UPI and MTO companies

Which varieties of UPI exist among MTO component producers and what explains these differences?

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SUMMARY

User producer interaction (UPI) is generally recognized as a valuable source of innovation. Different types of UPI are needed for different circumstances and sectors. The Dutch steel processing industry consists of many Make-to-order companies (MTOs). A great part of these companies only produce components instead of artefacts and are more involved in process innovation than in product innovation. This peculiar setting is not addressed in the scientific literature about UPI. In order to create a better understanding of this specific combination of MTO and UPI, the following research question is posed: "*Which varieties of UPI exist among MTO component producers and what explains these differences?*" This will lead to a set of hypothesis that can be tested among a larger group in further research. These hypotheses are built from concepts that are grounded in the data. This research has a qualitative explorative research design in the tradition of grounded theory. Data is collected by means of multiple rounds of in-depth interviews which are subject to constant comparison. Data analysis revealed four levels of UPI which are distinguished by the concept of initiative. In level three and four the initiative shifts from users to producers. A second model explains the underlying incentives of producers to anticipate on these levels of interaction and shows how these incentives are imbedded in the strategy of companies.

Key words: user-producer interaction (UPI), make-to-order companies (MTO), initiative, levels of UPI, incentives, process innovation.

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1. INTRODUCTION

Although a lot is written about innovation, it caught my attention that most research papers focus on the 'extraordinary cases' like fast growing markets or best practices. However, most papers tend to overlook the incumbent companies, which still make up for a large part of the economy, because they are not typically regarded as innovative.

With an annual turnover of more than 20 billion euro (Metaalunie, 2014) the steel processing industry is widely represented in the Netherlands. A typical company in this industry is a small medium enterprise (SME) that offers laser cutting-, drilling- welding- and assembly operations. These companies receive a technical drawing from their customer and start production according to given specification. They have a wide variety of machinery and processes. Their order portfolio ranges from small metal brackets to complete frames. After receiving the CAD (Computer –aided Design) files from their customer, they prepare it for production. Some products need a complete 'recipe' for production because the process consists of multiple steps e.g. laser cutting, bending, welding, surface finish and assembly. Their business activities cover all steps necessary to convert a technical drawing into a 3D product.

These companies are defined as Make-To-Order (MTO) companies by Kingsman et al (1993) because they only produce on customer specification and thus do not keep any stock. These MTO companies can be further divided into MTO companies that make complete products e.g. bikes or bike frames and companies that make parts of products e.g. bent tubes or adjustment plates. This research focuses on the latter category employed in the Dutch steel processing industry and will be defined as MTO component producers. They are referred to as producers in this research.

These producers are active in a broad field of technologies and are part of many production chains. In the Dutch steel processing industry there are many MTO component producers who have a lot of competition from similar companies that offer roughly the same technologies. The trade register of the Dutch Chamber of Commerce (KvK, 2014) generates a list of 4644 companies that can be recognized as MTO component producers. If we take a closer look to the province of Drenthe, for example, 145 companies fulfil the criteria of MTO component producer. More than 40% of these companies offers welding as their main technology. This low level of diversity in offered services is comparable to the rest of the Netherlands.

The MTO producers innovate at part and process level where they focus on the parts (of products) they produce. Hence, their innovative additions are focussed on producability, production costs and dimension tolerances and do not reach to the function of the final product. They, for example, know the limitations of laser cutting concerning tolerances and therefore suggest an alternative technology that could reach the requested tolerances. However, they do often not know if the requested tolerances are necessary for the final product. This case of the MTO component producers reveals how process innovations are generated based on interactions between producers and their customers. Because of customers' demands, producers are challenged to improve their processes in order to meet the high specifications. For example, making a high tolerance hole of 0,05 mm in a 20 mm sheet of metal requires an innovative solution from the producer.

In the innovation literature user-producer interactions (UPIs) are generally recognized as an interesting source of innovation (Lundvall, 1985). The research of Lundvall (1985) can be considered as a seminal writing about UPI. UPI can be defined as the "interactive learning processes between users and/or producers leading to or aiming at the reduction of uncertainty about the relation between product and demand characteristics" (Nahuis et al., 2012, p. 1122). Interaction with customers is necessary to do

business, therefore these MTO companies, by definition, apply some level of UPI, although probably a lot of them are not aware of it. UPI could be an interesting possibility for the large amount of similar MTO component producers in the Netherlands to differentiate themselves from competition. Customers and producers could both benefit directly from cooperation and knowledge exchange about process innovation. Customers could receive a better, less expensive and more durable product, while producers could decrease their tool wear, failure rate and production time.

However, Nahuis et al (2012) state that different sectors and circumstances need different types of UPI. Lundvall (1985) focuses on product innovation as a result of innovation activities, where products should be seen as complete artefacts consisting of multiple parts. This is not the case with MTO component producers, because they are more involved in process innovation rather than product innovation. Lundvall (1985) focuses on the usefulness of UPI, where my research takes it one step back and explores the varieties of UPI and explains these differences for the MTO component producers in the steel processing industry. Therefore my research will contribute to the relatively unexplored combination of UPI and process innovation in MTO companies and add to the perspective of Lundvall (1985) by looking at UPI in this peculiar MTO setting from a producers point of view.

This leads to the following research question:

Which varieties of UPI exist among MTO component producers and what explains these differences?

Based on the scarce scientific literature about this combination of subjects, a grounded theory approach is chosen. Data collection is done by multiple rounds of in-depth interviews. In-depth interviews are suited for this research because they are used on topics of which little is known and where it is important to gain a better understanding (Quin Patton and Cochran, 2002). By applying constant comparison during the multiple rounds of interviews there is the opportunity to narrow the sample, adjust the interview design and redesign the coding scheme based on emerging results. All interviews are transcribed and coded directly afterwards. The first round of interviews is based on a convenience sample, the following rounds used theoretical sampling.

