EXPLORING A DECISION-MAKING FORUM IN EARLY PRODUCT DEVELOPMENT

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ABSTRACT

Decision-making in early phases of product development is of great importance due to the large impact these decisions have on the subsequent project, whilst at the same time being heavily characterized by uncertainty. This paper explores decision-making in early phases of product development, and reports empirical findings from a case study conducted in an automotive firm. The case study investigated a project meeting officially responsible for deciding the technical content of the product. It was found that defining working assumptions and asking questions were used as means to reduce uncertainty in the decision-making process, where three genres of questions were identified: elucidating, self-enlightening and argumentative. Further, a number of challenges in managing the decision-making process were identified, specifically for such agenda-based meetings as the ones investigated. These meetings were found to rely on instant interactions between the participants. For example, project management instantly has to judge whether to widen or limit the problem discussed, or whether to continue probing a problem or stop the discussion in order to protect the total meeting agenda.

Keywords: decision-making, concept development, case study, meeting, project

1   INTRODUCTION

Early phases of product development are given great importance as determine whether product development projects will be successful or not, since decisions made in the concept development are allocating the main part of product and life cycle cost [1]. Making "wrong" concept decisions can have severe consequences such as launching "wrong" products on the market, which customers are not interested in buying (e.g. [2]). If "wrong" decisions are discovered already during the product development project, rework can be initiated before the product is launched, requiring resources that could have been spent on developing new innovative products instead [3].

Early phases of product development encompass several activities with the purpose of defining the development project and technical content of the product to be developed. Characteristic for decision-making in early phases of product development is a lack of available and verified data regarding solutions on conceptual level. Thus, concept decisions are made using qualitative information, judgments and incomplete evaluations [4][5], and informal factors, such as knowledge of the concept presented [6], may influence concept decisions. Due to these challenges, supporting methods in product development and engineering design research have not been found to assist these early phases sufficiently and the area needs further research.

Therefore, this paper focuses on decision-making in early product development phases regarding technical solutions, and describes empirical findings from an explorative case study studying a project-level decision-making forum responsible for defining the product's technical content.

Following this introductory text, previous research on decision-making in product development is presented in Section 2, and the research approach used is described in Section 3. In Section 4 the empirical findings from the case study are presented. The findings are discussed in Section 5, and finally the paper is concluded and suggestions for further research are provided in Section 6.

2 THEORETICAL FRAMEWORK

The product development process is in some views treated as a rationalistic flow of activities, inhabited by rational decision-makers. By definition, rational decision-makers possess knowledge regarding all alternatives and their consequences, and act according to a consistent order of preference [7]. However, reviewing descriptive literature on decision-making in product development, one can

conclude that there is a gap between normative decision-making methodologies often suggested to support and steer decision-making in a rationalistic way, and descriptive research findings reported in empirical studies of product development practice [8][9][10]. Why rational decision-making is not a sufficient approach for complex problems, and therefore does not meet the needs of decision-making in product development to a full extent, is because *"it assumes intellectual capacities and sources of information that men simply do not possess"* according to Lindblom [11, p.80].

2.1 Decision-making in organizations

March [7] stated that organizations are open systems, including many actors and related decisions, and that classical normative decision theories underestimate the interactive conflicts, confusions and complexity in actual decision making that appear in organizations. In complex situations such as industrial practice, there are different stakeholders, both inside and outside the development projects, who act as decision-makers and thereby influence the decision-making process and its results [12]. Several things go on in parallel within an organization, perhaps affecting each other, which means that decisions may be coupled but not necessarily coordinated [7].

Decision-making in organizations are seldom neutral event; instead they are influenced by both political and social aspects, in which different preferences and definitions of social reality play a role [10][13][14]. Such aspects influence decision-makers in what consequences they are expecting, and which alternatives they will consider [15]. Due to complexity, product development work has to be divided between experts within different areas, and consequently structural problems of managing part-whole relationships arise [16]. Further, the work is not supposed to have a large number of contradictory goals, or participants who play games in the decision-making process [17][18].

