Standardized communication- a way to shorten cycle time?

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ABSTRACT
When suppliers are involved in new product development (NPD) projects communication can be of crucial importance for the project success. Also the standardization of processes can lead to an increase in efficiency and, therefore, shorten the overall project time. Shorter cycle times of NPD projects are becoming increasingly important, due to shrinking life-cycles of products. Consequently, a qualitative research was conducted. Six project managers have been interviewed regarding the influence of standardized communication on the cycle times of one specific project. The results show that there is a pattern between the companies' level of standardization and their own opinion concerning the importance of standardization. When the communication process was described as standardized an influence on the time reduction was reported. Especially, the standardization of 'who is talking to whom' within the NPD team was indicated as important factor, which increases the efficiency of the communication process and can have a positive influence on the reduction of cycle times.

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1. INTRODUCTION

Successful new product development (NPD) is of high importance to many firms, especially because products are becoming more complex (Johnson, 2009), the product life cycles are shrinking (Guveritz 1983; Rosenau 1988), competition has increased and products are faster classified as obsolete (Hayes, Wheelwright, and Clark 1988; Womak, Jones, and Roos 1990). Therefore, not just to bring products to market as initially planned, but also to introduce products to the market in a shorter timeframe is of high importance to many companies (Carlson 1994; Vesey 1992). In order to gain competitive advantage under these market conditions, successful NPD can be a key driver in the nowadays marketplace. It cannot only lead to a strong competitive advantage but have a high impact on the entire company performance (Loch, Stein, & Terwiesch 1996).

Therefore, innovation processes become more networked and often include a high number of external units (Utterback et al., 2006). Companies develop channels through which knowledge is shared and combined in order to increase their access to resources and, therefore, competitiveness (Chesbrough, 2003). In many cases, the external partners involved are suppliers in order to make use of their specific product/process capabilities and expertise during the NPD process (Johnson, 2009). However, NPD is still described as one of the 'riskiest endeavors of the modern corporation' (Cooper, Edgett, & Kleinschmidt, 2004, pp. 31). A high amount of novelty products, which have been introduced to the market, were unsuccessful. Cooper et al. (2004) stated that around forty percent of new product development projects are not able to achieve initially stated objectives. Taking this into account, companies have a need to continuously improve their NPD processes as well as the cooperation with external partners. Literature shows, that if companies make use of supplier involvement in their NPD process, communication between buyer and supplier can represent a key driver to overcome barriers to successful NDP. Gulati et al. (2000) stated, that intensive communication supports the coordination of all tasks involved in the NPD process and therefore helps to prevent misaligned activities, which are main problems for companies to overcome in order to create a successful NPD cooperation. Thomas (2013) describes NPD as a concept including external parties as an 'activity based on the exchange of knowledge' and therefore inter-organizational communication as essential. Additionally, process standardization is often described as important in regards to process performance (Lee and Kim 1997; Manrodt and Vitasek 2004). Jang and Lee (1998) define standardization 'as the degree to which work rules, policies, and operating procedures are formalized and followed'. Ramakumar and Cooper (2004) stated that business process standardization can lead to a higher profitability and Swaminathan (2001) describes standardization as beneficial for business processes. Therefore, the increasing complexity of processes and products and the involvement of independent parties within specification, design and implementation of products, calls for more formal specifications and improved integration methods. Yet, despite the importance of both areas – communication within NPD projects described by Yan and Dooley (2013) and Thomas (2013) as well as standardization of processes explained by Münstermann and Weitzel (2008) and Wüllenweber et al. (2008) - neither the communication nor standardization literature has offered a conclusive picture of the value of standardization of the communication during the integration of supplier in the NPD process. Since, due to the stated literature, the standardization of processes can lead to more efficiency and reduction in time required for tasks, this research wants to investigate whether the standardization of the communication process can lead to a reduction in time required of an NPD project. In this paper, the overall research question is thus:

> *How does the standardization of communication between a buyer and supplier effect the overall cycle time of an NPD process?*

The overall cycle time is, as mentioned before, a crucial variable in regards to the competitiveness of companies. The advantages of a well working communication and standardization can lead to the hypothesis that the standardization of communication can positively influence the overall cycle time. The independent variable therefore is the standardization of communication between a buyer and a supplier within an NPD project. The dependent variable is represented by the overall cycle time of an NPD project.

The outcome of the case study can aid organizations in the way of understanding the influence and possible advantages of standardized communication; thereby being able to lead to an understanding of possible ways to increase their competiveness in the market by reducing cycle times and introducing new products faster to the market.

The further content of this article is organized as follows. The next section reviews the literature on standardized processes, the communication between buyer and supplier and the importance of cycle time. The literature review is followed by a description of the research design with a short introduction of firms and projects involved. The next section reviews the outcome of five case studies and presents the results with regards to the context of the conceptual framework. The explanation of the limitations of this research and the implications of this cross case study as well as possible future research implications based on the findings will form the concluding end of this article.

2. LITERATURE REVIEW

2.1 Standardization

Jang and Lee (1998) define standardization 'as the degree to which work rules, policies, and operating procedures are formalized and followed'. De Vries (1999) describes four determinants by which standardization could be defined. Those are namely: 'The entities standardization is concerned with, the sectors in which standardization is applied, the purpose(s) of standardization and the way people/parties are involved in standardization.' Furthermore, the standardization of processes mostly implies that these processes are coordinated and followed by pre-determined rules and regulations (Münstermann and Weitzel, 2008). The international organization for standardization defines a standard as a 'document established by consensus that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context' (ISO,1996). Moreover, literature shows multiple possible benefits of business process standardization. Manrodt and Vitasek (2004), for example, conducted a case study to present the benefits of process standardization and prove that those not only affect the firm, but also its customers, in a positive way. Wüllenweber et al. (2008) prove that business process standardization is an important supporting factor for business process outsourcing. Münstermann and Weitzel (2008) summarize the advantages of process standardization. The value drivers and its advantages listed in this article are the following:

'The value driver: improved process performance is described as a factor to reduce end to end time, reduce process costs, improved process quality and increased performance measurability. The second value driver: enhanced readiness is

identified as a driver which supports the outsourcing of business processes, the merge and overtaking of other companies, the ability to react to market, external change and trends by increased process flexibility. The third value driver: enhanced ability to react to regulatory changes describes, that the more processes are standardized, the lower the probability for process driven mistakes will be. Consequently the overall quality and thereby customer confidence improves' (Münstermann and Weitzel 2008, p. 6).
However, standardization also has diasadvantages next to the multiple advantages described above. Griffin (1997) stated that companies with successful NPD processes do not always use formal processes. It is further argued, that formal processes might not be necessary in order to perform successful NPD, but instead only provide advantages for some specific kind of projects. In more detail this means that using formal processes throughout NPD for complex products will reduce the cycle time more than in less complex projects.