This research question will explore the different varieties of UPI available in this industry and aims to discover the incentives seen from a producers point of view. These insights have a practical goal and have theoretical implications. First, the results of this research will entail a set of hypothesis, built from concepts grounded in the data, that could be further tested with larger samples. Second, I hope that this thesis inspires scholars not only to look at the ‘extraordinary cases’, so this will lead to more research in this area that could complete the theory of UPI and MTO component producers. And finally, the results of my thesis can create some level of awareness for the producers in steel processing industry, so they could benefit from UPI and take it into account concerning their strategies. UPI could be a relatively easy and acceptable method to increase their relationship with their customers and distinct themselves from their competition.

Chapter two of my research sketches a more detailed picture about Dutch MTO component producers in the steel processing industry. This will enhance the understanding of their daily processes and present background information that helps interpreting their attitude towards UPI. The third chapter provides an overview of theories connected to MTO companies and UPI, and is complimented with additional theoretical insights to connect the two strains of theory. The fourth chapter provides an overview of the methodology. Chapter five provides the results, based on quotes from the data. The penultimate chapter, chapter six is the discussion followed by the conclusion.

2. How it's made

My research focuses on the MTO component producers in the Dutch steel processing industry. Because this sector is not widely known within innovation studies I will provide some background information about these companies based on my ten years of experience working in this field as an entrepreneur. First I would like to elaborate on the position of MTO companies in the production chain based on an example of the production of a bike. Next I would provide a general description of a MTO component elaborating the technologies often available with MTO component producers. And finally I discuss the process from quotation till component within the MTO companies, so the different stages that provide opportunities for innovation becomes clear. One should keep in mind that the level of variation is very high in this sector, therefore only a general picture can be presented. Hence, this chapter will enhance the understanding of the daily processes in MTO companies which will give more insights in their attitude towards UPI.

MTO component producers in the production chain

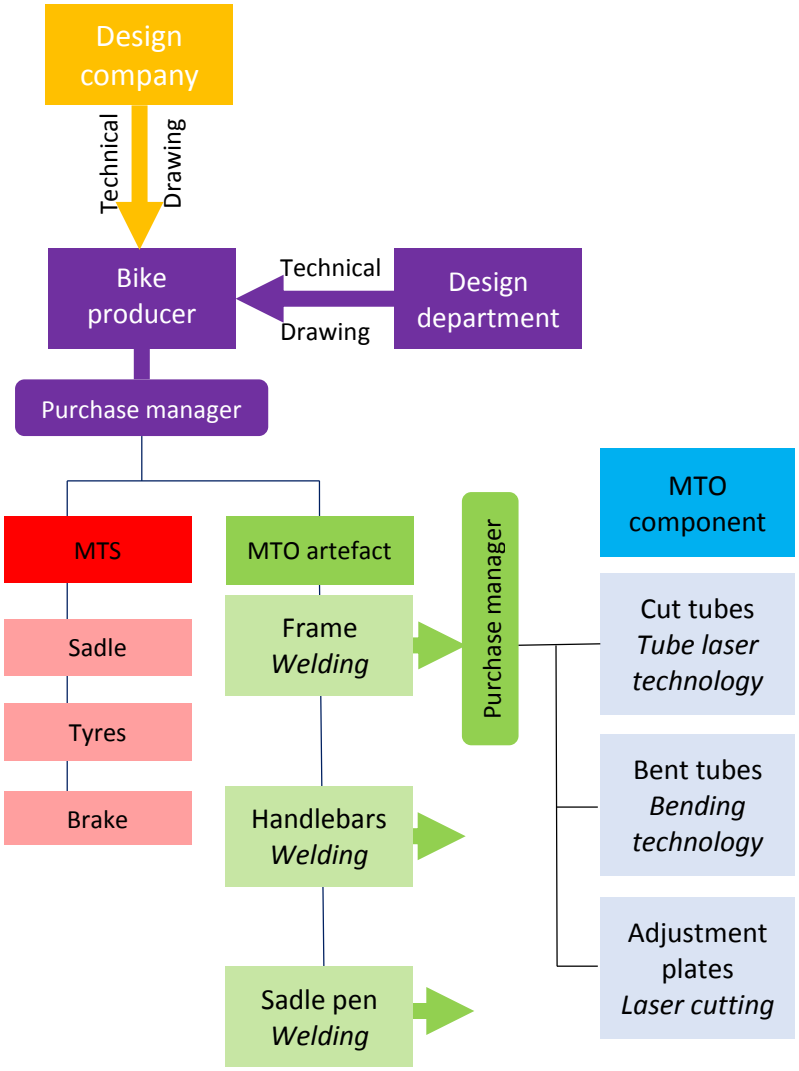


Figure 2.1: Schematic overview of production chain of a bike.

In figure 2.1 the production of a bike is used as an example to explain the location of MTO component producers in the production chain. The bike is developed by the bike producer in his own design department, or with help of an external design company. The purchase manager of the bike producer buys the standard parts like saddles and tyres from Make-to-stock (MTS) companies and custom made parts like frames from the MTO artefact producers. MTS companies deliver products and parts to their customers from inventories and their production is in line with sales forecast, in contrary to MTO companies that only manufacture in response to customers' orders. In the example of the bike, most producers buy standard saddles or tyres. Hence, they do not have their own design. Therefore multiple bike producers will apply the same type of saddles or tyres. Frames however are often custom-made and differ for each bike brand. Customised products can only be made to order (Amaro et al.,1999).

Each MTO artefact producer has their own purchase manager that buys the different components from MTO component producers. If we look at the example of the bike frame (artefact), we can distinguish different components. Tubes with specified holes in various shapes will be purchased at a company that is specialised in laser cutting of tubes. Bent tubes for the frame will be purchased by companies that can bend all kinds of tubes and profiles and so on. The customers discussed in this research can be seen as the MTO artefact producers in this example.

General description of MTO companies

MTO component producers in the steel processing industry have their background in mechanical engineering. Most MTO component producers have one technology that is their specialisation. This could be for example (robot) welding, sheet metal processing, diecasting or laser cutting. These technologies can be divided into standard and complex technologies. Standard technologies are defined as technologies that every mechanical engineer is able to work with or to design for. This can be, among others, sheet metal processing, welding, milling and drilling. There are multiple companies that offer one (or more) of these services. Complex technologies are technologies that aren't part of the standard curriculum of a mechanical engineer. They demand thorough knowledge and specific equipment. These companies typically have not many competitors or none at all and distinct themselves on a high level of process innovation. They are ahead of competition in developing new technologies, processes and applications of their processes. Therefore they can meet the specific needs of their customers in e.g. new materials or extreme tolerances (± 0,001 mm).