Badke-Scahub and Frankenberger [19] found that successful design decisions in organizations are based on a thorough solution analysis with experts from different departments, where the successful analysis is heavily influenced by information that is available through communication. Further, they state that the experts have to communicate in depth to match and co-ordinate different requirements. Face-to-face is found to be the richest medium and such meetings are considered to support mutual understanding and agreement, and thereby have an ability to overcome differences allowing immediate feedback, through communication channels such as body language and tone of voice, using a natural language expressing the message content [20].

2.2 Decisions growing out of a process

Previous research on decision making in early phases of product development illustrates that it is even challenging to capture where, and how, decisions are actually made (e.g.[17][21][22]). For example, Bragd [21, p.85] stated based on observation studies in an automotive project: *"I cannot say when or how it happened even though I was there. Suddenly, everyone in the project team was aware of the chosen direction".* In several studies it has been observed that decisions seem to be determined in a process rather than at a specific moment in time [12][23][24], including a variety of iterations and non-linear elements [10][25]. Bragd [21] observed that the organization she studied more or less relied on *"directions"*, *"recommendations"*, or *"tracks"*, which organized and structured relevant matters, and Jönsson [17] concluded that decisions in early phases of product development are preliminary, being of a "what-if" type. Further, Jönsson uses a "tent" metaphor: decisions seem to serve as "tent pegs" in setting up the total result (i.e. a tent). Contradictions occur and the "tent pegs" are adjusted in order to get an acceptable overall result. Within engineering design research the use of *tentative decisions* (where criteria and information available in each tentative decision situation are used) [12], and *implicit decisions* (by actions as well as inactions, i.e. by doing nothing) [26], has been identified.

Wickelgren [23] found in his studies of a project management team that "actual decisions" were a relatively small and formalized part of the process; instead he emphasized what happened *before* the decisions. He concluded that a main share of the process was not spent on making decisions, but rather on deliberations regarding issues concerning the decisions to be made later; thus the management team members were acting more often as deliberation-makers than decision-makers [23].

An identified challenge is of creating forums that relate important details to the whole system and vice versa when the organizations consist of highly specialized labor [27], and the fact it is hard to fit such deliberation into tight meeting schedules since the few minutes allowed in the agenda do not provide a good basis for sense-making [17]. It has also been observed that interactions in the meetings, e.g. who was presenting the issue, affected judgment of the content, meaning that if the person was trusted in

the organization the possibility to obtain the required decision was higher [17]. Further, Bragd [21] observed that the project leader, instead of listening to every detail of what was presented, listened to the "rhythm of the project", meaning *how* project members presented different issues.

Deliberations can be seen as processes of interpretation and sense-making, addressing ambiguity and conflicting interpretations of organizational situations, and therefore adding value through reducing uncertainty and equivocality in such situations [27]. This applies easily to product development work due to the complexity and invisibility of the process, and since the work is performed inside people's heads [28]. Pava [29, p.59] defines deliberations as *"patterns of exchange and communication in which people engage with themselves or others to reduce equivocality of a problematic issue"* and covering all communication and reflection regarding a specific topic. This also includes value-adding interactions that occur outside the formal organizational structure and between meetings, which differs from a discrete decision or project milestone in that it encompasses informal human interactions and information related to a particular topic over time [30].

To describe the non-linear decision-making process, Lindblom [11] used the term 'muddling through', which meant successive limited comparisons and approximations to some desired objective, in which what is desired itself continues to change. To judge whether an outcome is satisfying, Lindblom stated that there often *are* no preferences and a "good" policy is when there is an agreement that it is a good policy. Christiansen and Varnes [18] conclude, based on their studies of project portfolio meetings, that decisions rather are constructs rather than calculative outcomes, meaning that it is more a matter of making appropriate decisions than of optimal or rational decision-making.

