEAD engineers: structural, mechanical, electricity & plumbing (MEP), building physics, fire & safety • Cost manager • Client	• Lead project manager / design manager • Project controller (senior project manager) • Building Information Model (BIM) Coordinator • Executive architects • LEAD architects • Engineers: mechanical, electricity & plumbing (MEP) • Cost manager • Client
Meeting structure	• Steering committee: once every two months / every phase transition • *Project team: once every two weeks* • Design team architectural office: once every week • Client meeting: once every two weeks • Engineering team: once every week Spoken language: Dutch	• Steering committee: every phase transition • *Project team: once every week* • Design team architectural office: once every week • Client meeting: once every two weeks • Engineering team: once every week Spoken language: Dutch, English and foreign language
Team composition	The design team consists of team members from various disciplines and companies. The project team meetings are often attended by 8 members, being: *design manager, process manager, project controller*, executive architects and lead engineers.	The design team consists of team members from various disciplines and companies. The project team meetings are often attended by 3 members, being: executive architects and lead architects.
Team managers	The design team has 3 managers, who are *(often) present* during project meetings: 1. Design manager 2. Process manager 3. Project controller (also referred to as assistant project manager)	The design team has 2 managers, who are *mostly absent* during the project meetings: 1. Lead project manager / lead architect (similar to design manager role) 2. Project controller (also referred to as assistant project manager)

Table 9: Context comparison case studies

In conclusion both case studies involve a hospital design project executed in the same foreign country according to custom regulations. The case studies are led by a consortium and have a similar organisational structure in terms of the division and hierarchy of the steering committee and project team. Based on collected data through research methods the case studies differ in the following:

1. *Project size*: case study 2 involves the construction of a new hospital building complex which is 4.5 times the size of the additional building to the current hospital in case study 1.
2. *Area context:* case study 1 is located in an (existing) urban setting, in contrast case study 2 is located in a non-urban setting. Taking the location into account the execution of case study 2 is less challenging and less complicated to organise.
3. *Contract*: in case study 1 the engineering company and architectural office each have an approximately even share of the project in contrast to the less evenly distribution in case study 2.
4. *Planning*: case study 1, currently in the preliminary design 2 phase and involves a longer project process which has a 3-year delay until completion in contrast to case study 2, which is currently

in the specification phase and delayed by 1 month.

5. *Spoken language*: in case study 1 project team members communicate in Dutch in contrast to case study 2 where project team members communicate in multiple languages: Dutch, English and a foreign language.
6. *Project meeting agenda:* in case study 1 the design manager shares the project meeting agenda with team members via email while in case study 2 team members use an information management system to track and resolve comments.
7. *Team composition:* In case study 1 the project team is bigger and more diverse compared to case study 2.
8. *Presence of managers:* In case study 1 the project team has 3 managers who are often present during the project meetings in contrast to case study 2, where the 2 managers are mostly absent.

4.3.2 Team functioning

Team functioning refers to the activities *within* a team to make project progress. In this research team functioning is determined by observing team members' behaviour, actions and the discussed project topics during project team meetings (described in Research design & Method).

- *Nature of project meetings*: In case study 1, all project meetings have a formal nature whereas in case study 2 most project meetings have an informal work floor level nature.
- *Use information management system*: Both case studies use an information management system. However, in case study 1 project team members refer to the 3D model as Revit, while in case study 2 project team members refer to it as BIM.
- *Focus of project meetings*: The project meetings in both case studies can be divided into two parts. In case study 1, part A focuses on project process and collaboration whereas part B focuses on project content and progress. Contract changes result in financial pressure and severe strain on the collaboration, which in response called for an additional engineering team meeting and steering committee meeting to resolve tensions and find suitable solutions. In contrast, the project meetings of case study 2 continually focus on content to make project progress. The managers are mostly absent after part A (the first project meeting), the assistant process manager addresses the project process and collaboration in separate meetings with the lead project manager / lead project architect

5 FINDINGS & SYNTHESIS

This chapter describes the findings of this research. The first finding is that there are three types of managers, being:

1. **Project controller**

   In case study 1, the project controller is a representative of the engineering company and does not have a formal role in the project team. He mainly focuses on the engineering team (intern) by facilitating mutual understanding among these team members.