2.2 Communication

In the following the influence of the communication between a buyer and an integrated supplier will be discussed. The communication within a team can be defined as 'social interaction through messages' (Kalla, 2005, p. 303) and by the exchange of knowledge (Thomas, 2013).
Thomas (2013) emphasizes on the increasing importance of knowledge exchange between a buyer and a supplier. Furthermore, it is mentioned that every NPD team needs effective communication between members. It is argued that one of the most difficult barriers within successful supplier integration in NPD is represented by finding an effective way to communicate. Additionally, these hurdles are harder to overcome when involving suppliers, because the teams often show organizational and functional differences (Littler et al., 1995; McIvor & Humphreys, 2004). Thomas (2013) argues further that, 'NPD is an activity based on the exchange of knowledge'. The knowledge exchange is described as the expertise which has the function to complete and expand the capabilities of the buying firm. Therefore, Thomas (2013) points out that the inter-organizational communication is essential for successful NPD.
NPD literature has proven a positive link between sharing knowledge and innovative performance (Allen, 1997). It is described that, if suppliers are willing to share their complete knowledge about technologies it could lead to reduced cycle time, reduced costs and improved product quality (Ragatz et al., 2002). Moreover, it is stated that the access to knowledge and information is an important determinant regarding success in R&D with external partners. It reduces the uncertainty of the supplier as well as the buyer (Un et al., 2010). Knowledge exchange is therefore expected to be positively related to NPD performance.
Furthermore, it is found that the asymmetry of information in a buyer-supplier relationship makes it mostly hard to determine uncooperative behavior (LaBahn and Krapfel, 2000; Petersen et al., 2003). Yan and Dooley (2013) investigated that effective communication can support companies to detect these problems. In more detail this means that, communication helps to correct potential uncooperative behavior by improving buyer-supplier relationship and information exchange (Nunlee, 2005; Van de Ven et al., 1976).
Further, intensive communication also enables firms to encourage cooperativeness by frequently communicating with the external party, creating suitable incentive mechanisms and decreasing concerns which are formed as a consequence of miscommunication or lack of communication (Yan and Dooley, 2013). Therefore, Yan and Dooley (2013) conclude that communication can support integration and cooperativeness in NPD projects with an external party.
Moreover, Yan and Dooley (2013) analyze the relationship between communication and the uncertainty level within NPD projects. They conclude that 'interdependency among activities are more likely to be identified in a timely manner to enhance coordination, while conflicting motivations could be effectively aligned to encourage cooperation' (Yan and Dooley 2013, p.526)

2.3 Cycle time

The dependent variable in this research is the cycle time of the NPD project in which a supplier is involved. Cycle time can be defined as the total duration of a project and is of high importance to most companies, since the life cycles of products are shrinking (Guveritz 1983; Rosenau 1988). Furthermore, products are faster obsolete to customer than in the past and the competition within many industries has increased (Hayes, Wheelwright, and Clark 1988; Womak, Jones, and Roos 1990). In order to stay competitive under the listed circumstances firm's objective from introducing products to the market has shifted towards bringing more products to the market in a shorter timeframe (Carlson 1994; Vesey 1992). Griffin (1997) stated that, due to this reason a high number of companies announced to have shortened their NPD cycles drastically. The implementation of cross-functional teams as well as external parties in NPD processes is often described as an effective way to reduce cycle times (Gupta and Wilemon I990). Cycle time can therefore be described as an essential factor for competitiveness.
This research focuses on finding out whether the possible advantages of process standardization - more efficiency and reduction of time required - can be applied on the communication process within NPD teams in order to reduce the cycle time of a project. This, as mentioned above, can help companies to gain competitive advantage.

3. RESEARCH DESIGN AND METHOD

In order to answer the above mentioned research question an empirical and qualitative research will be performed, which includes the conduction of six interviews. The interviews have been conducted with medium and large sized manufacturing companies, namely: AkzoNobel, Apollo Vredestein B.V., Sensata Technologies, Siemens AG and Bronkhorst High-Tech B.V. The interviews took place in the German and the Dutch locations of the named companies. These companies are primarily chosen for this research, because they use supplier involvement within NPD projects.

Apollo Vredestein B.V. is part of Apollo Tires Ltd India since 2009 and is a global company with offices and production locations in multiple countries; mainly in India, South Africa and the Netherlands. The core business of the company is to develop and produce car tires for agricultural and industrial applications as well as bicycle tires.

The Siemens AG is a global organization, active in electrification, automation and digitalization businesses. They are known for energy-efficient manufacturing, resource-saving technologies and as a supplier for medical diagnosis. The company operates in around 200 countries and has around 343,000 employees. The head office is located in Germany.

Sensata Technologies, an American supplier of sensors and controls, was found in 1916 and has an office located in the Netherlands. Their manufactured sensors and controls are used in automotive, appliance, aircraft, industrial, military, heavy vehicle, heating, air conditioning, data, telecommunications, recreational vehicle and marine applications.

AkzoNobel is a leading global paints and coatings company and a major producer of specialty chemicals. The headquarter is located in Amsterdam, the Netherlands. AkzoNobel operates within over 80 different countries all over the world, thereby employing 50,000 people.

Bronkhorst High-Tech B.V. is located in the Netherlands and leading manufacturer of advanced mass flow and pressure measurement as well as control solutions. The company includes around 400 employees working in 70 countries all over the world.

These firms invest high amounts of money and time in R&D departments in order to stay competitive. They also make use of the involvement of global suppliers in NPD teams in order to improve the NPD performance. Therefore, communication between the international team members is required, which provides suitable characteristics for this research.