2.3 Research objective

Decision-making is considered to be a process of critical importance within product-developing companies, but available supporting methods defined in research are not meeting the need in practice. Based on the literature presented, it is stated that much time and effort in the decision-making process in product development consists of elements such as tentative and implicit decisions, as well as deliberations. It is also found to be preferable to communicate face-to-face, which is the richest medium, in situations characterized by uncertainty, and to have cross-functional participation in order to make successful decisions. Addressing this, actual industrial practice of decision-making will be explored in this paper, investigating a decision-making forum (i.e. face-to-face interaction), where participants from different parts of the organization are present (i.e. cross-functional participation). The research objective for this paper is therefore defined as 'to further explore actions of deliberations made during meetings in order to come to decisions on technical content in the product'. This in order to find how such elements in the deliberation and decision-making process can be improved, addressing a long-term purpose of improving decision-making in industrial practice.

3 CASE STUDY

In order to explore actions of deliberations, a case study approach was chosen since it is suitable for situations where variables are hard to separate from the context and situation present [31], and when to studying a particular phenomenon within its dynamic real-life context [32][33]. A case study involves investigations using multiple sources of evidence [31][33], and a qualitative approach is beneficial when the aim is to obtain an overview of and to explore a complex area [33]. In this case, observations were used as the main source of empirical data, complemented by interviewing and searching company-internal documentation. The selected case to study was the concept phase in a large product development project within a Swedish automotive firm, focusing on an official decision forum with cross-functional participation dealing with technical issues on a project level.

3.1 Observations

A benefit of making observations in on-going projects activities is that the observer can detect activities that would not be reported in post-action interviews and documents search [23]. The author's role as observer was known by the project management and several other participants, i.e. an observer-as-participant [34], although not by all people attending the meetings. Observations were made over a time period of 16 weeks, and the author sat in the back of the meeting room, approximately in the same place every time. The author took field notes, a method used in ethnography [35], but using a pre-defined template as a support to ensure that important issues were not forgotten. This template was developed in a pre-study conducted at the same company on another weekly forum prior to this study,

and contained headings like: facts (Date, Timing, Room and Language) as well as questions (Who? What? Support? Surprises? Citations?). The template also included a column for notes and reflections to be added after the meetings, and the notes were finally transcribed for the analysis.

The author also used the opportunity to gather contextual impressions, along with the observations from the meetings, such as by discussing with meeting participants before or after the meetings, often walking to the next appointment. The author was provided with a desk close to a number of key individuals in the project, which gave the opportunity to capture even more contextual information regarding the topics of the studied meetings. The author is employed in the studied company, which means that the author has access to company documentation such as minutes of meetings, but also to the general information distributed to all employees within the company during the study.

3.2 Triangulation using interview and document search

In order to triangulate, an interview was conducted with the Technical Coordinator (TC) of the project, using purposive sampling [35]. The TC is responsible for all planning and administration concerning the observed meetings. The interview was conducted in the end of the observation period and treated the purpose, structure and execution of the observed meetings. A semi-structured form was used, in order to modify the pre-determined questions during the interview, if that seemed to improve the quality of the interview [33]. The interview was digitally recorded and transcribed verbatim. The respondent has read and approved the transcription. Additionally, company-internal instructions, available on the intranet, and the official protocols from the observed meetings were collected.

3.3 Analysis of data and verification of results

The observations, interview and documents (instructions and meeting protocols) were analyzed in order to identify meaning [36], guided by the research objective. Themes emerged from the raw data and categories were identified through the author's interaction with the data [37]. Further, during the process, preliminary and final results have, at an aggregate level, been presented to and discussed with members of both project team and functional organization in the company.

4 EMPIRICAL FINDINGS

The presentation of empirical findings starts with how the project management has adapted company-internal instructions into their own project, i.e. how the project management planned it to be. Subsequently, observed execution in the project is described, i.e. what was found in the observations, interview and meeting protocols. For reasons of secrecy any technical details are distorted.

4.1 Planned approach of governance of the case project

The product development organization encompasses different functional engineering departments, and also the Vehicle Engineering department, which is responsible for leading concept development work (i.e. the Technical Concept Leader, TCL), and for integrating and balance the systems into a complete product (lead by the Vehicle Engineering Project Leader, VEPL).