   Role explanation:

   "I have no formal role in the project team. I mainly focus on facilitating mutual understanding among team members of the engineering team. So internally" (Project controller, case study 1, informal conversation, February 18, 2019).

   Examples:

   "According to what has been discussed I calculated and came up with the following planning […] Is that sufficient time margin for you [addresses project team member] or how much more time do you need?" (Project controller, case study 1, observation 2, October 1, 2018).

   "Is this clear for everyone?" (Project controller, case study 1, observation 3, 2018).

   In case study 2, he is a representative of the engineering company and supports the team. He is responsible for staff, planning and cost control.

   "I do not understand, is this more work or custom based on foreign regulations? Please explain"
   (Project controller, case study 2, observation 1A, August 29, 2018).

   "When can you arrange this? I need to know specifically because I do not want to make promises I cannot keep" (Project controller, case study 2, observation 1B, *August 29*, 2018).

2. **Design manager**

   In case study 1, she is a representative of architectural office I and is the point of contact for the client, her main tasks involve coordination of the design process.

   Role explanation:

   "Design manager (project management role with a strong focus on design). The project architect does not design but guards the quality of the design. And sufficient coordination with other disciplines. Taking responsibility by making sure that my team that works on a project does the right things. We do what the client needs of which we ourselves should think it is good and that the quality is good. There is also a bit of cost management. So that we guard our scope" (Design manager, case study 1, interview with Syed, June 2017).

   Examples:

   "We received condensed feedback from the client, they are very satisfied. I will ask them to elaborate more because I personally think the feedback is very condensed" (Design manager, case study 1, observation 1, August 15, 2018).

   "What do you need to be able to […]" (Design manager, case study 1, observation 3, August 15, 2018).

   In case study 2, he is a representative of architectural office II and the point of contact for the client. He is also referred to as lead project manager or lead project architect, similar to the role of the design manager he coordinates the design process. He is also responsible for planning and financial control together with the project controller / process manager.

3. **Process manager**
   Both case studies have the same process manager, he is a representative of the engineering company and is one of the project directors in the steering committee of the consortia. He has the ultimate responsibility for the project, including planning and financial control. In October 2018, in case study 2 the project controller takes over the role as process manager.

   Role explanation:
   "My formal role is master project responsible or project director. I am responsible for the financial quality and the overall project aspects. And this can be fulfilled in different ways. That is what I sometimes do, I try to go the roots of the tree which I try to do from a sideway and not using a hierarchical approach. I'll do this by asking inquiring questions, e.g. "how is the project going?" and "how are you doing?". And try to get to know the bottlenecks. The response you get out of these questions and the atmosphere are the most important. I try to facilitate and optimize that by setting the team in motion and that will help the team" (Process manager, case study 1, interview with Syed, October 2017).

   Examples:
   "We should be strategical in finding a manufacturer for [addresses element]. It should be according to regulations" (Process manager, case study 1, observation 1, August 15, 2018).

   "I sense that there is tension in regard to […]" (Process manager, case study 1, observation 2, October 1, 2018).

Second, there are two important aspects related to shared leadership in project-based integrated teams:

1. **Project organisation and context**
   Team functioning is influenced by the presence of team members. The project team meetings need to stay on task and maintain focus on content to make project progress. Stagnation of project progress occurs when topics or problems are attempted to be solved in the wrong context (in Dutch: "het probleem wordt op de verkeerde tafel gelegd". The IMO Team Effectiveness Framework (Mathieu et al., 2008) indicates that the organisational context can influence team context and team members. The consequences of attempting to discussing topics or solving problems in the wrong context are that project meeting deviates from the agenda, altering the communication and team functioning. This ultimately influences the planning and outcome of the project.

2. **Information management systems**
   One of the aspects of an internal team environment is shared purpose, supported by common understanding and shared mental model. To achieve this all project team members, need to be engaged during face-to-face project meetings supported by tools, e.g. drawings or 3D model.