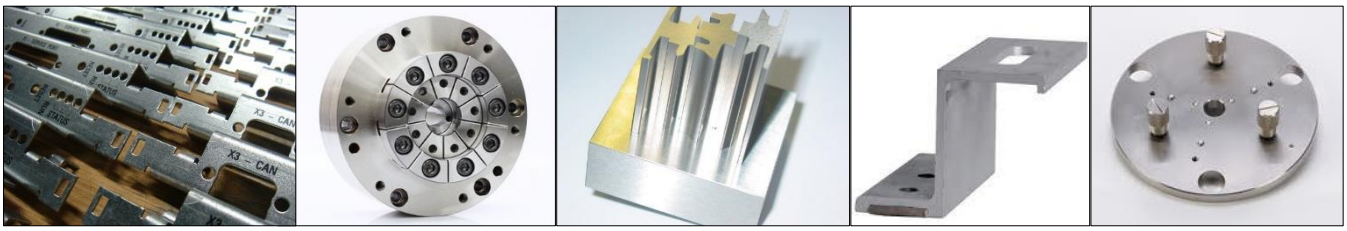


Figure 2.2: Examples of components

This distinction is important for the analysis because the knowledge gap between customers and producers with a complex technologies is larger, than the gap between customers and producers with a standard technology. The knowledge gap can be defined as the difference between the level of technological knowledge of the producer and the level of technological knowledge of the customer. For example, all mechanical engineers know the basics about welding. Therefore a producer who offers welding as his main technology does not have to explain much about the proper delivery specifications or limitations of the technology to their customers. Technologies like die casting or spark erosion can be defined as complex technologies and require more specific technological knowledge. Producers need to guide and sometimes even educate their customers, because their customers do not have sufficient knowledge about the specific requirements needed to get the product according to their

specifications. Next to their specialisation all companies have a set of accompanied technologies like welding, drilling and assembly. Figure 2.2 shows a random example of components.

From quotation to component.

This section describes all steps needed to convert a quotation into a component. The given example is based on a company that has sufficient employees to divide the different steps of the process into different departments. Obviously, in small companies one person can have multiple roles and boundaries between the different tasks become vague. When a customer sends in a quotation the sales department makes an offer. Sometimes this can be as easy as counting the amount of material and hours of labour, but often this involves some steps of engineering. This is based on the input of customers. A complete technical drawing needs less preparation than a quick hand drawn sketch. At this moment innovation can already take place. The engineer can suggest product changes that influence the production process in a positive way. This can be based on the function of the product or the limitations of the production process. When the offer is finished and the customers agrees, work preparation can begin. The component needs to be divided into production steps. For example: buying raw material – laser cutting contours – drilling holes – add screw-thread – fold material – weld additional parts on component – grind welds for smooth finish – add coating. During all these steps improvements (based on innovation) can be made. For instance, another type of steel can be proposed based on the composition of the material in combination with welding. Some alloys are more suitable for welding than others, or the producer proposes to include the holes in the laser cutting process and therefore skips one additional step in the production process. They also can propose a different set up for the product by applying more bends than welds. This will reduce welding and finishing time and therefore costs.

3. THEORETICAL FRAMEWORK

In this chapter an overview is given for the relevant theories. Starting with the taxonomies of producers and background information about MTO component producers. Next section describes the professional users and is followed by theories about user-producer interaction. This chapter is concluded with the embedding of this research in current scientific literature.

3.1 PRODUCERS

There are several taxonomies known to categorize firms. If we define producer firms or producers of technology according to Nahuis et al. (2012) as "firms that transform knowledge, skills and artifacts into products or services to be offered on the market place" (p. 1122), the most appropriate way to categorize these kind of firms is the taxonomy of Pavitt (1984). He divides firms into four categories: 1) supplier dominated firms (e.g. agriculture and textile), 2) specialized suppliers (e.g. high-tech instruments and machinery), 3) scale-intensive (e.g. consumer durables and basic materials) and 4) science based (e.g. electronics and pharmaceutical). In this research the focus is on companies that fit in the category of specialized suppliers. Within this category there are still great differences between companies. In order to reach the right level of scope of this research the categorization has to be refined based on the taxonomy for production companies which response to customers' orders, proposed by Amaro et al. (1999). After excluding the Make-to-Stock companies (MTS) they propose a classification of 4 Engineer-to-Order (ETO) categories, 5 MTO categories and 2 Assemble-to-Order (ATO) categories based on the degree of customization and the number of activities performed after winning an order. However none of these categories pay special attention to subcontractors without having an own product line. They therefore suggest "further research is necessary to reach definite conclusion on this topic " (Amaro et al. 1999, p. 367).

In order to reach the final level of analysis we can categorize the MTO companies according to their level of technology details. Disco et al. (1992) distinguish four levels of technological detail: 1) components (e.g. materials and fastening materials), 2) devices (e.g. engines and batteries), 3) artifacts (e.g. furniture or cars) and 4) systems (e.g. electricity network). My research focuses on specialized suppliers which fit to the component level of technological detail, further on defined as MTO component producers or producers. Research about MTO companies and innovation covers mainly the following three subjects. First they focus on production planning and the differences between MTO and MTS (Kingsman et al, 1993). Second are the articles about the bidding process which is an important and returning activity for MTO companies (Spengler, 2005). And final the subject of integration between marketing and production, which has close links with the first subject is investigated by inter alia Kingsman et al. (1993) and Konijnendijk (1993).