The company's prescribed governance structure defines official decision forums, the meeting hierarchy, and what parts of the organization are to be represented in each forum. The project management of the case project adjusted the prescribed governance structure since they considered it not to fulfill their needs. The studied meeting, the Technical Review Meeting (TRM), is the highest ranked forum for technical issues within product development projects in the company, and has a purpose of defining (i.e. reviewing and approving) the technical content of the product, held on a weekly basis. The TRM requires a cross-functional representation from Vehicle Engineering, Product Planning, Engineering departments, Purchasing, Manufacturing, Quality, and Finance. The VEPL is chairperson of the TRM and the Technical Coordinator (TC) is secretary. The TCL is expected to be present, and in a specific time slot for issues affecting the total business project, the Business Project Leader is present.

A Lotus Notes® database is used for all administration of the meetings: plan agenda, file presentation material and document decisions. The TC sends out the agenda, planned together with TCL and VEPL, and each issue (item) is planned for 15 minutes (some more minutes if needed). Typical items deal with product attributes and solutions that span over several design teams, and balancing must be done e.g. when a design team needs extended financial frames for part price and tooling investments. Project planning, specific product design issues, and commercial issues are handled elsewhere.

Items should be well prepared and the presenter is responsible for consulting all affected parties, preparing all technical, timing and cost consequences for proposed solutions prior to the meeting; *"it is a decision meeting, not a working meeting for in-depth discussions"*, the TC states. The mandate of the meeting is, according to the TC, that people should be able to act directly after the meeting, needing no further confirmation in other forums, and therefore writing clear protocols becomes very important.

4.2 Execution as observed in the case project

All observed TRMs were held in the same room (on the same weekday). The room is equipped with a projector and screen, and has no windows; and the door is in the back end of the room (see Figure 1). There is a large conference table in the middle with 18 chairs around it and approximately five extra chairs in the end of the room (of which one was used by the observer).
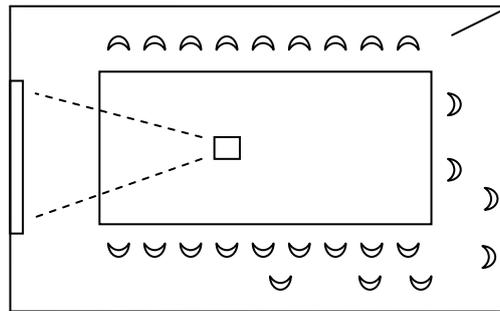
Figure 1. Layout of meeting room

The meeting started in the morning, and ended depending on how many items there were to handle. Sometimes items were added to be dealt with in the evening. Given that the meeting is agenda-based and that each item is 15 minutes there are many issues handled in every meeting.

Key people were TCL, VPL, and TC. These people were usually sitting almost in the front because they were key people but also probably for practical reasons. They are present during the whole meeting while other participants come and go more frequently. People presenting the different items often arrive just in time to present their item and then leave immediately after the presentations, which almost results in playing "musical chairs" between the items.

From the observations a typical item can be described as follows (see Table 1 for an overview). The responsible presenter arrives at the meeting a minute or two before the item should start according to the agenda. Sometimes the agenda is late, whit the results that people attending the ongoing item, as well as the people arriving to listen to the next item, are present in the room at the same time. The person responsible for the item presents it and is often backed up by a number of colleagues. Besides required cross-functional representation (listening the whole day), there are also other interested parties, from other departments, who come to listen to the specific item.

