Communication in multidisciplinary product development teams

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“The Future of Innovation ... Is Together”
-David Simoes-Brown
Preface

During my years at Luleå University of Technology (LTU), I have studied Arena Innovative technology and Business, and I asked myself why sometimes. The two last years my question gets answered. It spells knowledge and product development. I realised that my interests was not only sport, I had found new things that engaged me in serious way.

The power of knowledge was introduced to me, through the education I read some project courses (Greenhouse Project) and courses in product development that made me understand the obstacle when working in teams.

The last year at LTU, I worked as a project leader for a group of student in close collaboration with a company in the commercial airline industry, during that time my interest for how teams collaborate and communicate evolved even more.

I am very pleased with how the division of Functional Product Development (FPD) have supported and encouraged me and given me the opportunity to write my master thesis at the division. I must admit that your continual asking about my future has affected my thoughts about becoming a PhD student, all your help and enthusiasm, have made this work so much easier.

Thanks to you all at the division FPD, especially to my supervisors Mattias Bergström and Åsa Ericson for a playful and inspiring time, you two get me back on track when I was confused, independent if it had to do with how to precede my thesis work or not. To my roommate Marco Bertoni, thanks for answering my questions and letting me share room with you during my work, it has been a great time.

The work with this thesis has been an enjoyable learning experiences and I hope I get the opportunity to continue improving my skills in this field of knowledge in the future.

Finally I would like to express my appreciation to my family and friends for all your love and support during this work.

Thank you all!

Johan Holmqvist

Luleå, January 2010
Abstract

The background of this thesis is based partly on own experience in how teams collaborate and how important communication is in multidisciplinary teams, because different fields of knowledge makes diversity in how to express oneself. Will the whole team understand what you want to explain?

The thesis work is performed at the division of Functional Product Development at Luleå University of Technology, partly involved in a research project regarding Global Team Based Innovation and contributing to another focusing multidisciplinarity in teams.

I seek to understand what some of the challenges in team-based innovation might be. Foremost regarding communication and collaboration, not only share information as it commonly is in many cases. During the work focus has evolved to investigate meetings and observe how teams work in different situations. I have also looked into how trust, different personalities and distributed meetings affect the team in terms of collaboration and communication.

My contribution with the thesis is to identify and map meetings in order to enhance the understanding about what differs a meeting from others and how different types of meetings can be used to support a project team. In addition to that I have established suggestions of parameters of how to handle communication and team collaborations.

Keywords

Communication, collaboration, meetings, team-based innovation, functional product development
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1 Introduction

This section of the work includes an introduction to why this M.Sc work has been done within the area of Team-based innovation, background, and proposes of the thesis work, guiding questions and delimitations.

A fundamental condition in a product development project is to have a process and roadmap over what to do and roughly when it should be done. Companies usually develop their own process. How they communicate it and conform to the process differs, depending on how addicted, unbiased and open they are to this way of working. A project's development process is not only important to be able to follow a way of working, but also as a process that makes understanding for how to collaborate and tackle possible problems [1, 2].

Product development work is rapidly moving forward and the capability to adopt new methodologies and techniques will affect the outcome in a project. To succeed, and manage deadlines, we could not continue working with incremental innovations. A quotation that catches the difficulty; “Getting started in the right direction is more than half the battle when it comes to innovating effectively” [3, p.15].

Global product development and working in multidisciplinary teams builds on the assumption that the group has understanding for the project, communicates and collaborates as a team. That might sounds obvious, but in many teams insufficient understanding is one reason why result of the project has not been as good as it could be. Almost everyone can share information, but will that encourage collaboration or just increase the gap between different departments? ‘True collaboration’ [4] is what this is about. True collaboration is that team members think together and have collaborative discussions in their daily work, not only share and exchanging information. Multidisciplinary teams consist of peoples from different knowledge domains with divergent competences and skills; to bring these individuals together in a team is a challenge [4, 5].

Companies struggle with projects in close collaboration with partners other departments or a divergent team within the company. Klas Tübinger, manager at Sandvik Coromant explained their challenges during an open talk at LTU; Prioritize projects, getting the same goal, cross functional teams and diversity. Even in a global industrial company within the Sandvik group with about 50 000 employees [6], they still talk about getting the same goal and have diversity and cross-functional teams. These challenges have a very close connection to how to communicate and collaborate.
1.1 Background

This thesis is related to a research-project; ProViking THINK - Teams for Heterogeneous Innovation Knowledge. The division FPD has anticipate some results and deliverables in this project; e.g.

- A multidisciplinary group, possessing a diverse set of competences, equipped with methods of collaboration is the core to realize team-based innovation.
- Knowledge about strategies and approaches for team-based innovation.
- Establishment of approaches for a knowledge driven innovation process to support heterogeneous teams in early design phases. The capability to assess knowledge maturity within the team’s collaborative environment is part of this approach.

The division had set up a proposal for this thesis work and since this fits well into my interest for team collaboration, I got the opportunity to frame my own question and field for the thesis. The thesis is also built upon another research project at the division; Global Team Based Innovation with Volvo CE [7], which also aims to increase the knowledge within the area of team based innovation. My own experiences from collaboration and how to implement radical innovation approaches and creative methods have inspired this thesis work.

I have as a project leader own experiences of how hard it could be to break the standard procedure in a meeting, e.g. how to achieve shared understanding for the task, engagement, and common responsibility, i.e. approaches that contributes to efficiency of the meeting.

This thesis work will feed the area of team-based innovation with theoretical input and builds on methods, tools and formats of collaborative meetings. The framework for this thesis work will consist of; observing teams with different knowledge areas, with diversity of competences and categorizes meetings and proposal for how teams can be supported.

1.2 Delimitations

During the work with this thesis delimitations have been made, to focus on communication and collaboration within projects related to teams, and categorization of meetings. What they communicate was not in my interest, how they talked to each other was the main focus. This thesis focuses to explore the area of communication and collaboration in multidisciplinary product development teams. Thus, the work does not include studying the possible effects on collaboration due to the physical environment or the use of development processes.
Further, another delimitation has its roots in the assumption which guides the work, namely that a multidisciplinary team is an ideal situation for innovative work. In the studied teams the groups were arranged as multidisciplinary global teams. The company had established tools and methods to perform their work. Thus, the study excludes the initial phases of arranging and deciding on the team format.

1.2.1 Questions

Considering the scope of this thesis and the proposal for the framework of the thesis, two general questions have been working as guidance;

Q1: How to support multidisciplinarity in development teams?

Q2: How can communication and collaboration be encouraged within a team?

1.3 Disposition of the thesis

Chapter two presents how the work has been accomplished, explaining the research process and which methods that have been used.

Chapter three outlines of the theoretical framework; a literature study of product development teams, global and Co-located, what differs between these teams and how the informal communication affects the collaboration. In addition to that investigation of how communication can be used in projects to understand the task, create team trust and common ground. The chapters also present categories of meeting formats.

Chapter four introduces empirical data to give insights into how teams collaborate.

Chapter five is where the discussion is presented. Here, the contribution from the literature study and the observations are linked, and discussed in relation to the area of team based innovation.

Chapter six presents the conclusions. The chapter ends with the future work, where research questions and subjects to continue with are suggested.
2 Method

This chapter presents the method used in the study. The study is based on both theoretical and empirical data. Previous work at the division of FPD provides a frame of reference for the study. Each of the following sections will describe why these different methods were chosen.

2.1 Literature study

To establish an understanding for this subject a literature study was done initially. Later relevant papers and research articles have been read to focus the study on the actually scope for the thesis. I also looked in earlier thesis and paper written at the division, this gave me the insight and inspiration of what to explore. The theoretical studies; has been performed to get knowledge of different aspects within product development and collaboration in multidisciplinary teams. Keywords in the beginning were used to search for articles and books; e.g. collaboration, communication, open innovation and team-based innovation as the study unfolded, a focus on meetings in product development became clear. A short review of what the different authors have published and in what journal gave a general view of where to find additional relevant literature.

2.2 Observations

The observations were focused on how the team members interplay and how they communicate. I watched video records from work meetings and took field notes, these notes were later analyzed and arranged to improve my understanding and make a comparison to the literature study.

The work involves besides physical observations and watching video-records also field notes from the observations and I also went back to watch some parts several times to reflect upon my interpretations of the team performance from another. Thus, the analysis has been an iterative process that has contributed to insights into the activities and challenges, but it has also been a very time-consuming work.
3 Theoretical framework

This chapter presents the literature study that has been done to enhance the knowledge of team-based innovation and mainly understand how collaboration and communication works in different teams. The contents of this chapter are divided in subgroups, thus also providing an overview of what a team is and different approach to how they could work.