3.1 Overall Design

This research can be described as a cross-case study which is based on the conduction of in depth interviews with project managers of the above mentioned companies. Cross-case studies enable the researcher to collect more in depth information about one specific topic. Furthermore, it provides more capability for in depth explanations (Gable, 1994).

The interviewees are managers of NPD projects involving suppliers, because they are intensively involved in these projects and, therefore, can provide in depth information. Furthermore, they mostly work close together with suppliers on a daily basis due to the responsibility for a successful NPD project. Project managers, hence, often have access to the information required for this research. The interviews consist of eight open questions regarding the independent and its dependent variable as well as their relation: The independent variable is the standardization of communication between a buyer and supplier within an NPD project. The dependent variable is the overall cycle time of an NPD project.
Open questions have been chosen in order to create space for personal assessments of the individual project managers as well as to collect further valuable information. The first four questions refer to the independent variable, the standardization of communication. This research focuses solely on the communication between the firms which are interviewed and their supplier involved within the NPD projects. The standardization of processes is defined as discussed above. However, standardization of communication is not defined by literature in respect to the communication within NPD teams. Consequently, this research defines the standardization of communication within the NPD teams by four determinants. As investigated earlier, the communication of NPD teams is based on knowledge exchange between the team members (Thomas, 2013). The first determinant, therefore, is the context of the knowledge communicated. The second aspect determining the standardization of communication is represented by the platform/channel used in order to exchange the knowledge. Another factor having an influence is the frequency in which the knowledge is exchanged and the last determinant focuses on actors being involved and exchanging the knowledge. The standardization of processes implies that the process is followed by pre-determined rules and regulations (ISO, 1996). Therefore, when the four determinants underlie rules and regulations and are performed in repeating and equal terms, then the communication in NPD teams can be expected to be standardized. Consequently, the standardization of communication within the NPD team is defined by the pre-determination of:

- Actors involved in the communication ("who is talking to whom?")
- Channel/platform of communication
- Frequency of communication
- Context of communication

In order to gather information about these four determinants, the following four questions are asked during the interviews:

1. **How often do you communicate with your supplier and is this frequency standardized?**
   - Is the schedule predetermined?
2. **How do you communicate with your supplier and was the channel or platform used standardized for the project?**
   - Which channel/platform is used?
   - Are the channels/platforms predetermined?
3. **Were standardized rules or formats used during the project in regards to the context of communication?**
   - Determination of context?
4. **Was it pre-determined which employee is communicating to the supplier?**
   - Determination of "who is talking to whom" /direction of information exchange?

These questions are asked in order to determine whether the communication was rather standardized or not during the specific projects. The answers will be analysed in respect to the definition of standardization by the four determinants.
The next question aims on investigating to which extent the overall communication was standardized during this project in the interviewee's own opinion.

5. **To which extent would you describe your communication as standardized in regards to this specific project?**

The interviewee was asked to indicate the level of standardization on a scale from one to ten; one describing a low level of standardization during the project and ten a high level of standardization**.** For simplicity reasons, and because a precisely measurable level of standardization of communication is not given by previous literature, an indication between zero and five suggests a rather low level of communication a classification between five and ten suggests a rather high level of standardized communication.
Another question refers to the dependent variable, namely the cycle time of the entire NPD project, which is also a subject of this study in the interviewed firm. In order to understand how cycles times are measured for the different NPD projects, and if there are differences in regards to the standardization of communication, the following question is asked during the interviews:

6. **What was the initially planned cycle time of this project and did you stick to this time schedule?**

The following two questions consider the relationship between both variables and the individual experience of the interviewee. The last question, again, leaves room for additional valuable information which might not be covered by previous questions.

7. **Was there a difference within the cycle time which was caused by standardized communication in respect to this specific project?**
8. **Does the standardization of communication processes generally influence the cycle time of a project?**
    - Comparison between different projects and personal opinion.

The interviews will be conducted following the same procedure. They will be hold face-to-face with each project manager individually. Furthermore, each interviewee will be asked the questions described above within a time span of 30-60 minutes. These interviews were hold in order to gather information, which can answer the research question of this qualitative case-study.
The findings and results of the interviews conducted will be presented in the analysis section, whereby each case is described individually. Furthermore, in order to find out if there is a relationship between the standardization of communication and the cycle time, not only each case will be analysed, but also, a cross-case comparison will be conducted.

3.2 Case-Study Selection, Sample, and Unit of Analysis

The unit of analyses is the investigated project within the above described companies. Since it is a cross-case study, one project in each company was chosen, except for Apollo, which was interviewed regarding two NPD projects. In order to define the unit of analyses further the research focused on the entire project, meaning from the idea generation to the market launch. Additionally, each project concerned NPD and involved external suppliers. In order to gather information and required data the project managers, of the described unit of analysis, were asked the questions listed in the previous section.

The first interview was conducted with Sensata. The project manager stated that, the project was a challenge for the NPD team due to very high customer demands regarding the lead time, construction and costs of the product. The NPD team had only 20 weeks in order to produce a sample, which is ready for the production. In order to understand the dimension, he stated, that usually they have 35 weeks only for individual components of the end product. In order to meet the customer demands, Sensate made use of strategic supplier involvement. Therefore, they started by creating a drawing which included the main characteristics and specific customer needs and send it to a predetermined strategic supplier with whom they already had a close relationship in order to receive feedback and suggestions. Furthermore, Sensata only invested 1,5 working days on finding the right trade-offs between the reduction of lead time and the level of quality in order to produce the sample product within 20 weeks. The project manager stated that the focus was on: "finding a good solution really fast." Additionally, it can be said, that after receiving the first drawing, the supplier was heavily involved in the entire process and could add a high amount of value due to its expertise. A high number of changes were still made, due to new approaches of the supplier. The project manager stated that usually this amount of changes would take multiple weeks in order to discuss each factor. But due to the time pressure the processes of communication, information exchange and the internal decision making processes needed to be speed up. However, in order to meet customer demand in regards to quality and lead time a close partnership was necessary, which also includes trust in the relationship from both sides. Therefore, an "internal cultural shift" was required. In the previous NPD projects the team members of Sensata tried to keep most of the decision making power to themselves. They asked for the supplier's opinion and expertise, but did not give the supplier much power on decision making. Therefore, they had to learn to put more trust on the relationship with the supplier and to give up some control in order to reach the best possible outcome for the Sensata customer. In addition, the interviewee confirmed that this process of internal cultural shift and the close cooperation with the supplier required intense communication from both sides. Overall the project was described as a huge success, because all customer demands could be met due to a close cooperation.