Table 1. A typical item in a Technical Review Meeting

Who is present?	Presenter, mandatory (TCL, VEPL, and cross-functional representation), TC secretary, colleagues of presenter, and other interested parties.
What is presented?	Using a PowerPoint®, filed in the data base prior to the meeting. Material most often in English (a mixture of English/Swedish is frequently used).
How is it presented?	Presenter heads straight to the problem (only in exceptional cases do they start by stating their name, due to time restrictions or since they are already known. After a short presentation of problem and status, a lot of questions are asked and answered. Answers are given "off-hand", with no time spent on searching for information in documents/systems (exception: the Program Prerequisites was consulted a number of times – in a binder lying on the table). Questions covered several angles, but two questions frequently asked were: (1) Consequences for product platform, i.e. commonality with the other products? (2) How do competitors solve it? Verbal communication in Swedish, protocols in English.
Output from meeting?	A selected system solution, agreed requirements or most often a "working assumption", i.e. a main track to focus further work. For example, which one of two conflicting parts should be adjusted to the other: *"solution X decided as main track"*.

The TCL and VEPL make concluding comments now and then, to scope the problem or summarize the status. The author experienced that they sometimes were asking straight out in the room, almost as if they were thinking out loud. The TC also concludes, in another way, through reading out loud what was to be written in the official protocol. Sometimes the protocol was shown on the screen but mostly the screen showed the presentation material. Often the TC had to remind the participants that the available agenda-time for the issue was running out.

It occurred several times that people referred to other forums, such as top management, design, platform meetings, functional departments, or more informal meetings conducted in the office in the evening. It was found that an issue often has a life in its own: it has a prehistory (e.g. from official decision meetings, or separate task force meetings initiated for this specific issue), and sometimes it is expected to have a history after it was brought up at the TRM.

The author experienced the atmosphere in the meeting as mainly positive and constructive, and for many project members this is the only time they meet the project management face-to-face. On a number of occasions, the TCL praised the presenter for a job well-done (no explicit comments to the contrary were observed). Any open conflicts were not detected, even if there were situations where people were talking past each other pushing their own interests. Additionally, a representative from an engineering department commented to the author after a finished item that *"The work has been done in collaboration, but someone from Vehicle Engineering should present the recommendation since that is more neutral than if someone from our department presents."*

A great deal of the observed time was spent on questions from the "audience" to the presenter, and three genres of questions were identified:

- Elucidating questions/comments: to reinforce what the presenter has presented – to widen and strengthen the *other* participants' knowledge of the problem/area/solution. These questions were asked by someone who also has detailed knowledge – often a colleague or perhaps someone from another department working in the same task force. These questions, which could also be comments, came from both peer's management.
- Self-enlightening questions: people who ask the question do so in order to enhance their *own* understanding of the problem/area/solution. These questions were often posed by managerial people.
- Argumentative questions/comments: to falsify or diminish what was presented, i.e. critical questions in order to reveal weaknesses. These questions were mainly posed by peers, often when consequences of presented solutions would not benefit the person who asked the question.

Challenges identified: balancing a complete product and managing the process

A car is a complex product encompassing several systems and functions that have myriads of internal relationships. For instance roof height and curvature have consequences for body strength, which has consequences for geometrical packaging of electrical devices in the roof area, which has consequences for roof height and so on. These relationships, and consequences of them, were frequently discussed in the light of the proposed changes. Such balancing requires a deep knowledge of the product and all relationships within it, especially in the meetings where it was required that participants answered directly. Different opinions regarding who should change their part were often observed. For example, Person A: *"The part X (used in different projects) has one specific bracket – the surface where the bracket should be mounted should be adjusted within each project to fit the common bracket on part X."* versus Person B: *"No, I think it should be the other way around. The bracket should be different in each project to take up the difference – so that the mounting surface can be common for all projects."*

Besides balancing the technical content, challenges in managing the process were observed. Key people such as the TCL and VEPL have to act instantly in many situations (frequently observed):

- What issues to focus on? According to the TC the TCL based this very much on his experience. *"He knows what issue has to be focused on and what issues that could be less focused on for the time being – it is never black or white."*
- Determine whether the problem can be solved solely within the technical project or whether it affects the total business project: *"If the item is affecting the overall business project – that is hard to tell."*
- Judge whether it is a large problem (where large leaps are needed) or if it can be solved with "tuning" the present solution. Technical competence is needed in order to know any limitations, but also a process knowledge is required in order to understand when it is necessary to start over.