3.1 Ways to Grow

It is important to have a mutual view for how to place the company in terms of development and innovation [3]. Ways to Grow seen in Figure 1 are overlapped by another 2 by 2 matrix named Innovation outcomes. Project teams can explain where they want to go and what they really are into and using ways to grow to visualize their thoughts. Discussing common goals within the team makes it easier to understand whether it is an incremental innovation and small improvement or a radical innovation with new products and users.

![Figure 1. Ways to Grow [3].](image)
Way to grow can be used in the beginning of a project to identify if the team have the right combination of competences; it is more or less a tool for evaluating the organization. If the goal is to optimize the market or develop a totally new product what, knowledge do you need? During the process, Ways of Grow perform the functions of evaluating if the project stays on track or if the goal has to be rearranged. Using this matrix to communicate within the group could enhance the understanding of the project and thereby encourage the collaboration, which affects the effectiveness in the beginning of a project.

### 3.2 Informal communication – a compliment to formal communication

In many contexts, formal meetings can be seen as something negative and non-developable; "A meeting is a group of people that keep minutes and waste hours" (Furnharm 1993:55). Informal communications and meetings apprehend as a positive and permitting environmental. Informal meetings could still be frequent but not planned e.g. at coffee breaks; where you meet colleagues and communicates without planning to discuss work, there are often some problems that you solve during this ‘breaks’ related to the daily work. Occasions for communications that will be explained as hallway-meetings and private-meetings are often not conceived as a meeting, but have been classified into a meeting-organizational structure, see 3.5 Meetings [8].

In product development projects a challenge is to balance between innovation and control. Innovation in terms of solving a problem, but also to make decisions, e.g. choose a concept to proceed with, and, control in terms of controlling the projects through adopting and implementing routines that works. Confusion appears when there is an under-defined activity or a process step that it has not been planned for in the project.

In research by Westling [8], one finding is how an informal structure in a team, is used to make collaboration to grow, but it could also affect the ability to collaborate in negative ways if you split the team. The motivation diminishes and difficulties in over-viewing the project, develops to a downward spiral. Westling concludes that a mix between informal and formal communication develops the collaboration and understanding; on one hand for the contents and on the other for the participators and their expectation in a project.

Informal communication is used in order to prepare oneself for a meeting, discuss ambiguities to solve problems or communicate ideas with colleagues e.g. work out a concept to a certain level and then present it for the manager in a project, when the concept idea has reach an ‘acceptable’ level of maturity. Considering this, formal meetings can be seen as limiting creativity and innovation, as opposed to the informal communication [8].
The frequency of communication has an impact on the possibility to initiate collaboration. The distance between two engineers' offices influence their connection and by that also the number of talks. Independently if team members communicate through mail, phone call or physical meetings it has an affect on their pattern of behaviour. The communication shows how important the informal meetings and interactions are for collaboration. First of all the informal meetings increase.

The contact and communication but also the quality of communication. Kraut et al [9] explained the two-way interaction, and how it simplify the mutual understanding in a meeting. The informal meetings also create opportunities to letting everyone to get their voice heard.

### 3.3 Team

A team can be defined as; “A group of people with a full set of complementary skills required to complete a task, job, or project” [8]. This explanation is a simplification that not takes into consideration how teams are organized geographically. In this thesis the definition of teams or their meetings will be divided into two main groups; Global and Co-located.

#### 3.3.1 Global

There are many differences in how global and co-located teams communicate and collaborate. Global teams often consist of individuals from different backgrounds and disciplines, especially in larger worldwide teams the differences in culture and language occurs as a problem.

Larsson [4] addresses the importance of how to express oneself and communication in global teams. A mutual language in terms of vocabulary makes sense in collaboration, not only that everyone in the team speaks e.g. English whether if it is your native language or not. There are differences in how to express yourself if you are confident within the group. But this communication is also affected by which disciplines and professionally areas the team members are familiar with. The vocabulary could be a challenge for understanding each other, e.g. that engineers from different companies, countries and cultures could interpret the communication in a various way, or if the team have members with different competences. Ambiguity in the sense of a word, affect how team understand the design communication.

#### 3.3.2 Co-located

In contrast to global meetings, co-located meetings occurs both as formal and informal meeting. Global and co-located meetings are related to the place where the meeting is performed, and then formal and informal meetings can be defined as the balance between innovation and control. It is not an encouraging environment for innovation to have a too formal structural organization [8]. One of the advantages with co-located teams is spontaneous contact that occurs in a more natural way co-located than in global teams. A quote from an engineer shows the importance of informal meetings; "Spontaneous contacts in the hallway - they are what design work is built upon. If they would disappear, the time it would take to solve our problems would be prolonged” [8, p.156].
3.3.3 Individuals in a team

In the book teamology [11], four categories of teams were elucidated: the experiential, professional, sociological and cognitive varieties. Also, how they work is described. Experiential variety occurs often in academia when students from different grade and with different practical experiences collaborate. Professional variety in a team is when you set up a multidisciplinary group with divergence expertise. Sociological varieties are defined as ‘non–traditional’ members in the team e.g. different background, other native language or a female in a male-intensive team. These three varieties improve team performances, enhance the collaboration capability in diverged teams and are common and easy to manage relatively to the last variety. Cognitive varieties are dealing with how different personalities could work together [11].

The Jung’s Cognitive Modes are divided into an Information Collection Modes and a Decision-Making Modes and this matrix were used in an experimental test at Stanford University, while observing teams. According to Jung’s cognitive modes seen in Figure 2 diversity in cognitive behaviour are also a way to improve performance in a team but more difficult to achieve and understand.

![Image of Jung's Cognitive Modes](image)

*Figure 2. Jung's Cognitive Modes, after [11, p.6].*

The left side; Information Collection Modes describes personalities in different ways of collecting information in a team, based on e.g. experiment, knowledge or imagination. There is also other dimension to balance; extraverted or introverted persons. An extroverted person is very open and as shown in Figure 2, he or she uses ideation and experiments to collect information, unlike the introverted person that advocates knowledge. The introverted person analyses and evaluates decisions and the extroverted are an organization and community person. An extroverted intuition
person has a complementary pair of the introverted sensing person, and through this mix within
teams, the performances could increase. The same way of complementary pairs is shown in Figure 2
for the Decision-Making Modes. By using cognitive questionnaire e.g. Myers-Briggs Type
Indicator® [12] the different cognitive personalities could be screened and then settle a team with
distinguishing characteristics.

In experiments at a University this way of putting together the group has been compared to
randomly mixed teams to observe how they perform. By taking the person with the highest
number of modes in the cognitive-test and select as ‘core-member’, then cover the remaining
modes by other group members to found for a successful mix in the team [11].

Regarding this technique of building teams a conclusion are that on one hand the randomly mixed
teams are faster to get together as a team, on the other hand the diversified cognitive teams are
more creative but since there are so different types of individuals, they needed formal organization
meetings early in the process to establish a mutual communication. In large teams every individual
gets less responsibility and therefore the personal development are reduced. Those teams contain
often a hierarchical structure, and through showing a model of the organization, it is easier to
communicate the responsibilities and tasks.

A double-introvert person explained how the personalities influenced the teamwork and how work
in diversified cognitive teams affected him; “A malformed team can lead to undue stress, lack of
productivity, and the isolation of individuals with thoughts of doubt and social ineptitude. … Working in such
a conducive environment increases the probability of future success because the teammates are more likely to be
willing to work again using the method” [11, p.63].

3.4 Development projects

In an article about design thinking [13], five characteristics are pointed out for a design thinker;
empathy, integrative thinking, optimism, experimentalism and collaboration. All of them
important, and affect the team spirit and the outcome of a project in either ways. The article
elucidates that the best design thinkers also are; ‘enthusiastic interdisciplinary collaborator’ and they
have experiences from working with team members from more than one discipline. When working
within a team with divergent knowledge it is necessary to have the skills to communicate your ideas
so the team understands every point of view [13].