The next interviews were conducted with Apollo. The first project included the development of car tyres with improved wet-breaking times. The interview was hold in Netherlands, but Apollo has as mentioned before, also a R&D centre in India. As most of the NPD projects, was also this one based on a close cooperation with supplier from India. The cycle time of the project is two years and is also based on heavy supplier integration. The project manager stated that the expertise of the supplier is of high importance due to their knowledge about specific materials, which is crucial for the wet-breaking performance. He mentioned further, that they also exchange confidential information regarding the test results of the tyres, with close strategic supplier, because the exchange of information can lead to a better quality performance of the end product.

The second interview was conducted with the manager of the testing department. The chosen project included the development of tests for new products, in order to enable the company to precisely measure the performance of new innovative products, with new features or to measure them in regards to new customer demands. Also during the project a supplier was involved heavily and from the beginning on. The cycle time of the project was one year. This supplier was not located in India, but in Germany, which is in comparison to India closer to the Dutch office. This allowed the interviewee to meet the supplier for frequent face-to-face meetings and supported a close personal relationship.

The fourth interview was conducted at AkzoNobel with the BU technology sourcing & innovation manager. The product developed during this project, is a new kind of paint. The cycle time of this project was seven years in total. The first five years were required in order to finish the necessary research and the additional two years for intensive product development. The supplier, which was heavily involved, enhanced the project by providing additional research facilities to manufacture the molecule and specific expertise.

The fifth interview was conducted with the Siemens AG. The interviewee´s position is project manager and senior procurement president responsible for electronic components. The project was about the development of the product PCB for industrial use. The project had duration between three and four month. Also within this NPD project a supplier was heavily involved. Furthermore, the company works with strict policies on how to select the right supplier. Also for this project the supplier was carefully chosen, in order to reach the pre-determined goals and satisfy the Siemen´s customer.

The sixth interview was conducted with the company Bronkhorst. The interviewee was Marcel Booiman. This project was about the development of a new instrument. Due to a discretion agreement the interviewee was not authorized to provide a more detailed description of the product. The cycle time was four years. The project required more time as initially planned, due to errors in the supplier integration and a lack of

communication between Bronkhorst´s customer, R&D department and supplier.

It can be stated that, in each of the projects, the exchange of knowledge between both parties, was of high importance.

In the analysis part all above named projects will be analyzed. Therefore each project individually will be assessed by describing the answers to the questions asked during the interviews. Subsequently patterns and differences between the interview outcomes will be presented. This will be followed by a discussion which will include possible interpretations of the findings. After that a conclusion based on the findings will be stated.

4. CASE ANALYSIS AND FINDINGS

In this section the answers of each individual interview will be described. The findings to each question asked during the interview will be stated. After the description of each interview, the findings will be summarized, compared and possible patterns analyzed.

4.1 Findings

4.1.1 Project one: Paul Pluter from Sensata

The interviewee was asked the questions described in the methodology section. The first four questions intend to collect information about the independent variable: Standardization of communication between Sensata and the supplier involved in the NPD project.

The first question asked was: 'How often do you communicate with your supplier and is this frequency standardized?' In respect to this question, the interviewee stated, that the frequency varied between the different stages. Sensata works with predefined stage gates, which means that communication is scheduled in regards to each stage. To pass through every stage gate Sensata and the supplier must have certain information available. However, the stage gates are not set in any particular timeline and, therefore, the frequency was not standardized during this project. Further, he explained that during this particular project, an intense communication was required due to time pressure from the customer's side. In respect to that, he stated that a standardization of communication frequencies would be difficult in this NPD project with intensive communication between both parties, since flexibility played an important role and often spontaneous meetings had to be scheduled.

Regarding the standardization of the platform or channel used for the communication, Mr. Pluta explained, that the NPD team used multiple, different communication platforms in order to exchange information. Namely: E-mail, telephone calls, teleconference and face-to-face meetings. However, they met as often as possible face-to-face in order to discuss the complex product characteristics and find new solution by combining their knowledge. Further, he described that it was not predetermined, which of those listed platforms to use. When the interviewee was asked to answer the third question with regards to a standardized form for the context which was communicated, he stated that Sensata uses stage gate reviews. These are reviews from both sides conducted by following specific rules. The project had to pass each stage gate, which was only possible when certain information about the project were available. This information was communicated in a standardized way. Sensata´s engineering and purchasing staff requested the data about status of the project, and the supplier had to respond and give specifications in a very standardized manner. However, the project manager additionally stated that during the project the context of the communication was only standardized in regards to those stage gates. Despite the stage gates, the NPD team did not always use a consistent format of documents and, therefore, had to deal with quotes created through different standards. He described, that this can be problematic when when dealing with legal pre-requirements. By not fulfilling legal aspects more time is necessary to change it to an appropriate format. Moreover, the analysis and evaluation of different formats was more time consuming, than delivered in an equal format. Mr. Pluta additionally mentioned that this was not only a problem in regards to this project, but also within other NPD projects, especially, when there is more than one supplier involved. Therefore, Sensata plans to increase the standardization of the documents used for the communication within NPD projects.

In respect to the fourth question, the project manager explained that the person, who is communicating with the supplier, was pre-determined and very standardized for the project. Sensata determines always a specific person, which collects all the information from both sides and exchanges them. Also, when face-to-face meetings or teleconferences take place the person must attend. This is a routine and standardized procedure, which was integrated in order to coordinate communication better and have an overview of the information exchanged. It is also important in regards to legal issues and helps to speed up the transfer of information.