3.2 USERS

Users in general are defined by Nahuis et al. (2012. p. 1122) as "individuals, groups of individuals or organizations that employ products or services to fulfill a particular need". They distinguish different types of users. One categorization that is applicable to the scope of this research is the distinction between final and intermediate users. The definition of intermediate users as a group of users that function as technical team members between producers and final users, fits to the users of MTO component producers. In addition to that, Lundvall (1985) proposes a distinction between professional users and consumers. The goal function of consumers can only be described by general terms like satisfaction and happiness whereby needs are difficult to separate from wants. Professional users are more eager to find new solutions to solve their problems and will be actively engaged in the process. The categorization of Lundvall (1985) implies the same division as the concepts used by Oudshoorn

and Pinch (2008), where consumers are referred as implicated actors and professional users as co-producers. Because the term users often refers to end-users or consumers, the word customer is used in this research for the companies that buy their products from MTO component producers.

3.3 USER-PRODUCER INTERACTION

User Producer Interaction (UPI) is seen as an important source for innovation (Lundvall 1985). UPI can be defined according to Nahuis et al (2012) as "an interactive learning process between users and or producers leading to or aiming at the reduction of uncertainty about the relation between product and demand characteristics " (p. 1122). Nahuis et al. categorize seven types of UPI all based on producers who produce a complete product (e.g. bike). Not all forms of UPI are applicable to all types of firms. According to Van de Poel (1998) the characteristics of sectors influences the interaction with users.

Although his paper doesn't cover the same specific user-producer interactions as my research, Lundvall (1985) describes some concepts are used as a starting point for this research. His paper about product innovation and user-producer interaction states that producers need information about user needs. The obtaining of these information always involves some amount of effort and costs. In order to interact channels of information are used which describe "a flow of signals which are not embodied in the regular flow of products" (Lundvall 1985, p. 7). Lundvall (1985) describes three different forms of interaction between producers and users: exchange of products, exchange of information and cooperation. Users will be engaged in a search for information about new technological opportunities to enhance their performance or to solve their problem. While their level of engagement will differ, their interaction with producers will also vary. This can be influenced by the incentives to exchange information. On the one hand, users must give producers a minimum amount of information to get a proper solution to their problems. This can be a risk, because this information is often classified. On the other hand, producers would like to showcase their skills and knowledge without disclosing it to competitors. These interdependences shall till some extent lead to a need for cooperation between user and producer. These cooperation can take place in different steps of the production process. The concepts channels of information, need for corporation and exchange of information were used as sensitizing concepts because they are general concepts that have close links with the subject under investigation and are consistent with the open research strategy as proposed in chapter four.

3.4 MTO AND UPI

Companies cannot work without UPI. All companies need some level of interaction with their customers in order to do business. Although a lot of research has been done about UPI, is seems no research is done about UPI in combination with MTO component producers. The existing literature about UPI of Lundvall (1985) has a product innovation focus, while this is not particularly relevant in the case of MTO component producers. MTO component producers are not involved with product innovation at artefact level. They innovate at component level where their innovations are strongly influenced by technological knowledge about limitations and possibilities of the relevant processes. Lundvall (1985) focuses on the usefulness of UPI, where this research takes one step back and explores the varieties of UPI and explains these differences for the MTO component producers in the steel processing industry.

My research addresses this gap in literature by enhancing the understanding of UPI within this specific environment. Lundvall (1985) describes some general statements about costs and effort that are needed to get user information, but lacks in depth understanding of these concepts. My research will look into the underlying incentives and strategies of producers connected to costs and effort and therefore increase the understanding of UPI among MTO component producers.

Next to the theoretical relevance, there is also a practical relevance connected to my research. There are many MTO component producers in the Dutch steel processing industry who have a lot of competition from almost similar companies that offer roughly the same technologies. UPI could offer them a possibility to differentiate. Customers and producers could both directly benefit from cooperation and knowledge exchange about process innovation. Customers could receive a better, less expensive and more durable product, while producers could decrease their tool wear, failure rate and production time. The results of this research will raise awareness for the possibilities of UPI for MTO component producers and could serve as guidelines to include UPI in their strategy.

4. METHODOLOGY

In this section the course of my research is discussed. It starts with a short introduction to the research design, followed by the case selection and data collection, the data cleaning process and the coding and analysis phase. The last section elaborates on the scientific quality criteria.

4.1 RESEARCH DESIGN

The aim of this research is to get a better understanding of the varieties of UPI between MTO component producers and their customers and the underlying explanations for these variations. This will lead to a set of hypothesis that can be tested among a larger group in further research. These hypotheses are built from concepts that are grounded in the data. My research has a qualitative explorative research design in the tradition of grounded theory. Grounded theory can be defined as "theory that was derived from data, systematically gathered and analysed through the research process" (Bryman, 2008, p. 541). Data collection and analysis are closely connected and proceed in tandem (Strausss and Corbin, 1998). This refers to the concept of constant comparison (Silverman, 2005), which entails data analysis after each step of data collection. This research design fits this case because the current literature is underexplored for the specific combination of MTO component producers and UPI.

Data was collected by means of multiple rounds of in-depth interviews. In-depth interviews are less structured than semi-structured interviews, often cover only one or two issues and can be used to explore in detail the respondent's own perceptions and accounts. In-depth interviews are suited for this research because they are used on topics of which little is known and where it is important to gain a better understanding (Quin Patton and Cochran, 2002). The first round of interviews used a convenience sample which can be described as "a sample that is selected because of the availability of the researcher". (Bryman, 2008, p. 692). For this research I approached some MTO component producers with whom I have worked in the past. The following rounds used theoretical sampling. According to Bryman (2008) theoretical sampling is an alternative strategy that suits qualitative research. Glaser and Strauss (1967, p. 45) define theoretical sampling as "the process of data collection for generating theory whereby the analyst jointly collects, codes and analyses his data and decides what data to collect next and where to find them".