Collaboration is much more than sharing and dissemination of information [4]. A quote stated by a
coordinator shows the importance of collaboration; "Collaboration does not happen automatically here.
We ought to have something similar to the well in old societies where all gathered. We need a well, but we do
not have one at present" [8, p.135]. There are other aspects that affect collaboration skills within team
more than sharing information. ‘Two heads are better than one’ are a common statement nowadays
and Hill [14] have analyzed groups compared to individuals in four terms; task, process, individual
differences and methodology. The study showed that team performance in these four categories was
both qualitatively and quantitatively better than how the individual performed in the study. A
survey with about 10 000 U.S workers showed that 97% stated that they needed; better condition that encourage collaboration to be able to perform their best [15].

In Collaborative Information System (CIS) a hierarchy have been defined, concerning the differences in collaborative capability of technologies. Collective, coordinative and concerted are the three different levels [15]:

1. Collective capabilities consist of teams and organizations that work uncoordinated and individually, the sum of all individual is the productivity. They work more or less alone from start to the end. Applications that help the team are graphics and spreadsheets.

2. Coordinative capabilities are also uncoordinated even though they could contain ad-hoc teams. The sum of all ad-hoc teams and individuals represents the productivity within this level. They have a common timetable and share applications, use videoconferences and have structural discussions.

3. Concerted capabilities are teams with a common effort and goals. They could work asynchronous (different times) or synchronous (same times). In this level there are dynamic teams with a common understanding for the process, the productivity are the sum of all individuals and the concerted performances of the team. Team with this level of capabilities supporting their work with electronic meetings and Computer Supported Cooperative Work (CSCW) systems.
In Figure 3 a visualization of how the connections between understanding, collaboration and groups are displayed. According to this the intellectual bandwidth are depending on these aspects [15]. Figure 3 shows that a project team will not perform better just because of a larger team, they also need to manage the collaborate capability.

3.4.1 Typical problems in product development

There are many elements to handle in a product development project, not only the task itself, but also the establishment of a common ground and understanding for each other within the team. According to that many problems could appears, some related to communication issues. Based on a study in the tele communication industry, 6 areas of problems in complex product development are found [8]:

- **The system expert bottleneck problem** - Imperfection of knowledge in a certain area, effects the development in other areas that are connected to each other.

- **The technical problem** - Hardware related problems that occur late in the process and are therefore difficult to predict.

- **The interface problem** - Fit and function problems, i.e. does the interface of two parts fit into each other and how does it work with the software.
• **The tracking problem** - Especially in projects where many peoples are involved, the progress could be hard to overview. Keeping the pace or being behind schedules can have its cause in, e.g. confusion in the group.

• **The boundary problem** - Consists of how to focus the project, resources and what expectations all partner have i.e. stakeholders, users, R&D, project managers etc. Everyone have his or her own expectations, settled boundaries, it could end up in a Tug-of-war. Three main boundaries are highlighted functionality, time and staffing.

• **The coordination problem** - These problems appears because of difficulty in collaboration and aligning actions within a project; in a big team, a mutual understanding is hard to achieve. Often there are many levels of hierarchy in the organization, geographic, cultural problem and confusion of languages that are the underlying reason to these problems. Experts from different areas have not the ability to understand each other since they do not share a common language, i.e. design and manufacturing experts have different views of how to develop a new product.

Problems appear and increase often both in horizontal and vertical direction in an organization. Horizontal direction as an effect of the number of people involved and vertical in terms of how many levels there are in the hierarchical structure. All coordination problems will diverge if the communication gets worse, a mutual understanding could be exchanged for mutual blame. Therefore one fundamental issue in a team will be to create good collaboration [8].

### 3.4.2 Team and task

In the art of innovation [16], teams are compared with individuals. Interplay between personas is elucidates as encouraging to an inspiring environment with variation in both competences and personalities, which is an advantage when working in teams. The author explained it as a ‘Hot team’, a group of individuals that perform, give and share. Group dynamic and shared responsibility contribute to the morale, and also showing appreciation when a team member that done a great job is stressed as important. Thru a ‘show-and-tell’ scenario, a co-worker could inspire the team with ideas and successes so the whole team performs and acts more positive. The sense of belonging to a team ties member closer together, in consequence this affects the 'team trust' and encourages to communication.

Another concept for dynamic team work is ‘Tiger teams’; “Tiger teams are distinguished by both a high level of coordination and a deep interpersonal dialog among the members” [17, p.8].

Tiger teams originate in an initiative back in 1980s with U.S. military and the industry. The purpose was to encourage concurrent engineering. Defence Advanced Research Projects Agency (DARPA) tried to include technologies that support concurrent engineering, i.e. the goal was to develop an architecture that relieve the problems with geographical dissemination, organizational structure etc. Communication with others and how to share, store and have access to the
information are essential issues. Insights in how team members interplays with each other is a fundamental condition that contributes to team trust and that conflicts and problems are easily brought up to light [18].

‘True collaboration’ is not to express oneself just to share information rather it is to think together. Considering that, negotiation discussions and argumentations are important parts of the collaboration. Bucciarelli concluded that design is; “as much a matter of getting different people to share a common perspective, to agree on the most significant issues, and to shape consensus on what must be done next, as it is a matter of concept formation, evaluation of alternatives, costing and sizing” [19, p.187]. Collaboration is a daily part of a designers work, and when working co-located you meet in informal meetings and as well as in formal meetings discussing project and how to proceed [4].

When putting together a new team the skills for how to collaborate and communicate are important to get a good start. Different characteristics within a team have to be defined and the awareness of what roles and knowledge that are necessary in the team should be established. And by that the members become aware of how they can contribute to the project.

Figure 4 is a visualisation of how McFadzean [20] defined different steps of development in a team and relationships between elements, which were included in each level.

Project team have different levels of engagement depending on what kind of project they are dealing with and how they interpret the task. It is important that everyone is addicted to the project. Working in a group without the feeling that team members have the same expectation, or that anyone does not put efforts to contribute to the team could set aside all trust in the team. McFadzean [20] established the team performances in different levels of attention; ‘The attention steps’ Figure 4. According to level 1 team only tried to complete the given task, they did not put any effort into the project besides complete their part of the job. Often these projects are more or less routine work and will not demand any further development of the relationship within the team.

Level 2 in the attention steps focus on the meeting process. Even though these kinds of team have a congruent goal, they have to manage the process towards the goal. This is not routine work like level 1. The meeting/project has an agenda and timetable to follow, still the team needed to have a process in terms of; what methods, techniques and program that are suitable for the team. If team members are not familiar or comfortable with a technique it could have a counteracted effect on the performances [20].

In the attention steps, level 3 clarify what experiences, knowledge and other skills that are required in the team to contribute to the outcome and efficiency [20].

In addition to the levels described above, a fifth level manage the maturity of attention in the team. Teams that can manage this level of mutual agreement have awareness of the importance to develop good relationships within the team [20].
The model includes many team aspects that have to do with collaboration and communication. Beside the team, a facilitator and creativity techniques are pointed out as valuable elements in product development projects [20].

Product development projects involve often many different departments, by those problems appear because of lack of knowledge of other department’s work, but also problems with communication and understanding each other. Divergent perspectives are inherent in development work, for example a specialist suggest an advanced geometry to optimize it, the manufacturing wants to simplify the turning-operation, the marketing wishes a faster launch, and the management seeks to reduce the costs. A team in that situation needed to improve the communication and understanding for each other’s perspectives [8].

Westling [8] categorized organizations into sub-systems; Operation, Administration and Allocation sub-system. Within the operating sub-system mostly technical problems occurs on component or system-level, in the administrating sub-system there are problems related to the organizational-level in a project. And the allocation sub-system is dealing with the overall project context. In the sub-systems, project members from the team are involved in different extent depending on their ordinary role in the project.
How different project members perceive and explain their roles respectively differs, thus this attitude also affect their contribution in the project. Project manager said that; my task is to lead the project and look after the development and how the projects proceed. Engineers said that; our task is to develop the design and functionality together. The coordinator said; my work is to perform a team that work together and develop the design; I act as a facilitator and support the team. The manager in this example expressed his work not as a part of the team performance. He hints that he has to ‘look after’ the project group instead of be a part of it. These attitudes affect the whole project group and the collaboration within it [8, 16].

The attitude and understanding to each others contribution within a team also resulted in less meetings ‘off-the-record’ between this groups. Such ‘off-the-record’ meetings are conceived as an important way to communicate in a project. It has been recognised that engineers spend more than half the overall meeting-time on communication in informal meetings and work at an operating sub-system level [8]. Coordinators have mostly meetings as an interaction between the operating and administrating sub-system. Managers have a wider dissemination of meetings in different hierarchical levels.