The next question was as following: 'To which extent would you describe your communication as standardized in regards to this specific project?' He stated here, that the overall communication was very standardized. They always spoke to the same people and went through the same procedures, he stated. Additionally he mentioned, that this can be explained by the formal communication which was required because the of early supplier involvement. The interviewee was additionally asked to indicate the level of standardization on a scale from one to ten, where one is describes a low level of standardization during the project and ten indicates a high level of standardization. Paul Pluta emphasized, that the level of standardization during this project can be described as seven. In his opinion, however, there is room for improvement, i.e. by standardizing the documents used for exchanging information between the NPD projects. This leads to a more efficient way of communicating and, therefore, reduces the overall project time in order to meet the customers' demand of lower cycle times. However, the desirable completely standardized documents are not yet used by Sensata due to a lack of software and, thus, were only partly used in this project. Moreover, the interviewee also expressed criticism in respect to a completely standardized way of communication. He mentioned that the risk of overly standardized communication is that people stop questioning the validity of the information. In this NPD project there was a need for employees with the experience to digest information rather than staff, which only processes standardized formats and software.

Furthermore, he fears that it would reduce the creativity of the team members, because they would not try to find the best suitable way of communicating, but rely on the companies' rules and policies. Therefore, only the direction of information exchange and the context of information were standardized.

The next section reviews findings concerning the dependent variable - the cycle time of the VDA-Sensor project of Sensata.

It was mentioned that the duration of the entire project accounted only for twenty weeks, which is very short for this kind of project. The short cycle time was requested by Sensata´s customer. In the beginning the NPD team did not expect to fulfil the demanded cycle time. However, due to the expertise of the supplier and the fast accomplishment of tasks, the cycle time could be met. They measured the time schedule by the

stage gates the product passed. The project is completed, when the last gate is passed.
The seventh question was as following: 'Was there a difference within this cycle time, which was caused by standardized communication?' Paul Pluter answered, that he could not determine exactly whether the cycle time could be reduced from multiple months to only twenty weeks, due to partly standardized communication Nevertheless, he implied that the standardization of communication combined with other factors e.g. expertise of supplier had a positive influence on the cycle time. In this specific project it helped to exchange information faster, since the documents between the stage gates were standardized, as well as, the coordination of 'who is talking to whom'. This made it easier to coordinate the exchange of information and, therefore, speeded up the process.
To the last question asked concerning the general relationship between both variables, he answered: 'Surely, the standardization of processes, also communication processes, speeds up the entire project and therefore is one of the factors reducing cycle time.' Furthermore, it was explained that a standardized communication could lead to less misunderstandings between the team members due to clear task description. Also, earlier problem recognition will be supported by standardized formats, which also leads to less time spent on the project. However, the extent, to which the cycle time can be shortened, depends further on the project size, duration and objectives. Moreover, standardized communication does help to speed up projects, as it reduced the time one has to analyse data. However, standardized data can prove to be dangerous. Often, the data communicated by the suppliers may not seem to be what it is. Too much standardization can lead to possible complications due to the fact that the human factor of analysis would have been taken out. These complications could lead to an increase in cycle time.

4.1.2 Project two: Nico Gevers from Apollo

In respect to the standardization of the frequency from communication process of the NPD project, Mr. Gevers answered, that during this project Apollo and the supplier tried to communicate as much as possible. People from the R&D department in the Netherlands and India have been included in the team so that frequent information sharing was necessary. During this project the frequency was predetermined and a standardized procedure.
Regarding the second question it was stated that the use of a platform during this project differed from situation to situation and that there were no pre-determined rules to follow or platforms to use.
Further, a standardized context within the communication process of the NPD project was not used and no specific rules for the context of information exchange were present.
However, previous experiences have shown that, a standardized context/ format of the information exchanges is better and more efficient. Therefore, parts of the documents exchanged were very formal and standardized during the project, but not entirely. Furthermore it was indicted, that the communication between Apollo and its customers is very standardized and has led to a more efficient way of communicating.
Moreover, "who is talking to whom" was very pre-determined and standardized. Each member of the NPD project knew who had to talk and report to whom and which person of the supplying company was involved in which situation. This was standardized during the entire project.
The fifth question was: 'To which extent would you describe your communication as standardized in regards to this specific project?' Here interviewee was asked to indicate the level of standardization on a scale from one to ten. The interviewee stated, that on this scale he would describe the project as a seven. The overall communication was standardized but could be improved.
In respect, the cycle time of the NPD project, it was indicated, that the duration of the project was two years and the initial time schedule could be kept.
Furthermore, when he was asked about the influence of the standardization of communication in this project, he explained that the standardization had an influence, but no specific measurement could be presented. Further, it was explained, that the reason why they standardized the frequency of communicating during this project, and determined who is talking to whom. It made the process more efficient and helped to stick to their initial time schedule. Further, it was mentioned that through standardization Apollo knows, where the problem occurs due to faster available information. This was helping in this specific project, because Indian employees need a more specific task descriptions and uniformly information in order to avoid misunderstandings and complete tasks in time.
In last question, regarding the relationship of both variables, it was stated that cycle time can be reduced through standardization by making communication processes more efficient, supporting the coordination of tasks and information, and enabling the team members to detect problems faster. In addition, it was indicated that the life cycle of products became shorter and requirements are getting higher due to globalization. Hence, standardization becomes more important.

4.1.3 Project three: Maarten van der Poll from Apollo

Concering the frequency of communication between Apollo and the supplier involved in the NPD project, it was indicated that the frequency of communication for this project was not pre-determined or standardized. The NPD team members communicated with each other when there was a need to do so.
In regards to the determination of a specific platform or channel used during the project, it was illustrated that there were no rules to follow or pre-determined channels, which one had to use. However, it was further mentioned that the management did standardize the way of communication confidential data, which always needs to be exchanged in certain, pre-defined format and delivered either by e-mail or post.
Considering the use of standardized formats it was implied that standardized documents were used, especially in the beginning of the project. This helped to avoid legal issues. Another reason was that Apollo could only exchange information with the supplier about its customers when they are authorized to. However, it was stated that the rest of the information context communicated was not standardized and followed by pre-determined rules. Therefore, the context was described as rather partly standardized.
The direction of the information exchange was very standardized during the whole project. Each member knew exactly, whom to talk and report to. Furthermore, the interviewee was in charge of the coordination of communication between the NPD members and, therefore, collected data from both sides and spread it to the other members. He also attended each face-to-face meeting.
The next question was: 'To which extent would you describe your communication as standardized in regards to this specific project?' Additionally, Mr. van der Poll was asked to indicate the level of standardization on a scale from one to ten. The interviewee indicated the number seven. The score was explained by describing that not each part of the communication process is standardized by specific rules, but that mostly use of the same routine procedures was made. The reason for that is that it is "just the best and most efficient way to work".