Role of the process manager
The process manager needs to create or maintain team conditions which are beneficial for team functioning. The case studies indicate that a shared mental model helps define the scope and common goal, of which the process manager and project controller guard the planning and financial control. Case study 1 indicates that when the process manager is present during project meetings, his hierarchy and seniority negatively influences team functioning. However, case study 2 indicates that absence of a manager along with an unclear overview of tasks and responsibilities can lead to emotions and behaviour, such as irritation, which also negatively influences team functioning. The process manager must ensure that project meetings stay on task and maintain focus on content to make project progress; in case study 2 the process manager arranges separate meetings with the lead project manager / design manager to discuss the planning and budget. The case studies indicate that interpersonal skills can be applied to obtain organisational purposes, such as financial goals, and information management which can contribute to project progress; but also, to stimulate critical thinking and engage project team members to interact with each other (trigger shared leadership).

6 VALIDATION

This chapter describes the validation of the findings. Not only are the findings supported by this present research but also by previous research (Syed, 2017; Bel, 2018). The findings of the comparative case study and recommendations were mostly targeted towards case study 1. As described, there are two important aspects related to shared leadership in project-based integrated teams:

1. **Project organisation and context**
   Figure 38 illustrates that in case study 1 changes have been made to the project organisation in the project plan. The observations suggested that the roles and responsibilities are not well clear or well defined. In case study 1 contract changes and modifications of program of requirements have led to financial pressure and severe constraints on the collaboration (both in the organisational and team context). This resulted in a conflict (of interest), and a turbulent internal team environment which limits the emergence of shared leadership. Many project team members have difficulty following the decision-making processes, project deliverables and responsibilities to create a shared mental model. The complex organisational context influences the team context and internal team environment. At the time of the observations the project controller does not have a formal role in the project team due to formal department divisions. However, he mainly supports the engineers to develop an internal team environment, e.g. create common understanding (shared mental model). For this an additional engineering team meeting was held, attended by the project controller and process manager. Thus, the current project organisation structure needs to be modified, simplified to create a clear overview. This has happened 3-months after the last observation. However, a recent interview has indicated that the architectural office will not comply with the proposed changes. Thus, the project controller will provide the design manager with more support throughout the project.

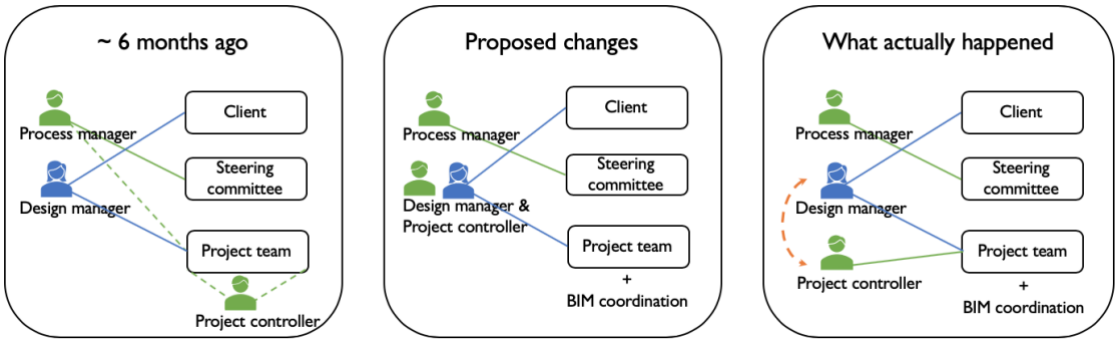

Figure 38: Case study 1 project plan: On the left, project organisation at the start of this research (August 2018). In the middle, proposed changes to be made (March 2019). The actual implemented changes made to the project organisation (March 2019).

In case study 2 despite the bigger project size and language barrier during project meetings, a steady internal team environment is maintained, and shared leadership emerges. It was noticed that project controller or process manager and leader project manager / lead architect were mostly absent during most of the project team meetings, but arranged separate meetings to discuss the project process, including planning, budget, etc. This indicates that planning and budget may not always have a (direct) relation with the purpose of the meeting or team. Furthermore, in this case study the project team created a team culture (e.g. providing social support) of an informal work floor level nature, project team members are engaged and have a high task cohesion. Team cohesion refers to a shared bond or attraction that drives team members to stay together and to want to work together (Casey-Campbell & Martens, 2009).

2. Information management systems

One of the aspects of an internal team environment is shared purpose, supported by common understanding and shared mental model. To achieve this all project team members, need to be engaged during face-to face-project meetings supported by tools, e.g. drawings or 3D model.