3.4.3 Understanding and agreement

An understanding for the problem is of vital importance for the result in a project. “We fail more often because we solve the wrong problems than because we get the wrong solution to the right problem” [21]. Ottenheijm et al [5] have made a framing matrix of the relationship between agreement and understanding seen in Figure 5.

![Figure 5. Framing matrix; Understanding and Agreement [5].](image-url)
If there is no understanding or agreement, the team will develop an uncertainty about the task and uncertain atmosphere. This will happen when teams, e.g., cannot find relevant information. When having a shared understanding and no agreement, conflicts appear within the team. A conflict affects the abilities to collaborate and trade-offs are needed, to be able to proceed with the project.

High level of agreement and no understanding contributes to ‘Group think’; this condition arises if not all individuals have the possibility to give their point of view or personal reflections. The opinion from all group members is important, since the presented information can be inappropriate or biased in relation to the problem. If the dialogue does not allow expressing different opinions, or everyone agrees on the presented information despite thinking that it does not define the problem correctly, a situation of ‘group think’ has occurred.

Information and communication technologies (ICT) could have a positive affect to avoid these scenarios, ICT is used to support meetings and enhance the productivity in teams. ICT could be useful in organizations where hierarchy diminish the team performance, as a consequence members are not allowed to express their ideas, or feel uncomfortable in the situation [5].

In the best case scenario, ICT gives everyone the opportunities to communicate their ideas. The ICT can support the team members to express their opinions in text, also anonymity can be provided for. Also, the documenting what has been said is an advantage of the use of ICT [5].

But, also, these systems have constraints in handle the social complexity and informal communication. The commitment within a project team tends to decrease if only these technologies are used [5].

3.4.4 Trust

An important part of a project in addition to understanding the process, task and team dynamics, is trust. Trust has a big impact on performances within a group. Apprehension of being judged when proposing ideas is a common behaviour in a group where the members do not have developed trust. Such feelings will reduce or prevent an open-minded and positive sprit, rendering up in feeling uncomfortable and not willing to try out new methods or techniques. Team trust is important and a good meeting-facilitator could encourage even an uncomfortable group to reveal their ideas that has not been presented to the others. If trust does not exists within a group, the outcome of e.g. a creative session could be reduced and you loss valuable information for the project [3, 16].

3.4.4.1 Storytelling

Considering the importance in understanding the team members, storytelling could be of help to communicate within the team. Not in terms of agreement, but for an understanding of each other’s opinion, no matter if it is a contrasting or common understanding, it has affects on the collaboration.
By using storytelling, the designer has to explain thoroughly what his or her experiences are in the context of the problem or how they interpret the task. “Storytelling as positioning and justifying individual beliefs” [8, p.142]. Different stories enable a wide range of the solution-space, and express the competences that the team acquire. It is a way to create understanding in a team, and telling your story will also bring sense to your own understanding of the task.

It is important to communicate to the entire team what you do and why, to make clear the different attitudes and responsibilities in the team. Preconceived ideas obstruct the collaboration, rather than contribute to and integrative solutions [4, 8].

3.4.4.2 Common ground

When a mutual knowledge, understanding and expectation could be reached within a team, they have a common ground, which is a fundamental condition for communication. A team was struggling with what to do, despite it seemed as an easy problem, they barely managed to define the scope [8]. Two-thirds of the project time was used to these activities. Also, a common ground of what to do can be quickly established, yet problems can arise for how to do it [8].

3.4.5 Culture

How squarely and fairly a project team communicate to each other differs and depends on the culture and how formal the collaboration is on a company. For instance, if the hierarchal levels in the organization prevent an engineer from expressing his new idea to the managers, then the organization has problems. Therefore trust and understanding is of great importance to create an open corporate culture. There are many ideas that are worth thinking about, regarding cultural changes e.g. how a delay could easily change the whole company’s view of finish before a deadline [8]. In the mobile system project at Ericsson AB, they were a few days delayed, but also this was the first time ever a project was delayed. After that time many projects have been delayed at Ericsson AB. One main project manager’s reflection of the situation was that a change in the organizational culture happen based on that occasion [8].

3.4.6 Facilitator

Supporting techniques for creative problem solving are suggested to be divided into three various types of paradigm techniques; Paradigm preserving, paradigm stretching and paradigm breaking techniques [20]. The facilitator needs to understand how comfortable the team are in using creative methods in their daily work. Also, the facilitator should possess skills to adapt methods and techniques to go with the flow in the creative session. Paradigm stretching techniques encourage creativity more than the paradigm preserving techniques, but also affect the participants and their sense of confidence. The third category; paradigm breaking techniques should not been used in a project if participants are uncomfortable with a technique that require certain experiences and understanding for the work. The facilitator has to manage to communicate the message during a
creative session and get an understanding of how easy the team could adapt to new techniques, therefore reflections about those models could be useful for a facilitator during the preparation but also while running the ‘show’ [20, 22].

3.5 Meetings

“Meetings produce organization rather than organization producing meetings. … It is in the meetings we come to know ourselves and our social system” [8, p.192]. Meetings are not only a format for collaboration, they also convey culture and organisational acceptable behaviour, for example being in time or not, and if it is doable to start the meeting even though the formal chief is delayed [8].

In many situations the hallway outside the meeting room is used as a place for 'pre-meetings', so called hallway meetings. When waiting for the meeting to start or waiting for access to the meeting room, the attendances gather in informal groups depending on relations. Usually this time of waiting is used to raise questions, ideas etcetera that does not fit into the agenda of the forthcoming meeting.

Four categories of meetings has been identified [8]:

- **Announcement meetings**
- **Work meetings**
- **Hallway meetings**
- **Private meetings**

Also, it is found that a variation in meetings and participants produced better ideas and a more satisfied team. And, that this flexibility is needed to deal with complex product development.

3.5.1 Announcement meetings

The meetings in this category are distinguished by a large group of people, with an asymmetric relation within the meeting i.e. one-way communication, in terms of a talk. The meetings are usually prepared and held by a person of higher order in the hierarchy, the most of the participants are audience and not active during the meetings.

Announcement meeting aim to explain how to proceed with the project for example who will have the responsibility for what. It will not invite to interaction and therefore collaboration is not encouraged. Participants attended such meetings often uninformed and uncommitted, then the manager run the meeting and present the message. A common view is that the informal chat did not take place in these meeting forms [8].
3.5.2 Work meetings

Work meetings involve 5-15 people. It is still a formal meeting and the participants attend as a project manager, specialist, engineer etc. The group in these meetings is more focused on the performance and how to proceed. Work meetings are official meetings the same way as announcement meetings and managed by a project leader.

The person responsible for the meeting guides the participants through the items on the agenda, and gives them the opportunity to respond and ask questions. Even though categorized as a formal meeting, a work meeting is less asymmetric in communication. Still it is embedded in routines according to existing hierarchical structure; letting the highest person in the hierarchy speak first. One problem with work meetings is that in discussions, the participants could lose their faces if they have given an evasive answer, and that can affect the team trust [8].

3.5.3 Hallway meetings

Spontaneous talks in front of the coffee-machine or outside a conference room are defined as hallway meetings. They involve smaller groups and could be in form of a semi-public ‘pre-meeting’ before a formal meeting. Hallway meetings also fulfil a social need; these meetings are more related to personal relations than hierarchical structure in a project.

An interesting finding with work meetings are about how the participants arrive to the meeting; which also could be described as a hallway meeting and includes a lot of ‘off-the-record’ information.

Hallway meetings are categorized as informal. The initiators manage the gathering, and some participants attend only to listen and other is more active in the conversations. Though hallway meeting could be used as a way of getting shared understanding and reduce conflict situation in relation with more formal meetings, talking in small letters are common to avoid everyone from hearing the discussion. In hallway meetings the roles are of less importance and that can be confusing sometimes, e.g. if the project manager speaks to you as a friend [8].

3.5.4 Private meetings

Private meetings are symmetric i.e. it is a one-on-one meeting, two persons talking to each other. As it sounds, private meetings are ‘off-the-record’ events or backstage meetings; unofficial, informal and invisible for others than the participators. They are not quotable and could not be referred to in other situations. Private meetings are assumed to have mutual trust between the participators and therefore it is easier to pick up a question concerning any perceived awkward subject [8].
4 Design observations

In my thesis work I have observed different kinds of meeting to investigate what characteristics that support collaborations within a meeting. In this chapter cases and an analysis of the findings from the observations are presented.