- Widen or narrow the discussion? Sometimes the discussion had to be widened to cover crucial connections to other problems, and sometimes it had to be narrowed down, demarcating the problem, in order to take essential steps forward.
- Keep on probing an issue or stop the discussion in order to not delay all the other items (that also require attention) on the agenda until late. For instance, the TC wanted to stop discussing an item but the VEPL commented that *"to get this decision is more important than timing right now"*.
- As TCL, having the power and mandate, to open up previously non-negotiable decisions when a situation seems impossible to solve.
- Instant judgment of the quality of the message delivered: *"if the person feels confident and not using the words 'think', 'maybe', etc…"* according to the TC.

Overall process, and major events occurring during the observed period

An item on the agenda can attract many people and sometimes it is hard to fit all the people who want to listen into the meeting room. In some cases people had to stand up along the wall, somewhat cramped. However, both the TCL and TC emphasized in discussions with the author that they did not want too many people in the meeting, since they experienced that the quality of the meeting decreased when too many people were present in the meeting room. Still, it is a personal responsibility to decide what items to participate in, consulting the agenda available in the database. For example, prior to a TRM the author observed a team in an engineering department discussing who should cover what items during the meeting. Consequently, the number of people participating in the meetings is a factor that seems to be beyond the control of any specific person.

During the period of the case study, there were some (planned) events that were found to guide the discussions, working assumptions and decisions. There was a Management Review (MR), which has the purpose *"to get management buy-in"* according to internal company material, and during the period before this MR there were often comments like: *"what should be reported in the MR?"* Another such event that did force a number of working assumptions to be defined was the release for a Virtual Serie (VS). That means a release of virtual models of the product in order to perform an extensive amount of calculations. The VS is a way to test the car in the virtual world using computer-based analysis tools and computations. Events of this kind were therefore observed to have a converging effect, because they were omnipresent in the discussions preceding the main event.

5 DISCUSSION

Deliberations cover the total process of value-adding communications, both in and between meetings, aiming to reduce the equivocality of a problematic issue [29][30]. This study focused on providing insights regarding a specific type of interface in the deliberation process, namely what happens in an official decision forum. The contribution of this paper is an exploration of the content of the deliberation process in a decision-making forum in early product development, but it also includes identification of a number of challenges in management of the decision-making process.

Previous research has stated that decisions evolve in a process that includes a variety of iterations and non-linear elements [10][11][25] (identified as implicit, tentative, and what-if decisions [12][17][26]), which can be confirmed in this empirical study. On several occasions, 'working assumptions' were defined, meaning main tracks that should be focused upon in further work. This was found to move the decision-making process forward. Due to product complexity, defined working assumptions may cause several implicit consequences, perhaps not always understood by the decision-makers.

Other elements in the deliberation process, driving the process, were questions frequently asked in the TRMs. Three different genres of questions were identified: elucidating, self-enlightening and argumentative questions, which were found to be posed by people in different roles. Especially people in managerial roles asked the enlightening questions, and to the author it seemed that they where the only ones allowed to ask "stupid" questions.

The forum chosen for study was agenda-based, meaning that each item has a time slot assigned. This was found to have some implications for the decision-making process. Even though project management meetings have been subject to extensive research studies, the author believes that consequences of using agenda-based meetings have not been discussed to the extent corresponding to the actual usage of this type of meetings. An agenda-based meeting is actually a series of short, separate but connected meetings, which consequently is a process that seems to be hard to overview for the participants, except for individuals participating the whole day. This type of meeting places

prerequisites on the facilities, such as having a meeting room that enables people to move in and out frequently without disturbing the meeting, but also on the participants. The process was found to be influenced by a number of personal dependent factors, related to different competences required of the actors present in the meetings, since each item has a short time slot during which information should be presented, understood, and decided on (see Table 2).