The case studies indicated that there are different ways to use information management systems, such as BIM. BIM can support the shared mental model among project team members and help define shared conceptual framework. In case study 1, project team members use drawings and 3D models referred to as the GoogleSketchup models and the 3D Revit models, to achieve common understanding and goals. Despite this, it has become apparent that project deliverables were unclear due to changes in contract and program of requirements which causes a difficulty to achieve a shared mental model. Later with the changes to the project organisation in the project plan (figure 38), the project team has included BIM coordination. In case study 2 despite the language barrier between project team members, the project team has created a shared language and mental model to achieve their common goal by applying BIM. During the project meetings the project team shares the responsibility for the BIM model and uses the BIM model, in contrast to case study 1 project team members do not actively use BIM during project meetings.

7 CONCLUSION & DISCUSSION

The purpose of this research is to understand the way temporal team dynamics work in integrated design teams. Literature shows that shared leadership may improve team learning and that hospital design projects are complex and can benefit from management information systems (e.g. BIM). Therefore the aim of this research is to explore the influence of interpersonal skills on team functioning and shared leadership by finding an answer to the research question:

Considering **interpersonal skills** how can **process managers** influence **team functioning** in **project-based integrated design teams** which apply **shared leadership**?

The findings of this comparative case study showed that the organisational context may interfere with the interpersonal skills of the process manager if roles and responsibilities are unclear. Hospital projects are complex construction projects involving multiple actors, the case studies showed that there are 3 types of managers: project controller, design manager and process manager, with each their own responsibilities and focus. However, in case study 1, the role and responsibilities were unclear. This is noticeable due to the changes made in the project plan. Throughout the project meetings the roles of the managers are interpreted differently than stated in the project plan, e.g. the process manager is also referred to as project director of project responsible and the project controller is referred to as the assistant project manager but actually assists the process manager. Also, the project controller mentioned that he did not have a formal role in the project team, he considers ensuring the common understanding between the engineers, guarding the budget and planning as his main tasks. However, the atmosphere / team cohesion and project progress during project meetings were also hampered by an information imbalance due to the fact that the process manager, was part of the steering committee, whereas the design manager was not. A strong involvement of the process manager at the initial meetings may then contribute to poor communication and negatively influenced the internal team environment (to develop shared leadership), because the strong emphasis on planning and finance may reflect a content which should be actually discussed in the steering committee. Whether or not topics that should be discussed in the steering committee were actually put forward by the process manager, is a matter of less importance. Since all the project team members know the process manager is a senior consultant and member of the steering committee, other team members will respond to him in such a way. Indeed, the findings of Syed (2017) lend support to such an interpretation as team members were much more responsive in the meeting, he was present, than in meetings without him. Importantly, after the first preliminary findings were discussed, a major change was made to the project plan. Clearly, this lends support to the trustworthiness of the here reported interpretation. According to literature shared leadership is an emergent property, dependent on the development of the team. Team conditions help develop characteristics of shared leadership. Findings indicate that the development of the team in fact influences the capability of the project team to apply shared leadership, in which engagement, safe environment, building relationships are essential.

Through task mental models, project teams express in tasks and responsibilities (e.g. planning) to make it more specific and manageable to achieve the result, in which the discussion between goal and result can be addressed. Case study 1 suffered from changes in the contract and program of requirements. However, be it in a different and perhaps less complicating context, similar issues were present in case study 2 as well. Indeed, at first sight it was expected by the researcher that the development of a shared understanding would be more difficult in case study 2, because team members were not all sharing the same native language. However, in this case team members seem to use the Building Information Model as a means to support shared understanding, thus, to develop a shared mental model part of shared purpose. In contrast in case study 1, BIM was not used as an information management system but was referred to as the 3D Revit model. This is consistent with what has been put forward by Papadonikolaki, van Oel & Kaglioglou (2019) and Bel (2018). BIM involves software for information management and 3D modelling (Wong & Zhou, 2015), and can act as a ‘boundary object’, thus as a virtual, physical or electronic object, which carries information (Bel, 2018). to facilitate communication, sharing and management of building information between various project stakeholders (Papadonikolaki et al. 2019). Indeed, the way BIM was defined in case study 1 compares to their findings that novices tend to use BIM as a revit model which does not actually supports information sharing, whereas case study 2 reflects the expert use of BIM emphasizing information sharing. Since there were also complaints on the availability of information in case study 1, it was suggested that it would be better to include a BIM manager from the engineering company to enhance information management in case study 1. Indeed, in addition to the redefinition also a BIM manager from the engineering company was

added lending great support to the trustworthiness of the here reported interpretation. It would be very interesting to follow-up both the cases to see whether information sharing improves.