The coding and data analysis existed of multiple rounds to enhance constant comparison (Silverman, 2005). This method provided the opportunity to include all relevant information that emerges from the data during the research and leaves room to adjust the direction of research based on previous results. The constant comparative method has several strengths. First, the transcribing and coding directly after each interview provided possibilities to steer and adjust the interview design. The analysis remains open for encountering on unanticipated patterns or concepts and could be redirected based on them. Data collection and analysis are intertwined. Second, the literature about these specific combination of MTO component producers and UPI is so scarce that an open and exploratory approach is warranted. By using multiple rounds of interviews, new concepts that were revealed could be added to the interview design and tested in the next round. Third, the case selection could be adjusted or narrowed based on the relevant variables. Finally, the first interviews had their main focus on answering the first part of the research question: "*Which varieties of UPI exist*?", and the following interviews focused more in-depth at the second part of the question: *"What explains these differences?"* and provided an explanation for the differences in these varieties.

The next sections describe the research process in chronological order starting with the case selection and data collection. They are followed by the preparation of the data, the coding and analysis phase and concludes with the scientific quality criteria.

4.2 CASE SELECTION AND DATA COLLECTION

Even after a thorough delineation of the MTO component producers in the steel processing industry, from general producers, to MTO producers and finally down to MTO component producers, based on the theories of Pavitt (1984), Amaro et al. (1999) and Disco et al. (1992), the level of variation is still very high in the population. Because this research has an explorative character it was a priori very difficult to determine if and to what extend variables influence the variety of UPI. In line with this explorative character I applied the following theoretical sampling strategy to identify MTO companies that meet the criteria for my research as specified above. The trade register of the Dutch Chamber of Commerce (Kvk, 2014) provided a list of companies that are registered under the code C.25.62, whereby C stands for Industry, 25 for manufacture of fabricated metal products, except machinery and equipment and 25.62 is the specification for machinery (Dutch: algemene metaalbewerking). Company websites were used to determine whether or not they were MTO companies. The companies that fulfilled the criteria of SBI code C.25.62 and were classified as MTO companies were put on a shortlist. This shortlist was used as the main document in the case selection process.

The sample has a high amount of variety in age, size and level of technology. Because there is no previous scientific research that provides any insights about the relevance of these characteristics in relation to UPI, I used these characteristics as a starting point, based on my ten years of professional experience in this particular sector. I suggest that older and larger companies have more funds and therefore more people available to interact with customers.

Nr.	Function	Age company	Number employees	Type technology
C1	Technical manager	25	80	Standard
C2	Director	41	15	Standard
C3	Managing director	25	10	Standard
C4	Managing director	80	30	Complex
C5	Account manager	40	20-25	Standard
C6	Director	2,5	1	Standard
C7	Managing director	70	50	Complex
C8	Director	24	30	Complex
C9	Director	72	40	Standard
C10	Director	79	15	Complex
C11	Director	24	2	Standard
C12	Plant manager	69	52	Standard
C13	Project manager	40	80	Standard
C14	Account manager	52	23000	Complex
C15	Owner	5	3	Complex
C16	Owner	21	7	Standard
C17	Account manager	96	10	Standard
C18	Owner	89	4	Standard
C19	Sales manager	70	70	Standard

Table 4.1: Comparison table: Company 1 – 19

In young or small companies people have multiple tasks and mostly insufficient time to spend additional time on interaction with customers. Next, I presume customers do not always have sufficient knowledge about complex technologies and therefore more interaction is needed between customer and producer in order to create a good end product. I strived for a broad variety of companies in the sample, which can be seen in table 4.1.

Data was collected by means of multiple rounds of in-depth interviews. In order to achieve sufficient external reliability, a topic guide was used during the interviews. This will create some structure and overview and therefore enhance the replicability of this research. The topic guide consists of a list of key questions and subjects to cover, including a set of useful prompts. The interviewees were instructed that there was no strict order of questions and that they were allowed to add all information that seemed relevant to them. Entrepreneurs like to talk about their business and most times they unintentionally answered multiple questions in one answer. All data was recorded with permission, which enabled me to focus on the answers and make notes of interesting subject that needed additional attention.

Round	Number of interviews	Sampling method	Goal
1.	4	Convenience	Elaboration of first sensitizing concepts and theoretical insights of UPI
			Refine interview design
2.	3	Theoretical	Set up main concepts
			Test refined interview design
			Yield first insights of varieties of UPI Draft model 1
3.	7	Theoretical	Test model 1
			Set up sub concepts and indicators
			Yield first insights of reasons for variation Draft model 2
4.	5	Theoretical	Get more insights about variation and underlying incentives and strategies of variation
			Test models 1 and 2

Table 4.2: Case selection: Interview structure

From the shortlist with the producers a convenience sample was taken for the *first interview round*. These four interviews provided interesting insights in the field of MTO component producers in the steel processing industry and gave rise to some additional concepts. These concepts were used as an input for both additional questions and the theoretical sample for the next rounds of data collection.

The *second round* of interviews aimed for setting up the main concepts and resulted in a global picture of the different types of UPI among MTO companies which led to the first draft of model 1. In order to

refine model 1, another seven interviews were held in *round three*. The focus was on constructing and refining model 1, as well as trying to find explanations about these variations of UPI. This led to the draft of model 2. The theoretical sampling continued in *round four* until saturation was reached. I gathered enough data to construct the second model which provides an explanation for the different varieties of UPI found in this sector.

After each round of interviewing, transcribing, coding and analysing the topic guide was reviewed and adjusted if necessary. The position of the interviewees in the firms varied from owners and managers to technical employees who interact with customers on a regular base. The interviews had an average length of 50 minutes. In most cases the available time was sufficient. In a few cases the time was limited, which forced the interviewee to make choices about the subjects to cover. Eventually nineteen companies participated in my research. Table 4.2 provides an overview of the companies that participated in this research. All personal and company names are made anonymous as was promised to the participants.