Therefore, the communication process in this project can be described as mostly standardized.
In respect to the cycle time of the project, the information was given, that the cycle time was about one year. The expected cycle time could be reduced, due to supplier´s expertise and the quick exchange of important information.
The seventh question was: 'Was there a difference within this cycle time, which was caused by standardized communication?' It was indicated that there were definitely differences, which were caused by partly standardized communication during the project. But it was not possible to specifically state those. It was argued that when each NPD member knows what to do, how to do it and to whom to report the information, it leads to a better coordination and speeds up the process.
The answer to the last question, which concerns the general relationship between standardised communication in NPD projects and the cycle time of those was, that it mostly does so, as explained by the example of this specific project. Further, it was mentioned that the better the communication, the less delays you get. At first one gets a request, then some follow-up questions about testing were collected. And last those problems have to be solved by engineers. In case, all information are directly available no re-engineering is necessary and the trial can start earlier. Therefore, standardized formats can lead to more efficiency. It was further stated that the standardization of communication can reduce the cycle times of NPD processes by preventing mistakes, enabling companies to evaluate data faster, and using expertise of another company. It makes further planning easier and faster. Also, it helps to detect mistakes easier, which speeds up the process because the team is able to solve problems faster.

4.1.4 Project four: John Sinclair-Day from AkzoNobel

The first question in this interview, which intends to collect information regarding the standardization of communication, was answered as follows: 'The NPD team members, communicated monthly or weekly, depending on stage of this project. This frequency was however, not pre-determined.'
Moreover, respective the pre-determination of channel or platform used, it was stated, that information were mostly exchanged by sending e-mails or during face-to-face meetings. The platform. which they used was chosen due to preferences and was not predetermined or standardized.
The next question asked was: 'Were standardized rules or formats used during the project, in regards to the context of communication?' It was indicated that the exchange of information was mostly informal, but there was always a formal aspect. The supplier made the material but AkzoNobel wanted a design patent so there was an agreement to protect AkzoNobel´s rights. Therefore, the context was standardized due to the formality of the documents exchanged, but the context within the e-mails or teleconferences was not pre-determined.
Sinclair-Day mentioned further, that 'who was talking to whom' during this project, was very standardized. There was one person who was in charge for the exchange of all information and the coordination of the communication.
Regarding the extent, to which the communication was standardized the interviewee indicated a three on the scale and said the overall communication is rather not standardized.
To the sixth questions, with regards to the cycle time of the project, it was stated that the cycle time of this project was seven years. This is rather low, because comparable projects mostly take about ten years of time.
Concerning a difference in the cycle time due to standardized communication it was stated that there could not be reported any specific difference in the cycle time, which was caused by standardization of communication in this NPD project. However, it could have had a positive influence in combination with other variables.
Respectively the last question, which concerns the general relationship between both variables, it was indicated that standardization can support the reduction of cycle time. However, if standardization implies that the same processes can be used for every supplier, this might be challenging. Every supplier relationship differs and, therefore, it is important that the NPD team chooses careful on how to involve the supplier with regards to communication. Further, it can be very useful to standardize each project individually. It was advised, to agree on a specific process with a supplier regarding the communication in an early stage. Therefore, it is not very helpful to standardise the relationship, but to agree on a certain process with the supplier.

4.1.5 Project five: Frank Schoepke from Siemens

During this interview, the first question concerns the standardization of communication between Siemens and the supplier involved in the NPD project. It was indicated that it depends on the stage of the project. At the beginning of the project, before the offer was submitted, the level of communication was already very intense. Once the offer was accepted and the project organization was set up, the communication frequency was more or less daily. Therefore the frequency of the communication can be described as a routine process during this project. Nevertheless, it was not pre-determined by standards or rules.
Moreover, when asking about the pre-determination of the channel or platform used to communicate within the project, it was stated that it was depending on the context. Siemens does not have a predetermined platform, but the NPD team communicated the different matters on different platforms. If the information was more sensitive and Siemens wanted to keep it confidential they communicated via phone. If the information communicated had to be proven in the future, they made sure to communicate it in e-mail. Therefore, the channels are partly standardized.
In the third question regarding a standardized context it was mentioned that at the beginning of the project the communication was more formalized, because they needed to ensure the supplier gets full understanding of what they need. But, for the rest of the project there was no predetermined context for the communication.
In respect to the pre-determination of which employee is communicating to the supplier, the project manager stated, that procurement engineers, which acted as a link between the R&D department and the supplier, were the main communicator. These people were responsible for the coordination of the communication for the NPD project. Furthermore, strategic buyers negotiated the prices with the supplier. Therefore, 'who was talking whom' was standardized during this project.
The next and fifth question asked for the extent of standardized communication in this project. Here, the interviewee was asked to indicate the level of standardization on a scale from one to ten. He indicated that the level of standardization is a five on the scale.
The cycle time of this project was three to four month. Additionally, it was described that the product had to go through project gates. These gates are also used to measure the entire duration of each step. This product was finished within the planned time schedule.
Concerning the influence of standardization on cycle time it was explained that standardization in communication can speed up the cycle time. However, in this project the main aim was to

create a highly innovative product and not to develop the product as fast as possible.
The last question concerns the relationship between both variables. The answer included that the standardization can influence it, but not in the case when the project is about bringing new innovation to the market. Additional information was given that standardization in communication can be dangerous for innovation.