Limitations of the research

The limitation of this research is related to the fact interpersonal skills are difficult to quantify as there can be various reasons behind a person's behaviour or actions, and the amount of time to collect and analyse the data. The various formations of the present project team members during project meetings have led to different team dynamics, which made it sometimes challenging to compare the observations or case studies.

Implications and future research

This research touches upon various aspects of the collaboration process. An interesting insight of this research are the discussed project topics and the concept of creating a safe environment, relating to (psychological) safety.

8 RECOMMENDATIONS

This chapter provides recommendations for practice and future research.

Recommendations for shared leadership
The observations indicate that managing expectations is also an important aspect and should be added to the action or communication labels developed by Syed (2017). Decision-making processes can be more efficient by engaging all project team members. However, to achieve this, it is important to create social support and a safe environment. Absence of trust, fear of conflict or conflict of interests negatively influences team functioning – as shared leadership implies shared responsibility but often does not imply shared risk. Furthermore, in the construction industry it still appears to be common that the architect is traditionally seen as the 'bouwheer' conflicts with shared leadership and bottom-up approaches. This calls for a change of mindset.

Recommendations for practitioners
Project team members should clearly define roles and responsibilities but also define project goals but perhaps also project meeting goals to assure that the project meetings stay on task with the focus to make project progress. Senior managers should provide social support by creating team culture and trusting project team members that they will do the right things and create an environment where it is okay to be vulnerable and ask for help. Team building activities and self-awareness workshops can develop communication skills to build relations between all types of people across all organisational levels. For shared leadership to emerge team members should be assertive, engaged, reflect and ask questions (Socrates questioning: *Why? What? When? Where? How?)*. This can be stimulated by ending every meeting with peer-to-peer feedback.

Furthermore, the corporate organisation context is an important aspect to take into account, as corporate organisational purposes tend to drive project teams. And in terms of regulating information management systems: during face-to-face meetings project team members need to be engaged, work together and be jointly responsible to create a shared mental model via e.g. BIM as a means. Note that clear definitions, arrangements and purposes need to be addressed in terms of applying BIM or other 3D models and BIM does not replace face-to-face meetings (Bel, 2018).

Recommendations for education
Project management is being taught through books as a top-down approach, which makes engineers often only focus on technical skills and ignore soft skills. While after graduation students seek challenges and work in dynamic environments in integrated teams. As research indicates integrated teams prefer more bottom-up approaches. The way project management is taught should be modified and become more interactive. During education students can profit from project or coursework which requires students to provide constructive peer to peer feedback. Instead of only focussing on the end result, there should be more reflection and evaluation of the collaboration process itself. This will help students become familiar and confident with building trust and speaking up, from which they will benefit in the future.

Recommendations for future research
The case studies indicated that one of the reasons that the decision-making processes were very lengthy was due to the changing program of requirements of the client. This makes it difficult to define deliverables and keep focus on the common goal. Also, the more stakeholders are involved, the more complex project organisations become, in which building trust and the way conflicts are resolved are important. Further research can be conducted in terms of ways to achieve social support and a safe environment and shared leadership related to shared risk (contractual and functional forms for shared leadership).

REFLECTION

Process

My interest in this research topic started when I studied abroad at KTH Royal Institute of Technology, Stockholm in August 2017. I studied concepts of Management & Leadership and Project Communication, involving personal, interpersonal and group skills, and the importance of communication. This was the notion which lead to my quest to have a better understanding of project and team collaboration processes. The Design & Construction Management graduation lab at the Faculty of Architecture focuses on these aspects, in which previous research has been conducted on these topics, including "shared leadership". In December 2017, I first met with my main supervisor about this topic. Previous research by Syed (2017) explored the soft side of project management: shared leadership in integrated design teams, which was in line with my interests and was a good starting point for further research of the relation between soft skills and team dynamics.