4.3 DATA PREPARATION

During interview round one and two all data was prepared by executing the following sequential steps. First all recorded data was transcribed, and all questions and remarks of the interviewer were displayed in italic. Questions that were on the original interview list were given the corresponding number, new questions where either coded with (#) or (##). The first group represents additional questions that could be interesting for the future interviews and the second group were specific for this topic or only used to clarify or prompt the interviewee. All questions from the first group were collected in a separate document which is used for designing and editing the set of interview questions for the next round of interviews. Because so little information was known on forehand, it was difficult to compose an interview outline that not only gathered all data that could be of use, but also did not include unnecessary questions, because time is valuable for the interviewees. This document with additional questions provided overview and helped exposing interesting as well as unnecessary questions. After seven interviews the interview outline was fully developed, so these steps became otiose. The final version of the interview outline can be found in appendix 1. The next step in the data cleaning process was to make all the data anonymous. All names of companies, people, customers and sometimes products were rephrased in general terms or changed into [..]. Hence, all quotes used in this research are presented like C#, where # refers to the number of the company as presented in table 4.2. All changes made to the original transcript are visualized with []. After all these steps, the data was ready for coding. The multiple rounds of reading and editing of the transcripts enhanced the understanding of the data and provided new insights.

4.4 CODING AND ANALYSIS

The first four interviews of round one were held to get a first impression of the topic in this sector. After round one the four interviews were cleaned and coded with help of the software program Nvivo. In the beginning open coding, according to the principle of theoretical coding was used. Hence, labels (concepts) were assigned to certain text fragments. To get an appropriate level of detail, texts were coded (mainly) sentence-by-sentence. This yielded over 160 different codes. These first yield of codes was evaluated and compromised into broad groups. During the complete coding and analysing phase process, memos were written which were considered a working document and were always available while working on the data. Each interview has its own memo and next to that there was one overall memo that combined insights from multiple sources.

The interviews of round two were transcribed and coded directly after each appointment. The codes from round one were used as a guideline but there were no limits in adding additional codes. Analysing each interview directly afterwards gave me the possibility to adjust the question and add interesting topics that emerged from previous data. At the end of round two the amount of codes was too large to work with, so the codes were regrouped based on axial coding, which created codes with a higher level of abstraction. During this process, categories were made that comprise relationships between the concepts and the conditions that gave rise to these concepts. Concepts that could not be linked to other concepts or seem to be irrelevant in light of the research, were withdrawn from further analysis. This resulted in a list with 9 main categories and 60 underlying concepts. In round three of the data collection this list was used as a starting point, again with no restrictions to add new codes. It became clear that some categories were not relevant in light of the research question or that other categories or concepts exhibited lots of overlap. Half way through round three the memo's showed some interesting linkages which, after a long process of shuffling, deleting and reshuffling, resulted in the drafts of model 1 and 2. The list of concepts was narrowed down to 25 concepts which formed the main building blocks of the models. These concepts were 'conceptual dense', i.e. containing various dimensions and linkages with other concepts. All 12 previous interviews were completely recoded based on the new concepts. Quotes that still seemed interesting, but did not suit the structure were given a special code (XX) so they could be investigated and included in the end of this phase, whenever they could add to the preliminary results. Round three yielded model 1 and a draft of model 2. These models were tested and refined during the last couple of interviews. In order to keep the models clear, the concepts describing the incentives of the producers; *decrease workload, expand business* and *improve status* and the concepts describing the reluctance of customers; *attitude, liability* and *underlying processes* were considered as underlying concepts of the main concepts *incentives* and *open for feedback* and were left out of the model.

The interviewee of company 13 mentioned something about the negative sides of UPI on his own initiative that caught my attention. This is a typical example of data that would have gone lost if I had not applied the constant comparison approach. Although there were no questions in the interview outline, multiple interviews revealed critical notes about UPI in hindsight. All former interviews were reviewed and the interview outline was updated. Data addressing this topic was included in the research as a critical note to the primary positive opinions about UPI in current literature. During interview 18 and 19 theoretical saturation occurred an no new data was retrieved.

4.5 SCIENTIFIC QUALITY CRITERIA

The standard quality criteria of reliability and validity are not always suitable in establishing and assessing the quality of qualitative research (Bryman, 2008). Therefore the alternative quality criteria proposed by Lincoln and Guba (1985) and Guba and Lincoln (1994) are discussed in this section. They propose two primary criteria: trustworthiness and authenticity.

The first criteria of trustworthiness is made up of multiple criteria. The first criteria is *credibility* which ensures that "research is carried out according to the cannons of good practice" (Bryman, 2008, p. 377) and that research findings are submitted to respondent validation or triangulation (Bryman, 2008). The chosen research method did not provide opportunities for triangulation by other sources like websites and brochures because UPI is not a subject that is explicitly mentioned in these kind of communications. It was possible to apply triangulation by interviewing multiple employees from one company, but in line with the explorative character, I deliberately chose to interview more people from different companies in order to yield more insights, than limit the amount of companies for the sake of triangulation. The research strategy employed a method of constant comparison which entailed data collection and data analysis taken place in tandem.

This makes respondent validation during the process very difficult because the results keep changing during the course of the research. The final results that need to be validated emerge at the end of the research. Because of the limited timespan of this research it was not possible to implement an extra round of user validation at the end of the project. However, all interviewees will receive a copy of this research and I am open for additional comments and remarks.

The second criteria of trustworthiness is *transferability*, which parallels external validity. In order to make judgements about the possible transferability of this research to other settings, researchers need to have a good understanding of the context under study. Chapter two provides an introduction about the specific sector of the Dutch steel processing industry and the role of MTO component producers in the innovation process. The many quotes provided in the results section provide detailed insights about the companies opinions concerning topics related to UPI. This all together provides sufficient information about the context under study and should enable other researchers to judge about the transferability of this research to other contexts.

As a parallel to reliability in quantitative research, a third criteria of *dependability* is proposed. This criteria should establish how far proper scientific research procedures have been followed. The methodology chapter provides a detailed description of the case selection, coding and data analysis. The two models in the result section are built from concepts grounded in data. These concepts emerged during data collection and were verified and adjusted based on insights gained from the interviews that followed, according to the method of constant comparison. The final round of interviews was used among others, to test and verify the proposed models. All concepts and statements made in the result and conclusion sections can be backed up by quotes. Next to that, the final interview outline can be found in appendix 1 and the anonymous transcripts will be sent on request.