4.1 Case I - First co-located meeting

This case involves final year students from Luleå University of Technology and Stanford University, California, USA, four from each university. The project was intended to increase the wellbeing of elderly persons. The meeting in this case was the first physical meeting for the team. The meeting lasted for one hour.

4.1.1 Account of the case

In this case the meeting started up with confusion about the task, while some of the participants began to write their ideas on a paper, others were chatting with the neighbour at the table to understand the goal for the session. Everything takes place around a table covered by paper and post-its. Everyone has the opportunity to write down the issues they feel should be addressed.

During the meeting, the intensity and the participants' engagement increased with time. A number of minutes before the break, the participation started to decline and team members began to chat more with each other about other things and was not listening to anyone trying to capture the group's attention. The session ends up with a brief summary of how the group will continue working with the outcome from this session.

4.1.2 Interpretations of the meeting

In this group there is a high degree of uncertainty and lack of trust for each other. Other elements that restrict the group's performance are language difficulties, since the students from Stanford University have English as their native language. The positive effect of this is that the team have to make other ways to communicate, e.g. through body language or sketches.

The Stanford students explained for the team what they have learned about creative meetings and took 'command' of the meeting. The students from Luleå seems to be uncertain in this situation, some of them started to speak Swedish to each others and were out of focus on what the group was discussing. These small talks and a cell phone ringing disturb the team’s commitment.

One team member suggests that they should try to activate themselves by standing up, after a while everyone's participation is higher and almost the entire team contributes. Thus, this suggestion had a positive affect on the commitment in the team. Some ask questions, which result in that other
writes their ideas down on the paper, also the body language and gesturing increase. Not everyone explain their contributions to the group immediately instead they just write it on the paper.

When participants start to clean up the white-board all other return to their original place round the table, and one of the team members takes a more central role as an informal facilitator. They go round the table and let everyone tell their thoughts and the informal facilitator asks questions and encourages the members, they start to list ideas on the white-board, during this comprehensive activity, some participators start to small talk and intention in the session fades out. How the group members act on the initiative to facilitate the session differs, in my view this seems to depend on the trust for that person. A positive effect was that his commitment rub off to those who was not active in the meeting, therefore the outcome was good.

### 4.1.3 Analysis and categorization

The representation of the case could be categorized as a work meeting. The participants have not established a common ground of the task and struggles with problems that come from a hesitance for how to collaborate. The meeting was creative and aimed to create new ideas round the subject. Because of the problems in explaining ideas verbally, the team developed their way to explain an idea with help of body language and sketches instead. Presentations of ideas gain the creativity and the open atmosphere, it also give the team members new ideas of proposals.

By observing the meeting in this case it is plausible to think that work meeting perform better with support of a facilitator, because the team’s hesitance for how to work would have been avoided. A negative aspect with having a group member as facilitator is that he gives influences from his point of view, because of that it is better to have an independent person as facilitator. For instance an independent person, which has skills rather in collaboration than the specific subject. The meeting was the first physical meeting, therefore the undeveloped personal relations in the group affected how they interacted. A support to better understand each others perspective and to agree on a common process could have helped the team to better understand the problem. The student that took a role as an informal facilitator contributes to a better collaboration between the whole team. It could have been good to point out him as a facilitator before the meeting though not everyone in the team looks confident with all his questions. In this case the confusion of languages was also a big issue to struggle with, though not everyone was confident in talking English.

### 4.2 Case II – Technical discussion, distributed phone meeting

In this case I have observed a technical discussion with in global company in the machine industry with help of video-records. The meeting involves two technical project leaders, one available in Sweden and one in Asia. This is a recurrent meeting that they have once in two weeks to discuss technologies and concepts in two parallel projects that the company runs one in Asia and the other in Sweden.
4.2.1 Account of the meeting

The meeting starts with an introduction so the observer (my supervisor) in this case more easily could understand the relations and the role of the two participators in the meeting. And let him introduce himself for the man in Asia. Subsequently, feedbacks from the last meeting to see how the work is completed were made.

The participators in the meeting communicate through phone with help of Office LiveMeeting to share documents. The meeting has an informal agenda though they have a presentation with action points to complete. During the meeting they discuss technical concept solutions, but they have problem with the access to the server were some constructional drawing are placed. They solve the problems temporary through mailing documents, and decided to use the project portal at the company in the future. A short summary of the meeting ends the session then one of them has to rush to another meeting. Duration for the meeting was just over one hour. Recording the meeting were used for enabling later analyzes of the data. They used the loudspeaker in the mobile, thus it was doable to catch up what happened in the meeting.

4.2.2 Interpretations of the meeting

The Swedish technical project leader act as he runs the meeting. He introduces the observer to the other participant in Asia. Also he explained briefly what they were doing in the project. In my view, the technical project leader has an inviting manner when he talks. It can be argued that he loses focus on what is happening on the computer screen when he turns to the phone when he speaks. Thereby, the malfunctional technologies could be seen as a disturbing factor in this meeting. The interaction in this meeting was not so good i.e. it is more a one-way communication. A ‘face-to-phone’ meeting with lack in letting everyone tell his or her things in a natural way.

They also describe other persons’ opinion with; “according to…” often these opinions should not be spread outside the meeting, because they are not official. They have an open and straight discussion; they have a certain degree of trust for each other.

4.2.3 Analysis and categorization

This case is a description of a private meeting, but it was plausible planned as a work meeting and change between the formal discussion and personal reflections. The participants involve comments and opinions about others that are not official and by that not quotable in other situations. It is not a creative meeting more a review meeting. Weaknesses or obstacles they have to deal with is how to share information in an efficient way, communicate through a mobile phone in this way tends to distract the attention from looking at the screen where the shared documents are shown. The technical problems affected the performance in the meetings and since they do not used the same solutions to store data files they have not seen all ideas and concepts that the other team has developed. Some misunderstanding and double work might have been able to avoid with better
communication between these persons in terms of explaining their tasks and problem in the project. They do not share notes in the screen, instead one of them take notes and send them out afterwards. In addition, some delay while participant calls from Asia results in lack in the communication and the session are not running so smoothly all the time. The call turns out as a one-way communication sometimes because of that.

This meeting could have been planned more clearly and prepared by all participators to become a more efficient meeting. It was not apparent how the Asian participant reacted on what was said. To check up understanding for the subject is even more important in distributed meetings. The constraints of not using body language, take away one dimension of communication.

4.3 Case III - Technical patent review, face-to-face meeting

A technical patent review with discussions in a co-located meeting between a mechanical project leader and a technical licensing manager has been observed in this case. This takes place at the same company as Case II, the meeting lasted for about one hour.

4.3.1 Account of the meeting

The participators were standing in front of a table, each one of them with a laptop placed on the table. One of them explained patents and what he sees at the screen; together they tried to draw some conclusions out of that discussion. They use body language and pointed on the screen to express themselves in a comprehensible way. The first step in the meeting was to get a shared understanding of what they were searching for. With help of figures in the patents and explaining an idea with sketches they built an understanding of how an ‘interesting’ concept looks like. The licensing manager listens to the technical project leader and took notes.

Afterwards the manager shows a database and explained how to use it, and discussed what they should search for. This resulted in new questions; they used their gathered experiences and searched for help from others when they did not have the appropriate knowledge at the time.

Together the participants searched the database, marked the patents that were interesting and discussed what to search for in different aspects. The meeting resulted in new suggestion for how to proceed and was also a preparation for later meetings with experts. The meeting ends up with a summary and more informal ‘off-the-record’ discussion about issues and people involved in the project, the format of the meeting changes then to a private meeting.

4.3.2 Interpretations of the meeting

The participators have different competences and areas of knowledge. That appears very obvious during the discussions, the mechanical project leader told what he sees and also searches for and then the technical licensing manager could help him to find the right documents. They discussed what they want to achieve with the project, the body language and engagement increased.
The manager found the ‘right’ documents but that was not actually what he thought the project leader was interested in. The problem with this was that the project leader could not explain the underlying causes why he wanted a special document, but when they have the shared understanding for what they want to achieve they worked more as a team, thinking together and helped each other. It was a breakthrough in their way of communicating, they complemented each other’s weakness and found different advantages with the documents. This understanding has been more time consuming and hard to achieve without the visual communication. The importance of discussing and reflecting during the work was found as key point to the progress. This kind of work is difficult to do in other types of meeting-formats or working on your own, because the instant feedback on an idea is important for the progress.