Research approach

Upon return in Delft until P2, I had mainly focussed having a better understanding of shared leadership, team dynamics and soft skills through literature review, which resulted in a collection various concepts and theories on the topic. However, the focus and boundaries of the research had to be sharpened, in which choices had to be made in concepts and theories. To help make this decision my supervisors advised me to start with collecting data, through which the link between theory and practice would become clear, thus based on (own) recognition it became clear which concepts and theories were applicable. The data collection also contributed to better understanding and development of new interpretations of the theory, along with this was the sharpening of the research focus. During the execution of this research it became apparent that the process manager plays a significant role in the way the team functions. This insight has led to the revision of the research question from 'how *project managers* can *[…]*' to 'how *process managers* can *[…]*'.

Literature

The course literature during my study abroad was a good starting point but did not cover all. One of the challenges regarding literature review was to be cautious about outdated concepts and avoid generic and trendy marketing terms. Another challenge was the attempt to link theory and practice in an early phase, as it was difficult to (pre)define terms prior to the data collection from practice.

In-depth interviews

In-depth interviews are an easy method to collect information on a specific topic or for a specific question because it fully engages interviewees as they provide maximum input. These interviews often occurred spontaneous in an informal setting, giving the interviewees limited or no time to prepare. This depicts a good picture of the way interviewees naturally feel or think about the topic. However, as the interviews occurred spontaneously it was difficult to capture or (audio)record the data as this action would make interviewees more aware that they are being recorded and become reserved.

Observations

Before starting with the data collection, I evaluated previous research conducted by Wijnstra (2016) and Syed (2017), extracted lessons learnt and determined where there was room for improvement. One of the goals of this research has been not to replicate previous research but rather complement and improve applied techniques. The methodology for data collection mainly involved observing design team meetings, which later on altered the interpretations as theory and practice tend to differ and made everything fall into place. Thus, the focus shifted from soft skills to interpersonal skills and it became apparent that there is collaboration on different levels within an integrated design team, such as project team level, steering committee level and corporate level.

Processing data

Processing the collected data was the most challenging part of this research. Due to the amount of collected data and codes assigned to the recorded audio, more time was needed to process, draw findings and conclusions. The line of reasoning helped to become more selective in relevant data to answer the research question.

Validation

The findings and conclusion are linked back to theory and validated by the changes in the project at a later time (3 months after the observations).

Research topic

Position within graduation laboratory and Management and the Built Environment

In general project management is still being taught as a top-down approach, with the traditional role of the project manager leading the team and having control of the decision-making process. However, nowadays it has become apparent that creative solutions are mainly found in bottom-up team processes that emerge in collaboration due to the fact that construction projects are becoming more complex with the required knowledge and expertise are scattered amongst more and more experts in different fields. In conclusion, theories taught during the course Design and Construction Management are somewhat outdated and contradicting to practice, as the main focus is “to reach the goal” rather on “how to reach the goal”, in which communication and interpersonal skills play a key part.

Dissemination

Social relevance

This research emphasizes the way human behaviour influences project outcomes and the importance of communication. We often fail to determine (all or underlying) causes which have resulted in process failure and neglect “action causes reaction”: behaviours shown by team members might be influenced by behaviour shown by other team members or in contrast it could also be that behaviours shown are static and connected to a particular person. In the end, everyone likes to be acknowledged and heard, which is why it is important to understand the way interpersonal skills can help build relationships which influence the team dynamics in a collaboration process.

Professional relevance

This research aims to understand the soft side of project management, specifically the relation between interpersonal skills and team functioning. It mainly focuses on the interpersonal skills of project managers in the construction industry. This research may contribute to the way project managers can apply interpersonal skills to influence team functioning in project-based integrated teams. The outcome of this research could be useful for construction companies and project managers, to better understand the way to effectively manage teams by applying interpersonal skills. Ultimately, organisations could profit from this by reducing failure costs.

Scientific relevance

The findings of this research can be useful for researches conducted on the temporal dynamics of shared leadership in integrated teams.