The second main criteria proposed by Lincoln and Guba (1994) is authenticity which entails among others the aspects of fairness, ontological authenticity and educative authenticity. All data and viewpoints of respondents are taken into account even though they did not always match the general outcome. Therefore no data is excluded from the analysis. The aim of the research was to create a better understanding of UPI among MTO component producers. The results of this research contributes to the gap in literature about UPI in this peculiar setting and provide interesting insights for MTO companies in this sector.

5. RESULTS

This chapter elaborates on the results gathered from the nineteen in-depth interviews. First multiple levels of interaction are presented accompanied with a graphical model. Next, the two top levels, level 3 and 4 are discussed in more detail. These levels provide the most opportunities for producers to differentiate from competition and will explains the differences in UPI.

5.1 VARIETIES OF UPI

The data revealed four levels of UPI for MTO component producers in the Dutch steel processing industry.

- Level 1: Producer delivers products to specifications of the customer.
- Level 2: Producer improves products based on technological knowledge.
- Level 3: Producer solves the problems of the customer.
- Level 4: Producer proposes new products or processes on own initiative.

These four levels will be discussed in detail, based on quotes of the interviewees, in the following sections. A graphical representation of these four levels can be found in model 1 at the next page.

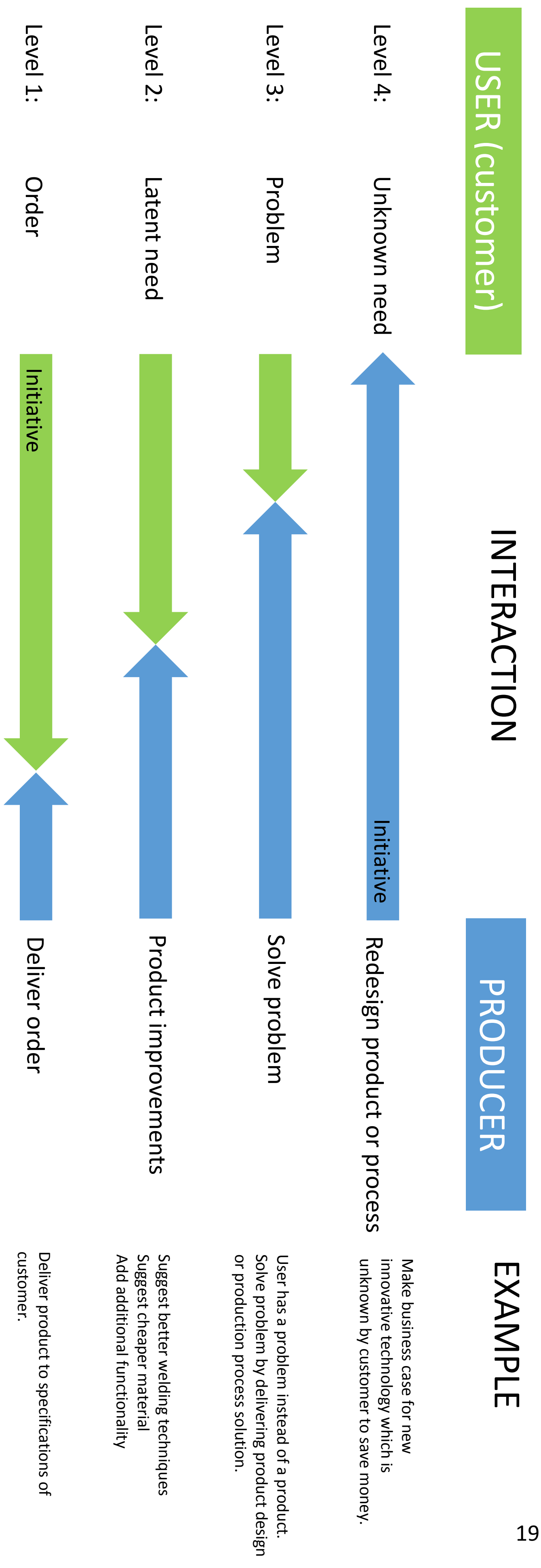
Level of UPI	Initiative	Interaction		Result
		Input customer	Input producer	
1.	Customer	Technical drawing	-	Deliver order
2.	Customer or producer	Technical drawing	Technological knowledge	Improved product
3.	Producer	Problem	Conceptual thinking based on technological knowledge	Problem solution
4.	Producer	-	Redesign product or process	Business case

Table 5.1: Four levels of UPI among MTO component producers in the Dutch steel processing industry

There are multiple levels of interaction between customers and producers. Within companies the levels of interaction can differ per customer. Therefore multiple levels can be present in one company at the same time. The level and quality of the customers' input differs a lot. Some customers have a complete technical drawing including all the technical details while others only have a 'home-made' prototype or a vague idea. "I think ninety percent of our turnover comes from customer drawings [level 1] and ten percent is an advising role [level 2 or 3]" (C1). Information that is familiar or even outdated for one company can be innovative for another company which has a lower level of knowledge. Innovation and knowledge exchange should be seen in perspective to the company. For example, on the one hand company 3 provides technical advice about welding constructions.

> "This morning I had a customer of a bed and breakfast who needed a steel plate with some folded sides. I said: "What are you going to do with that?" Yeah, well, this and that. Oh well than should you do it like this, it's better and stronger" (C3).

Figure 5.1: Model 1 –
Four levels of UPI in MTO component producers in the Dutch steel processing industry



While this is considered basic knowledge for customers of company 7. On the other hand, company 7 offers advanced technological solutions that not only overshoots the wishes for the customers of for example company 3, but in most cases also their capability to understand and implement.

Level 1

Model 1 presents a visual representation of four levels whereby the lowest is the most common form of interaction. This can be summarized by "They ask, we deliver" (C7). This first level describes the daily order process in which a customer sends in an order and the producer replies with a quotation. In the case of any missing details there can be a short contact moment, but most of the time the producer will complement the order to his own interpretation and will confirm this additional information on the quotation. "What we often see is that customers don't specify the welding or the finishing. That always comes verbally. We try to capture this in our bill of materials ['recipe'] " (C1). The products that are produced in level 1 are mostly simple, straight forward products made with standard technologies.