4.1.6 Project six: Marcel Booiman from Bronkhorst

In the last interview regarding the frequency it was stated that a daily exchange of information was required. Moreover, there was no close relationship between Bronkhorst and the supplier, which lead to a situation in which details about the project had to be discusses beforehand. However, there were no pre-determined rules to follow, in regards to the frequency.
Furthermore it was described that multiple different platforms and face-to-face meetings were used in order to communicate. However, which platform to use was not pre-determined.
Concerning standardized formats it was mentioned that it generally depends on the supplier, but there was only in fewer situations standardization for this project respecting the context.
Contrastingly, 'who is talking to whom' was pre-determined. It was specifically defined, which person in the department or project member talked to the supplier.
The next question was: 'To which extent would you describe your communication as standardized in regards to this specific project?' Here, the interviewee was asked to indicate the level of standardization on a scale from one to ten. The interviewee indicated the number five but gave no further explanation for this decision.
The next questions included the findings of the interview in regards, to the dependent variable, the cycle time of the NPD project. It was stated that the initial calculated time was about three years, which had to be extended to four years.
When asking for the interviewee's own opinion it was emphasized that there was no noticeable difference in the cycle time due to the standardization of communication in the project.
The general relationship of both variables showed that the reduction of the cycle time in an NPD project is not heavily influenced by the standardization of communication, but by the agreements that are made internally about processes.

4.2 Results

In this research some patterns can be found, which are described in this section. First, a cross-case comparison in regards to the independent variable (standardization of communication) will be presented; followed by the description of similarities and differences with regards to the second variable (differences in cycle time).
Table one (Appendix A) displays the similarities and differences between the six projects in respect to the four determinants, indicating whether the communication within the NPD project was standardized or not. Additionally, the table shows the numbers indicated by the interviewee with regards to the overall standardization of communication within the NPD project.

It can be observed that, none of the standardization processes standardized all four determinants. One project (Project2) pre-determined two out of the four determinants, which is the most in comparison to the other samples. The standardization can, therefore, be assumed to be rather low in each case. However, this does not hold true for project two, which shows the same amount of standardized determinants as non-standardized. Additionally, each project showed one or two partly standardized determinants of communication.

The first factor defining standardization of communication in this research is whether the frequency of communication between the buyer and supplier is pre-determined and followed by specific regulations. Each project, except for project two, did not use a pre-determined schedule for communication.
The second determinant is whether the platform or channel of communication was pre-determined in this project or not. Four out of six projects did not use pre-determined platforms to communicate with the supplier involved. The interviewees of project five and three stated that the platform used was partly determined mostly in respect to confidential data.
With regards to the third determinant, standardized contexts of information exchange was standardized in each project. However, each interviewee stated that this is not the always the case and, therefore, can be described as partly standardized. Furthermore, each interviewee explained the partly pre-determined context by describing that, when confidential data is involved, the context has to be exchanged following a pre-determined format. The rest of the data exchanged, however, did not need to be followed by pre-determined rules regarding the context.
The fourth factor (direction of information exchange) was pre-determined in each project of this research. Therefore, it can be observed that, there are similarities between the projects and the determinants.
The interviews showed that in all cases mostly the same determinants have been partly standardized or fully standardized, as for instance the direction of information exchange. Moreover, each interview defined the standardization of the direction of information exchange, in order to coordinate processes and information exchanged, as most important.
However, contrary to the similarities in regards to the four determinants, the projects show bigger variations when the interviewee had to indicate to which extent the communication was standardized. Three out of six interviewees stated a number between one and five (Project 4, 5 and 6) indicating a rather low standardization of communication. Three implied a number between five and ten (Project 1, 2 and 3) referring to a rather high standardization.
The cycle times of the six projects differ strongly from each other. This can be explained due to the different industries the NPD teams worked in and the different products which were developed during the projects. The cycle times can, therefore, not be compared. However, whether the NPD project was accomplished within the initially planned time can be compared. Here, it can be stated that, four out of the six projects could stick to the initially planned cycle time (Project1, 2, 4 and 5). Furthermore, one interviewee (Project3) reported a reduction in cycle time due to a fast accomplishment of tasks and fast exchange of valuable information. One project could not stick to the initially planned time and had to extend the cycle time by one year (Project6).
The cases show strong similarities in regards to standardized communication. There can be found a pattern between the number indicated by the interviewee and the influence of standardized communication on cycle time. When the communication process was described as rather standardized a positive influence on the time reduction was reported. Vice versa, when the standardization was indicated to be rather low none or only a not significant influence was reported.
The three interviewees, which indicted a number between one and five on the scale (Project 4,5 and 6), stated that the standardization of communication might have had a relatively low influence on cycle time or even none. Nevertheless, the influence could only be assessed individually by the interviewee's opinion and was not measured. They did not expect standardized communication to have a significant impact

on the cycle time. Furthermore, the project manager of project four mentioned that NPD projects are mostly about innovative products. It was also said that an innovative working behaviour and standardization of communication is difficult to combine. Moreover, the interviewee of project five stated, that each buyer-supplier relationship is different and therefore standardized communication is difficult to implement.
The project managers of the projects with a higher standardization, due to the number indicated, reported that the standardization of communication influences the cycle time in a positive way (reduction in time required). The second interview conducted at Apollo reported a reduction in cycle time, due to a standardized way of exchanging information. The interviewee mentioned here the importance of the two determinants "who is talking to whom" and the context which was communicated. Furthermore, project one and two reported a positive influence on cycle time in combination with other factors. Also here, the influence was explained due to the standardization of the direction and context of information exchange. However, no exact data or specific cycle time reduction could be described. It was mentioned that standardized communication was a supportive factor in order to stick to the initially planned cycle time, which was in both cases a relatively short cycle time in comparison to previous similar projects.

Additionally, there are also similarities for the general opinion about the standardization of communication and the reduction of cycle time. Three project managers (Project1, 2 and 3) stated that that the standardization of communication can lead to a reduction in cycle time by increasing the efficiency of the communication process. Furthermore, all interviewees stated that, when the direction of information exchange in a NPD project is pre-determined it leads to a better coordination and also reduces the required time. Moreover, cycle time can be reduced due to the faster and easier detection of problems and errors. Also, every interviewee described a better coordination of tasks and fewer misunderstandings when communication is standardized, thereby also reducing time required based on their previous experiences. Furthermore it was mentioned, by each of the three project managers, that when the context of communication is standardized it is easier for the NPD team to analyse data faster and to have a better overview of information exchange, which supports the reduction of cycle time.
Furthermore, there are similarities in the critics about the standardization. Two interviewees (Project 1 and 5) stated that, the standardization of communication can lead to a decrease in creativity and initiative of NPD team members, because they would start to rely on the standardized way of transferring information instead of thinking about more suitable ways.