Transferability

The conclusions of this research cannot directly be applied to other teams as the complexity and scope, team compositions, organisational structures and company cultures tend to differ per project and situation. However, lessons learnt such as the importance of reflecting and asking questions (Socrates questioning: *Why? What? When? Where? How?*) to get answers to achieve better understanding are transferable to all situations in life.

“The important thing is to never stop questioning” (n.d., Albert Einstein)

Validity

Due to the dependence on scheduled team meetings and the limited time for this research, there was no room for error and missing (background) information had to be collected through informal conversations with team members, in which the danger lies that the information could bias. Creative thinking had to be applied on the way to handle and exploit the collected data instead of collecting more. During the observations it quickly became apparent that my presence was not unnoticed and highlighted the sensitivity of the project information or the discomfort of the chosen methodology. Furthermore, in terms of coding and defining terms inter subjectivity through previous research had to be avoided.

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APPENDICES

Appendix A

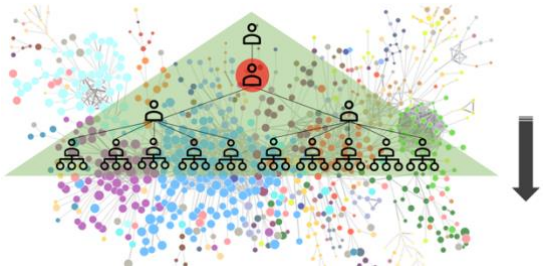
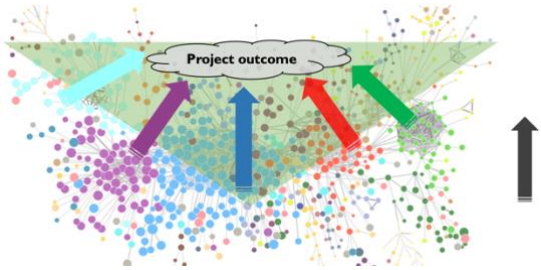
Traditional vertical leadership	**Shared leadership**
Top-down process	*Bottom-up process*
	
• Vertical or focussed leadership • Checklist mentality • Steering	• Shared or distributed leadership • Guides team members to lead themselves • Facilitating
Traditional boss	*Team leader*
1. Monitor 2. Regulate 3. Delegate 4. Certainty 5. Internal aim 6. Routine tasks 7. Operational 8. Method orientated 9. Control 10. Focussed on individuals	1. Support 2. Create requirements 3. Encourage 4. Uncertainty 5. External aim 6. Non-routine tasks 7. Tactic, strategic 8. Result orientated 9. Develop 10. Focus on team

Table 10: Traditional vertical leadership versus shared leadership (based on Van Amelsvoort et al., 2013).

Appendix B

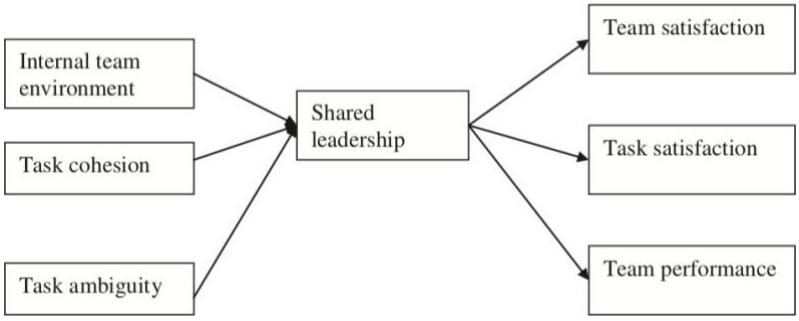


Figure 39: Hypothesized team-level model of shared leadership (Serban & Roberts, 2016)

Figure 39, Serban & Roberts (2016) further explored the antecedents and outcomes of shared leadership and determined the relations between team and task: *internal team environment*, *task cohesion* (refers to team commitment) and *task ambiguity* (refers to lack of task-related information to perform), and *task satisfaction* (refers to attitude towards task and the associated work environment), *team satisfaction* (refers to team experience) and *team performance*. They determined the following:

- Internal team environment is related to task satisfaction: team members perceive the quality of

their work as a high standard which is partly due to social support, opportunity to share ideas and shared purpose.