4.3.3 Analysis and categorization

This meeting will mainly be categorized as a private meeting. It was interesting how they interacted during the discussion, as one of the participators told afterwards; “There are things which are not in my domain… I could help him see the bigger picture”. They used all facilities they have access to; computer, databases, paper and pen, body language and they tried to communicate their ideas about the project in a comprehensive way. The manager that was involved also has the instinctive feeling of how to trigger and feed the discussion with new insights, ‘right’ questions and reflections about the work’s progression.

Communication in a global company could be hard to establish synchronous, because of different time zones, which reduce the possibility to get answers on every question directly as in this meeting. Still it looks like they have a large network of experts on the company that they have access to in case of any specific questions, but they was not a natural part of this meeting.

After the meeting the manager got some questions from the observer about how he experienced the collaboration. He explained it as an informal meeting, that were done ‘off-the-record’ but not hidden in a closed room; “This could not be done in basement or cellar, internally rather than transparently”.

The manager also mentioned the importance in having physical meeting, the relation with those you are working with are improved more efficient than if you just have distributed meetings. A conclusion from this case is that the diverse competences contributed positively to the outcome of the meeting, due to the development of a shared understanding. The database that was discussed worked as a mediating object for this understanding.

In meetings with diversity in competences it is hard to plan the agenda, because they needed the time for discussing ideas and ambiguities, therefore this meeting was less efficient in terms of tangible results then a meeting between participators within the same knowledge domain.
4.4 Case IV - Division meeting, distributed meeting

The division is spread over the world so they have participants from three countries, one in Asia and two in Europe. They have a monthly recurrent meeting. This time about ten participants from Sweden took part. The exact number of participants from the other countries cannot be accounted for. The time for the meeting was about one and a half hour. In the beginning of the meeting there were technical problems, they lasted for about 20 minutes. This affected how the meeting was performed. The head of the division leads the meeting with help from different presenters.

4.4.1 Account of the meeting

They have time-consuming problems with the phone-connection in the meeting; instead the Swedish participators used a chat-application to inform the others about what is happening. The meeting was delayed by approximately 20 minutes because of these technical problems.

The head of the division starts the meeting with an 'energizer'-video clip from one of the competitors, which relieve the atmosphere. Then the agenda was presented, and a member of the division in Asia started to present his work with new templates, why they should use it and the advantages. The audience looses their focus and commitment after the first presentation, so the presenters ask if they still listened, because he does not get any feedback at all. The presentation is more or less a monolog with only a few questions in the end.

A new presentation starts by another team member in Asia. She uses the mouse pointer to explain what she talks about, and by that showed what to focus on in her presentation. This was also a presentation with low interaction and more or less a monolog.

At last a man in the room presented his work still sitting in the chair, everyone looks on the screen, even if the presenter is in the room. The head of the division have some comments on the work and after that the presenter gets questions from others in the team but only from those that are co-located in the room.

The technical problem continues during the meeting, and the group in Sweden loses their connection for a while. Then a discussion starts with three active participants, the others just listen and not contribute at all. Therefore one proposes that the presenter should meet everyone in smaller group and collect their opinions and then prepare material to gather for a work meeting. Because of the technical problem the meeting has been delayed and therefore it ends up in a very short summary by the head of the division.
4.4.2 Interpretations of the meeting

This is a recurrent meeting and the feeling is that they do not give high priority to it, which also affected the engagement during the meeting.

During the presentations the Swedish team members chat with each other and that disturbs the presenters, and in my view this shows disrespect. The audience looses their focus and the presenters ask if they still listen. The presentation is more or less a monolog with only a few questions in the end. This could be as a consequence that they do not feel the interaction between the presenters and themselves. They just see a presentation on the screen; the second presenter used the mouse pointer to point at important things and asked for feedback, which gives more active and symmetric communication.

They could not see each other and by that not use body language to communicate, pictures in the presentation were useful to visualize an idea and it also catches the audience attention. A presentation with just a monolog contributes to a reduced feeling of participation in the meeting.

During the last presentation the interaction increased at the location in Sweden, a dialogue between the presenter and a some of the other in the room started, most likely because they have a face-to-face conversation and felt more comfortable with that, and also that it is a person they have a closer relation to the presenter. How he presented his work was more informal, with open questions and reflections of what needed to be fixed and he asked for help. The previous presentations were more formal, and the Asians do not reveal if there was anything they have not had time to do, or if they wanted any help to complete the task.

Directly after they hang up the phone a more informal discussion starts in the room, it felt as a more relaxed group and the talk were more based on their personal relations. The participants at the Swedish location have personal relations and also get feedback in terms of how the others react on a statement.

4.4.3 Analysis and categorization

This was a typical announcement meeting and also a distributed meeting. The presentations during the meeting are of informative nature. It became an even more asymmetric meeting when it is distributed and therefore everyone could not see the presenters and indicate that they have something to share with the others. Though they work at the same division, not all information is of interest or relevant for everyone in the team. That kind of information could be excluded from this meeting, and just be exposed for those who gain from it.
Not everyone in the team could attend and some came late into the meeting. Seemingly, the meeting was not highly prioritized and the commitment during the meeting was from time to time low. Since, several persons just listened to what was said in the meeting the communication was one-way and asymmetric as in an announcement meeting. Besides the technical problem the meeting could have been more focused on issues that gain the team and not just informative, more open discussions and dialog during the presentations.

### 4.5 Summary of observations, Case I-IV

Table 1 shows a summary of case the cases observed in the thesis. The type of meeting was defined with help of the categories work meeting, private meetings and Announcement meetings [8]. The private meeting has been changed into personal meetings since it has been noticed that the observed meetings did not fully agree with the interpretation of private meetings. Hence I will call the meetings that earlier in the theory was named private meeting for personal meetings. Private sounds to me as a meeting behind closed doors, and that is not particularly how I would like to categorize those meetings. Also, this was highlighted of the mechanical project leader in Case III. A personal meeting is foremost a small meeting that builds on relations and trust, personas that meet and have informal communications. A personal meeting is not necessarily a meeting with closed doors, but still not an official meeting that everyone could attend.

In the observations number of turn takings has been tracked at three different times in Case II – Case IV. Turn taking in this context is when the person who speaks during the meeting changes. The video clips that were used was 22 minutes, I decided to track the first 5 minutes in the first three clips from each of these meetings. In addition to turn taking I have tracked for how long the participants were passive in the meeting and by that get a better understanding how the activities vary in different meetings. It was more common that meetings with larger number of attendants were more formal and by that also had participators that were not active in the meeting.
• Case I - First co-located meeting
• Case II - Technical discussion, distributed phone meeting
• Case III - Technical patent review, face-to-face meeting
• Case IV - Division meeting

Table 1. Summary of case observations

<table>
<thead>
<tr>
<th>Case</th>
<th>Number of participators</th>
<th>Type of meeting</th>
<th>Turn taking</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>8</td>
<td>Work meeting</td>
<td>Not measured</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
<td>Personal meeting</td>
<td>25 turns, 12 turns, 26 turns</td>
</tr>
<tr>
<td>III</td>
<td>2</td>
<td>Personal meeting</td>
<td>12 turns, 31 turns, 21 turns</td>
</tr>
<tr>
<td>IV</td>
<td>15&lt;</td>
<td>Announcement meeting</td>
<td>28 turns, 0 turns, 23 turns</td>
</tr>
</tbody>
</table>

In addition to turn takes, the amount of times when participants were passive or not focused on the meeting has been investigated. This observation can only be performed on one side of a distributed meeting, and also being passive is hard to verify in meetings with many participants. I have studied the participants’ body language and noticed if they seem to be doing something else than meeting activities. Accordingly, in small meetings people were less passive, and during announcement meetings and in distributed meetings they seemed more passive.

As seen in Table 1 the number of turn takes is high in the beginning of the Announcement meeting. Those turns are related to technical problems with the meeting and opening discussions, and not an essential part of the division meeting.
In personal and work meetings the frequency of turn taking during my observations had a higher mean value, over 4 turns/minutes. In the announcement meetings the mean value of turn takes was about 3 turns/minutes, in the middle part of that meeting I could not count any turn takes in the whole section observed. Though a large gathering includes many participators and by that the first part of the division meeting had the highest number of turn takes in the beginning, according to rest of the meetings.

Figure 6 shows a 5 minute long part of a personal meeting and the turn taking for that meeting. It is a more symmetric graph than Figure 7, which shows the announcement meeting.