Table 2. Consequences of using agenda-based meeting

	Consequences and reflections
Who presents the item	Require solid knowledge regarding technical area presented, since the deliberation process is based on the presenter answering immediately. When making the observations the author often reflected on where all the knowledge flowing through the meeting actually was created, since there was only limited time for people to interact face-to-face in the meetings.
Who is present during the assigned time slot	It is a personal responsibility to decide what items to participate in (the TRM agenda is available in the database). Therefore, who is participating during a time slot is hard to steer and control: a key person could be missing or the room may be too crowded. Who is participating governs which questions are asked. For further work it would be interesting to investigate how the different types of questions contribute to, and enhance, the deliberation process.
How the process is managed	The process puts high demands on the project management that has to handle the process. For example, product complexity causes a challenge in demarcating the problem to discuss and solve, related to managing part/whole relationships [16]. People seemed to possess sufficient knowledge regarding the myriads of relationships between their own solutions, other solutions and different product attributes, but the challenges were how to limit the problem discussed, since a problem was often integrated with several other problems. Comments like *"we* cannot *discuss issue A without considering issue B"* were observed, but also the complete opposite *"I just want to discuss X, we have to ignore the issues with Y in this discussion"*. Another challenge was whether to keep probing an issue, in order not to delay the overall meeting agenda.

Bragd [21] stated that she did not register any decisions, but the author observed several actions in this case study that contributed to the technical content's being decided, in line with the purpose of the observed meeting. Hence, it seems to be a matter of what one includes in the expression 'a decision' which has implications for research on decision-making; e.g. the demarcation of what phenomenon to study, and the definition used for 'a decision' has to be clarified.

Due to the nature of a single case study, possibilities to make general conclusions are limited, giving way to the advantage of going in-depth [38]. However, findings presented in this study contribute to enhancing the understanding of decision-making in industrial practice, and the author would like to stress the benefit of being able to follow a meeting closely, experiencing it as the artery in an industrial project, and thereby to get critical insights that otherwise would not have been detected.

6 CONCLUSIONS

This study explored decision-making and deliberation activities made during a project's Technical Review Meeting (TRM), which is a project meeting (with cross-functional participation) defining the technical content of the product. As stated in previous research, decision-making consists of several non-linear elements, and in this study it was illustrated how defining 'working assumptions' in the meetings was used as a means to reduce uncertainty and move the decision-making process forward. These working assumptions, inherently preliminary, meaning that they are valid until it is found that new working assumptions need to be identified, confirm that the "tent peg" metaphor identified by Jönsson [17] was valid also for the observed case project, since it is most likely that some tent pegs have to be adjusted along the way in the project so as to define a balanced product content.

Based on the observations of the deliberation process it was concluded that much time was spent on asking questions to the presenter, and three genres of questions were identified:

- Elucidating questions: to reinforce what is presented, and to widen *other* participants' knowledge of the problem/area/solution (from anyone, often a colleague or an ally).

- Self-enlightening questions: to enhance his or her *own* understanding of the problem/area/ solution (from managerial people).
- Argumentative questions: to falsify or diminish what is presented (from peers, often opponents).

The observed decision forum was an agenda-based meeting and it was found that using such a design of meeting has implications for the decision-making process, since such meetings rely on present participants instantly interacting during assigned time slots – which means that the knowledge used in the meetings is the knowledge that the participants have 'by heart'. Further, the project management faces several challenges of managing the decision-making and deliberation process in such meetings. They are expected to act instantly on judging the quality of the material presented, but also judging how to demarcate the problem to discuss in order to take the next step (since real problems never have clear limits). Another challenge that project management constantly face is to judge whether to continue a fruitful probing of an issue in order to finally solve the problem, or to stop the discussion and move to the next item on the agenda so as not postpone the rest of the meeting.

The author concludes that to increase the possibility of successful decision-making in early stages of product development, great technical competence is needed by those present as well as an ability of the project management to handle the process of agenda-based meetings. Finally, the author would argue that organizations ought to reflect on the consequences of employing such a design of important decision forums, and would suggest further in-depth studies addressing actual improvements of the process, exploring how to support project management in managing the deliberation process.

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