- Under low task ambiguity shared leadership can still produce high levels of task and team satisfaction (if the task or instructions are straightforward).
- In challenging task situations task cohesion predicts shared leadership: teams focus on overcoming barriers to task completion as opposed to evaluating and building intra-team relationships (Rispens, 2012).
- Under time pressure shared leadership leads to high work quality and overall satisfaction with the output.

Appendix C

Actions	Description
1. Evaluation	Share knowledge of previous executed projects.
2. Reflection	How the team experience results and outcomes of the project and the collaboration process.
3. Set goals	Clearly appoint the corresponding tasks
4. Define shared conceptual framework	Form a combine framework of knowledge related to tasks / roles by sharing information.
5. Ask for feedback	Ask the team whether you are taking the right decisions or step.
6. External influences	External processes influencing the project.
7. Relation management	Make sure that the atmosphere is good without misunderstandings.
8. Ask questions	Ask questions to better understand the content.
9. Take responsibility by decision making	Focus on making things happen.
10. Preventive action	Take actions to prevent the occurrence of certain activities in the future.
11. Planning	Show input for the schedule of the project.

Table 11: Actions labels (based on 'communication labels' by Syed, 2017)

Appendix D

A. Actions	**E. Team leader**	**K. Information gathering and dissemination**
A1. Evaluation	E1. Coaching	K1. Building Information Modelling (BIM)
A2. Reflection	E2. Create requirements	K2. Foreign language
A3. Set goals	E3. Developing	K3. Revit
A4. Define shared conceptual framework	E4. Encouraging	K4. Sharing information
A5. Ask for feedback	E5. External aim	K5. Sharing knowledge
A6. External influencers	E6. Focus on team	K6. Regulations foreign country
A7. Relation management	E7. Managing	K7. 3D Modelling
A8. Ask questions	E8. non routine tasks	**L. Collaboration**
A9. Take responsibility by decision making	E9. Supporting	L1. Cooperation
A10. Preventive action	E10. Tactic, strategic	L2. Hierarchy / Power
A11. Planning	E11. Uncertainty	L3. Responsibility
B. Behaviour	**F. Traditional boss**	L4. Safe environment
B1. neutral	F1. Certainty	L5. Shared leadership
B2. Happy / Cheerful	F2. Controlling	L6. Socializing / non project related

B3. Explanatory	F3. Delegating	L7. Team process
B4. Irritated / Annoyed	F4. Focus on individuals	L8. Team progress
B5. Angry / Raising voice	F5. Internal aim	L9. Way of working
B6. Convincing / Decisively	F6. Method orientated	L10. Involvement
B7. Quizzically / Unknowing	F7. Operational	L11. Organisation structure
B8. Relieved	F8. Regulating	L12. Trust
B9. Surprised	F9. Routine tasks	L13. Honesty
C. Characteristics shared leadership	**G. Cognitive skills**	L14. Equality
C1. Shared responsibility	G1. Investigating	L15. Respect
C2. Team as process owner	G2. Monitoring	**M. Project topics**
C3. Result orientated	G3. Managing information	M1. Budget / Costs
D. Project team roles	**H. Business skills**	M2. Outcome / Result
D1. Process manager	H1. Coordinating	M3. Project process
D2. Design manager	H2. Managing financial resources / Cost control	M4. Project progress
D3. Project controller / Executive project manager 1	H3. Managing resources	M5. Quality
D4. Project controller / Executive project manager 2	H4. Operational analysis	M6. Scope
D5. Building Information Modelling (BIM) coordinator	H5. Technical know-how	M7. Contract
D6. Lead project manager / lead architect / design manager	**I. Interpersonal skills**	M8. Risk
D7. LEAD engineer building physics	I1. Decision making	M9. Client
D8. LEAD engineer fire & safety	I2. Influencing	M10. Design
D9. LEAD engineer MEP	I3. Leading	M11. Complexity
D10. LEAD engineer structural	I4. Managing expectations	
D11. LEAD architect 2A	I5. Motivating	
D12. LEAD architect 2B	I6. negotiating	
D13. Executive architect 1A	I7. Supervising	
D14. Executive architect 1B	**J. Strategic skills**	
D15. Executive architect 1C	J1. Identifying problems	
D16. Executive architect 2	J2. Spokesperson	
D17. Executive junior architect	J3. Solving problems	
D18. Energy engineer		

Table 12: Codes used in Atlas.ti