Figure 6. Turn takes - Personal meeting
In the announcement meeting (Figure 7) two of the participators was not committed at all during the presentations, they used their computers or phones. As seen in the figure underneath the turn takes were high in the beginning of this part, it is because a presentation just ended and therefore some discussion started. After that when a new presentation took place the communication decreased again.

Figure 7. Turn takes – Announcement meeting
5 Approach to enhance collaboration within the team

Based on observations and the theoretical framework, results concerning meeting arrangements, communications, categorizations of meetings and advices for how to encourage efficient meetings will be presented in this section.

5.1 Team collaboration

In my studies, I have observed teams with cultural and geographical differences and composition. When the team members meet at the first time they have not the personal relation and team trust, in such a case a facilitator has an important role. Individuals have diversity in knowledge for teamwork and understanding the task, thus the facilitator could guide the team in a common course [22]. A facilitator in a creative meeting has a role to encourage the team members to be committed and to explain the goal for the session. In a more formal meeting the facilitator could be the speaker or a person that organize the meetings. In one of the meetings observed in my work, it looks like they needed a facilitator, since some of the members were hazy of how they should act. A facilitator could have helped them in the right direction.

Interaction is one criterion for true collaboration, as noticed in the studies interaction is especially difficult in distributed phone meetings. Further, on distance it is not doable to have hallway meetings, thus the networking and developing informal relationships are commonly not supported in distributed meetings.

In comparison to Case IV, this was much, more formal in terms of how they collaborated. My experience from distributed meetings and especially when there are a large number of attendants, the collaboration and commitment in the team decreases if they are not able or allowed to contribute with results or opinion. In this case they just ‘collaborate’ in terms of that there were different speaker during the meetings and a short time for questions afterward.

Collaboration is much more than sharing and dissemination information [4]. Hot teams [16] and Tiger teams [18] are two ways of how collaborations would be explained when you talk about creative meetings. It is important to separate the preparations and execution for a creative meeting from a formal announcement meeting. The composition of the team; a mix between professionals with different skills are a good condition for a successful result in the meeting, but for that you need ‘true collaboration’ and not only sharing information.
5.1.1 Parameters for team collaboration

The following parameters are my suggestion of what you should pay attention to when working in teams. How well the team can communicate and manage these pin pointed items will increase the performance.

- **Individual competences** – What do you want you achieve and what do you need to reach that?

  In Team-based Innovation the diversity in competences is one important thing, it is not always good to set up a team within the division, e.g. if you all are engineers and you are supposed to do radical innovations, the diversity could encourage radical ideas. In other situations multidisciplinarity will not improve the result in a project, therefore the team formation should not be permanent through the whole project.

- **Team trust** – Will you trust everyone in the team? Are you working with a number of individuals or a team?

  In a team that have not built up the personal relation between the colleges, the collaboration could be obstructed though they do not feel confident in sharing ideas and things that they are not definitely sure that it is right. This will likely result in a situation where some good ideas not be brought up to discussion.

- **Rules** – Rules of thumb that the team can use as guidelines in situation when disagreement appears, or to show how to work in a meeting.

  ‘Rules of the game’ can be used in creative sessions, but also in other meetings it is good to have a standing of orders in a meeting, to get efficiency in meetings.

- **Facilitator** – Useful in creative sessions, preferably an independent person that helps the team to perform together.

  In some situations a facilitator could be used to keep the team on track and encourage them to see a problem with other eyes. The facilitator should help the team through the process, and contribute to a better collaboration in the group.

- **True collaboration** – Not only share information, ‘thinking together’ as a team are not so easy, but enhance the possibility to use the whole team’s knowledge base.

  Members with other competences then yours should be used as resources in the project, to explore new areas, not as a limitation of possibilities. Therefore true collaboration will gain a multidisciplinary team in develop new innovations.
5.2 Communication

In everyday language, communication is mainly perceived as expressing and listening to words. I will here emphasise different purposes with communication related to this study.

In this study, both distributed and co-located meetings were observed. At a first sight you can say that they communicate the same way; talking with each other, even though it is not face-to-face they could communicate by using the phone. The design observations have added more value to what to communicate and how to communicate.

One difference between a phone-meeting and physical meeting is how you use your body language, especially in creative meetings and symmetric meetings where you not only share information like it seems to be during announcement meetings. To communicate the ‘message’ over a phone is complicated when true collaboration is sought for.

In case I the main problem was just how to express themselves because the half team were not confident in using English while the other half had English as native language. They used the body language and sketches on papers to explain an idea, and it ends up in a common understanding.

In many projects it is not doable to always perform physical meetings. Video-conferencing systems are used to share screen views and information, but the interaction tends to decrease compared to co-located meetings. Distributed meetings appear as asymmetric meetings, that someone is performing a presentation and the others is watching and listening.

Case II and Case III could be compared in terms of participants and performance. The major difference is that Case II is a distributed meeting and Case III is a co-located meeting. There was not a distinguishable difference in turn taking, even though Case III has one more turn take then Case II, but that could not be counted as a significant difference.

Informal communications occurs mostly in co-located meeting [8]. It is hard to categorise what is informal communication and not in a meeting. The observations of Case II and Case III gain the understanding for how important it is to collaborate instead of share information.

In Case III they have a ‘moment of opening’ since they get the understanding for each other's knowledge and expectation of what to perform. That situation was clear when they became more engaged and really tried to explain how the document could gain their work. The spirit in the meeting was more relaxed and playful, and they really helped each other to develop the thoughts on how to continue. This can indicate that it is easier to establish ‘true collaboration’ in co-located meetings because of the possibility to communicate informal and also have the personal relations, the interaction occurs more naturally in such meetings [9].
Comparing Case II and Case III with the announcement meeting in Case IV, a major difference in how they communicated was observed. In Case II and III the turn taking was fluid, but in the second period of the announcement meeting no turn taking at all could be observed.

5.2.1 Parameters for communication

- **Global vs. Co-located** – Be aware of the different possibilities to communicate. Is it appropriate to have a creative session as distributed meeting? Could an announcement meeting be more suitable and timesaving to arrange as a distributed and formal meeting?

  It could in some situations be very expensive to run a meeting Co-located, and also time-consuming. Information meetings that are not aiming for true collaboration could be considered to be performed as a distributed meeting. In other meetings where relations and trust are found as important, the result will most likely be better if you run it co-located, as in a creative session.

- **Relations vs. Hierarchy** – How do you communicate? As a formal person in line with your role in the meeting, or as a friend? Be sensitive in what role you are taking part of the meeting.

  If there are any hesitations in if you talking as a manager or as a friend in a meeting the other participators may not share their thoughts, because of insecurity how that will be accepted by the team and you as a manager. In a private meeting you attend with a personal relation and will therefore get a more honest discussion, so be aware of what you communicate in what situation.

- **Formal vs. Informal** – Choose what you communicate in a meeting. Do you have the permission to share all you know, and consider what is relevant for the auditorium.

  A balance between formal meetings and informal discussions with your co-workers will gain the collaboration in the team and will by that also be more efficient. The informal communication could contribute to better relations in a team, in the long run it will enhance the team trust as well, so the nonsense talk are not a waste of time on the contrary it is productive as it builds long term trust.

- **Understanding** – With understanding comes trust and that encourages a comfortable atmosphere, which contribute to more fluid communication. It is not necessarily a shared understanding that is the desirable situation, understanding the differences in opinions, makes it easier to communicate and collaborate.

  If the whole team share the understanding and not reflect on other solutions ‘group think’ can occur. In that case, everyone just agrees on a suggestion and the diversity in the team will not be an advantage in how the team perform. So understanding is not the same as agreement. But it encourages the possibility to have a good collaboration.
Information – The information flow and what to communicate during a meeting is important to understand, because if the participants get irrelevant information their commitment will diminish.

Especially in larger meetings with the aim to inform colleagues, is it possible that they get much more information than necessary. That will not gain how the participators prioritize these kinds of meetings in the future in addition it is also time-consuming to be participate in meetings. Use the intranet, mail or other ways of communicate information that is not useful for everyone in the division, and therefore should not be brought up in a large group. Some information needs to be discussed in a meeting and will not get the same response if you just can read it on the intranet, so be aware of how to communicate an important message.

5.3 Type of meetings

In order to gain a deeper understanding of how to support meetings, this section will demonstrate in a visual way how to categorize meetings. This is based on the theoretical framework and especially how meetings have been identified and grouped in the book Balancing Innovation and Control [8].