5. DISCUSSION AND CONCLUSION

Gulati et al. (2000) described that communication in an NPD team supports the coordination of tasks and, therefore, helps to prevent misaligned activities. This was described and, therefore, confirmed by each interviewee. Moreover, literature stated that a reduction in cycle time of NPD project can be of high importance due to shorter product life cycles (Guveritz 1983; Rosenau 1988). Three out of six interviewees confirmed a reduction of cycle times because of the described reason above (Project 1, 2 and 3). Further, it is said that, the standardization of business processes can lead to the reduction in cycle times (Münstermann and Weitzel, 2008). The standardization of the communication process was defined by four determinants and, as described above, the cases indicate similarities on the individual parts of the communication process they standardized in order to achieve a reduction in cycle time. Each project standardized the direction of information exchange and, therefore, the direction of communication in order to improve the coordination and efficiency of the communication process. This can lead to the assumption that the standardization of this part of the communication process has a high influence on the reduction of cycle time. Additionally, the standardization of the context of the information exchange was partly standardized within each project. Furthermore, each interviewee explained this with similar reasons, namely: Prevention of legal issues; time reduction due to clear tasks description; and a faster evaluation of information. This indicates that the standardization of the context used within the communication process influences the efficiency of the project communication.
Furthermore, as described earlier, three out of the six projects indicted to have a rather high standardization of communication. The interviewees of those projects (Project1, 2and 3) described a positive relationship between standardized communication and the reduction in cycle time. Additionally, the same reasoning was given in each of the three cases, namely: A better coordination of information, clear task descriptions, prevention of legal issues, higher efficiency and misunderstandings. The three projects, therefore, show similarities to the pattern described in the literature.
The projects indicating a rather low standardization of communication showed different results in regards to a reduction of cycle times. It was mentioned, that the standardization of the communication process can be valuable but has no significant influence on the cycle time. Furthermore, it was stated that, a complete standardization of communication can have a rather negative influence on the NPD performance.
The differences of the indicated numbers in contrast to the strong similarities, with regards to the four determinants, can lead to the assumption that the definition used in this research does not cover each factor of standardized communication. Furthermore, none of the cases specify data on reduction in cycle time due to a standardized communication, which makes it difficult to compare the individual cases. Therefore, the research question:

> *How does the standardization of communication between a buyer and supplier, effect the overall cycle time of an NPD process?*

cannot be answered completely due to the findings of this research. However, it can be assumed that standardization of communication does influence the cycle time of some NPD projects in combination with other factors. This was confirmed by three of the interviewees (Project1, 2 and 3). However, the extent to which standardization affects the cycle time could not be determined within this research. Furthermore, it is important to mention that only three out of the six interviews reported a significant influence; the other three only indicated that it generally might have a small influence in combination with other factors supporting the reduction of cycle time, but can also influence the NPD performance negatively.
Additionally, it can be stated that, the standardization of "who is talking to whom" in an NPD team and the standardization of the context communicated has a high impact on the reduction of cycle time.
There is a pattern found between the companies' level of standardization and their own opinion concerning the importance of standardization. When the communication process was described as rather standardized a stronger influence on the time reduction was reported compared to when the standardization of communication was described to be rather low.

6. MANAGERIAL IMPLICATIONS

The findings of this in depth-case analysis can help management of NPD teams with supplier involvement to

understand the different results a standardized communication can show. It can be stated that it depends on the project and on which parts of the communication process are standardized. The frequency, for example, was often described as difficult to implement, due to required flexibility of the communication. The standardization of the direction of information exchange and the context were strongly advised by each of the interviewees; also when there was no direct influence on the cycle time measured. NPD management should be aware of the importance of communication within the NPD team and can use the stated cases as an support to decide whether a standardized way of communication could be a way to reduce cycle times or if the projects under concern might rather show similarities to the projects in which the standardization could negatively influence the creativity of the NPD team members. Furthermore, the research shows the importance of communication and presents the possible influence of standardized communication processes.

7. LIMITATIONS AND FURTHER RESEARCH

One limitation of this study is the sampling method. Companies from different industries were chosen to be interviewed. Furthermore, the findings cannot be generalized, because of the low number of samples (6). Additionally, the interviewees were asked about their personal opinion with regards to the topic of this research. The degree of truth can, therefore, not be determined. Moreover, the influence of standardized communication on the the cycle times of the projects could not be measured precisely in any of the projects. Also, the definition of standardized communication could only partly be derived from existing literature and was, therefore, created due to logical reasoning.

For future research, it could consequently be interesting to conduct a research in which the standardization is defined by further determinants, which might be possible to detect by an observation of NPD team communication process. Furthermore, future research could focus on an explanation for the pattern found with regards to the four determinants. Additionally, future research could investigate cases in which the influence of standardized communication on cycle time is measured precisely. Moreover, the influence of standardized communication could be investigated respectively other variable, than the cycle time of a project. The in-depth interviews present further disadvantages and advantages of the standardization of the communication process, which can cause e.g. a decrease in flexibility or creativity of the NPD team members.

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9. APPENDIX

9.1 A: Table one, standardization of communication

Table 1 Standardization of communication

Company: / Determinant:	Sensata	AkzoNobel	Siemens	Apollo1	Apollo2	Bronkhorst
Frequency of communication	Not pre-determined	Not-pre-determined	Not pre-determined	Pre-determined	Not pre-determined	Not pre-determined
Platform/ Channel used for communication	Not pre-determined	Not-pre-determined	Partly pre-determined	Not pre-determined	Partly pre-determined	Not pre-determined
Context of communicated information	Partly pre-determined	Partly pre-determined	Partly pre-determined	Partly pre-determined	Partly pre-determined	Partly pre-determined
"Who is talking to whom" within this communication process	Pre-determined	Pre-determined	Pre-determined	Pre-determined	Pre-determined	Pre-determined
Overall standardization of communication	7/10	3/10	5/10	7/10	7/10	5/10