5.3.1 Personal meetings

Case II and Case III in the design observation are both personal meetings. The difference is that Case II is distributed and Case III is a face-to-face meeting. The distributed meetings tend to be more formal in language, most likely because of the personal relation is less developed and the fact that they have to rely more on the verbal communication and therefore have to be perceivable. As mentioned before the number of ‘turn takes’ have been measured, the result shows that it is not a significant difference between these meeting. Though the co-located meeting have a higher total number of ‘turn takes’ during the three time intervals that were measured. This indicates that a personal relation and talk to a person face-to-face in general contributes to more intensive communication. It is plausible that you have a more open and informal communication with direct feedback in terms of how the other person reacts on what you tell during a co-located meeting.

5.3.1.1 Characteristics for personal meetings

- Symmetric communication – High number of ‘turn takes’
- Informal communication – Based on relations, with ‘off-the-record’ discussions
- Small groups – ‘one-on-one’ conversations or just a handful participants
5.3.2 Work meetings

Creative sessions are typical work meetings. But also some decision meetings could be categorized as work meetings. Creative meetings tend to be more like personal meetings, unofficial and build on personal relations. In comparison decision meetings will be like announcement meetings more formal, but still they are symmetric and can be classified as work meetings. In Case I they have their first work meeting and creative session, because of the diversity in expectation, skills and no personal relations developed the meeting has not the symmetric communication that is typical for a work meeting, but the ‘turn taking’ increased over time.

5.3.2.1 Characteristics for work meetings

- *Symmetric communication* – High degree of active attendants and ‘turn takes’
- *Formal communication* – Formal language, official meeting
- *Larger groups* – 5-15 participants, creative sessions and project meetings will be categorized as work meeting

5.3.3 Announcement meetings

In Case IV a typical announcement meeting is observed, a larger group that gather to share information about what happens at a department or in the project. These meetings are the most formal meetings and mainly one person speaks at the time. The main part of the participants attends the meeting as an audience, thus has no intention to be active in the meeting. An announcement meeting most likely starts with a presentation from the person that has summoned the meeting or by specially invited speakers, this is usually followed by a short discussion.

5.3.3.1 Characteristics for announcement meetings

- *Larger gathering* – Many attendants, but low rate of active participators
- *Asymmetric communication* – One-way communication, not all attendants will speak
- *Formal communication* – Formal language and hierarchal. No nonsense talk and focus on official information from the company’s point of view
- *Official announced meeting* – Planned meeting, in terms of agenda, scheduled time and often a formal invitation
5.3.4 Hallway meetings

Meetings that would be categorized as hallway meetings are e.g. spontaneous meetings next to the coffee-machine, outside a conference room or when you come across a co-worker in the hallway and start to talk to each other. It is hard to capture a hallway meeting and in this thesis work no hallway meetings have been observed or analyzed, other than those I personally have been a part of. According to the theory, and my own experiences, hallway meetings are informal and in some way also asymmetric. They can be seen as asymmetric since few people speak but several other are listening to the conversation. The number of attendants are less than in an announcement meeting but most likely larger than in a personal meeting. These meetings come into existence because of personal relations [8].

5.3.4.1 Characteristics for hallway meetings

- **Asymmetric communication** – The initiator of the meeting communicates with the participators and other will join the discussion or just listen, therefore it is not a symmetric meeting in terms of turn taking. Attendants are taking part of the meeting with no commitment or contribution.

- **Informal communication** – Talking about everything, not always related to work. But also problem solving or discussions about any issues that will be on the agenda in other meetings.

- **Unofficial meeting** – A meeting that could take place in any time and place, very spontaneous

- **Undefined group** – The number of attendants and their hierarchical position differs and could not been categorized, though this meetings tend to span over all groups of employees at a company

5.3.5 Categorization of meetings

Figure 8 shows a visualization of meetings that have been placed into the 2 by 2 matrix (Figure 9), that is a generalization of how teams communicate in meetings, the y-axis represents symmetric vs. asymmetric communication. Symmetric communication is defined as dialogues and, in the observed meetings, the number of 'turn takes' have been counted, i.e. when the person who speaks changes to another. A high 'turn taking'-value is not necessarily a number of successful collaboration, but it indicates that the team members are engaged, that have to be seen as positive [9]. The numbers of participants that take part in the discussions have not been taken into considerations.

X-axis stands for formal vs. informal communication and collaboration in meetings. As stated in the theory collaboration is not only sharing and disseminating information [4], the communication that appears in what here is classified as hallway-meetings and personal-meetings could be positioned as informal. The formal communication implicates an official meeting that the attendants have been
invited to, where there are a clear agenda, a formal language and the person responsible for the meeting speaks first [8]. Formal communication is more related to decision making ‘what we do’ rather than a dialogue about ‘how we do it’. The latter is more supported of an informal communication. It is important that the team members understand the difference so that they could join a meeting with the same expectation.

Figure 8. Visual picture of typical meetings within different areas
During a work meeting you want everyone to collaborate and contribute, therefore a high value of turn takes is preferable, but will not automatically enhance the collaboration, though the commitment during the meeting will increase.

The matrix in Figure 9 shows four general types of meetings and how they can be placed in order to understand what differs in terms of informal vs. formal communication. In addition, also how the conversation and interaction looks like in a meeting is visualised in Figure 9.
It is good to have the understanding of how these differences affect the group. For instance regarding the commitment during a meeting, e.g. in a formal meeting with asymmetric communication. The facilitator should know that the interaction would not be significant for the meeting and the person who speaks are doing it in their formal role. If you want to have an open and creative meeting, the collaboration has to increase, a symmetric conversation can help to enhance that.

Not only can the matrix in Figure 9 help explaining the observed meetings in this study, it can also be used to set up project meetings. Using the matrix to make clear what will be expected from the participants can support them in preparing for the meeting.

The matrix in Figure 9 is suggested to serve as a basis for discussions about how the team perceived the meeting. Was it the right format? And, the matrix could serve as a support for facilitator to explain what is expected when performing the meeting. The matrix could be used as a basis of discussion how the team experience a meeting, if it was the right format to do the work in, or as help for a facilitator how to explain what he or she expect with a session.
6 Conclusions

The purpose of my studies has been to investigate how to enable communication in multidisciplinary teams.

I have observed and presented four cases of team work. Each of the cases contributes to answering the research questions that have guided this work. I have stated two research questions:

Q1: How to support multidisciplinarity in development teams.

I have found that:

- Meetings are use in an arbitrary way. An intentional approach to design the meetings to fit the goal and contents can enhance the effectiveness.
- The commonly used tools for distributed meetings do not purposely support true collaboration.

Q2: How can communication and collaboration be encouraged within a team?

I have found that:

- Informal communication and ‘nonsense’ talk when done in an appropriate meeting format contribute to collaboration.
- Mutual trust and shared (or agreement on a contrasted) understanding contributes to team collaboration.

In this study, I have also made the categories of meeting visible, and my suggestion of different use of the 2 by 2 matrix can contribute to more effective meetings.
7 Future work

My work with the thesis has gained me a better insight of how meetings are used; in addition it creates new questions that I want to continue working with and investigate more in detail. One part of the work has been design observations, as a part of research project at the division (FPD). As a future step I want to look more into tools and methods that could improve collaboration within Team-Based Innovation.

• How do we reduce the start-up time in a project?

I would like to see how new teams running start-up meetings in comparison with a team that are used to work together in projects. Is there any typical criterions that differs and how does it affect the performance?

• How could the effect of an informal communication be obtained in other formats?

Informal communication seems to enhance team trust and collaboration. So how could that be implemented or encouraged in other situations, or are there other ways to achieve the same effect?

• How could the approach and commitment to formal meetings be enhanced?

I experience that participants attends meetings without any expectations or aim to contribute. If that is the case in other meetings than those I have observed, there are plausible that the commitment could be encouraged in some way.

• How could facilitators be integrated as a natural role in innovation projects?

In creative meetings the facilitator often has a clear role to guide the team through the process or meeting, I want to study how a facilitator role can become a natural part of projects.

• How does the environment affect creativity in collaborative meetings?

It is not only that you have to be creative and use tools and methods to create new radical ideas. How the environmental is designed will also have affect on your performance. Influences from the surroundings are an important element.

In addition to those issues, I want to observe hallway meetings and developed my mapping of meetings on a more detailed level.
References