In level 1 there is not much interaction and therefore also not much knowledge exchange. It can be assumed that the knowledge gap between producers and customers is small. There is no need for customers to interact because they hold the information needed themselves. Customers say: "We have our own engineers and we order at three or four producers. You don't have to think along, because we have done all the thinking ourselves" (C13).

Lundvall (1985) expects that the professional user is active in his search for new ways to solve his problems and that they are willing "to adapt their behaviour and qualifications when new technical opportunities come forward" (p. 5). Not all users or customers are actively involved in finding the best solution to their problem. Multiple companies stated that they warned their customers for wrong decisions or expensive procedures, but not all customers are open for suggestions. "In the past we tried to show things that could be improved. They did not want to hear it, they did listen, but did not act to it at all." (C2). Producers can have multiple reasons for wanting to help the customer to improve their products, but if customers do not listen, producers will give up on interaction and stay in level 1.

Lundvall (1985) focuses solely on UPI connected to product innovation while this research looks at UPI from a slightly broader perspective. Although there are possibilities for innovation in the situation described under level 1, customers willingly dismiss this opportunity. Therefore the situation degrades from an innovation opportunity to a purchase activity. However there can be minor innovations, because there is room for interpretation and behind the scenes producers can adjust little technical details to improve their production process. The following levels are more in line with the focus of Lundvall. Innovation for MTO component producers is on process level like supply- and cut settings of machinery, or an innovative way to clamp your material. "That is where we put our time and money. That is our innovation" (C7).

Transfer from level 1 to level 2

The transfer from level 1 to level 2 is mostly restricted on financial issues. Customers that have multiple suppliers and therefore have a strong cost focus, often have a dominant attitude and are not open for interaction. They have their product and they are only looking for the cheapest producer. They value low costs and short delivery terms over cooperation to reach more innovative solutions and therefore better products. Multiple companies mention the role of the *purchase manager* in this process. They state that it is his initial task to save money. This leads to an indifference for the costs that may arise during the production process. "The added value isn't always in the low purchase price, but also in the production [process] and the turnaround time" (C13). The difference between an engineer and a purchase manager is that an engineer states quality above costs. When the engineer and purchase manager of one company do not share the same vision, collaboration with producers is very difficult. "Well, if purchase and engineer cannot get along, we cannot achieve that [collaboration] at all" (C13).

Producers like purchase managers to change from custodians to relation builders, who will have eye for the complete production process and not only the purchase process at the front.

Level 2

The second level of interaction describes the situation whereby customers have a latent need for product improvement. The do not initially ask for example for a cheaper or stronger product but they are open for (technical) advice from producers. This is the first level that offers real opportunities for innovation. Company 4 claims that although the customer has designed the product, they actually improve the producability and decrease the costs of the product based on their experience. With their specific knowledge of a technology, producers are able to give practical feedback to improve e.g. strength, turnaround, producability, costs or material properties. This often starts with a discussion about the function of the product. Sometimes customers place some specifications on their drawings that are not really necessary or could in worst case scenario even quadruple the costs. They often do not have the specific technological knowledge to see the impact of their specifications throughout the whole project.

> "If you do it the other way, you will have another tolerance zone, but you will probably get more tension in your material or end product. Does it than fulfil its function?" (C7).

Most of the time the **initiative** for improvements comes from the producers. They provide customers with unsolicited technical advice that could improve their product. Especially producers who operate with complex technologies will think along with their customers. "How can we do this the easiest way? Or the smartest? Or the best? Or in the most efficient way?" (C4). Based on their years of experience they can easily say how to make a product better. They can discuss this at forehand with their customers, but most of the times they use it as a starting point for their offer.

> "If you leave out [this], you could save additional costs. That are things I directly change without consulting the customer. […] That is something we always automatically do" (C4).

Producers could provide improvements based on two directions of thoughts. The first one is based on their technological knowledge. They know what is possible with that type of material or machinery and they have seen similar products with smarter solutions for e.g. assembly or welding.

Aside from the technological aspects a producer could suggest improvements based on the function the product should fulfil according to their customers (or the customers of their customer). In order to anticipate on this they have to know their customer, so they can interpret their intentions. This getting to know your customers is represented in the concept of **involvement.** As a producer you have to know who your customers are. What is their vision and strategy? What do they value? "You know that one customer values quality above average while the other focuses on reliability. We absolutely try to keep that in mind" (C1). It is always an advantage if you know where a product is used. Sometimes customers provide the wrong input. This can be based on drawing errors or unsufficient knowledge. The first one can be illustrated by a case of company 8. When they received a drawing from their customer, they noticed a very small change in diameter. Because they work with complex technologies and are used to high tolerances they focused on that small change because they thought it would be functional. If they had known the nature of the product, they would have known, that it probably was nothing more than a drawing error. The second is illustrated by an example of company 4. They delivered products that are sandblasted. This process can lead to colour differences that do not affect the quality. They were not aware that this component was part of a larger product and was assembled on the exposed view. If company 4 had known where the component was used, they would have made sure that they were all in the same colour.

The concept of involvement is not only limited to their product but also reaches to their personal life of people.

> "To get to know the needs of the customer, but also the customer as a person we ask: "How are things at home? Do you have children? […] When is your birthday?" And all this to enlarge the goodwill factor for us" (C19).

If you know your customer and you customer knows you, you can gain **trust**. Customers know how you work, what your strong points are and they are willing to give you work. They do not have to explain everything to you and they know what to expect and therefore you can gain a lot of freedom as a producer. "The goodwill factor should be very good. And therefore you have to keep contact on a personal level" (C12).

Sometimes, the initiative lies with the customers, because the producers are not familiar enough with the products of their customers. They do not know the products well enough to share improvements, because most of the times it just involves anonymous components instead of complete products. And, as mentioned before costs are always an important concept. According to company 11 customers only have contact when the offered price is too high. "I have made an offer and he wants the price to decline. That is the moment we start to think about the product" (C11).

Level 3

In the next level the initiative and input from customers declines. They ask for a very general solution without providing much input or thoughts of their own. They say "I need something and it has to be something like this" (C6). They ask for a solution instead of a product and they provide a problem instead of a drawing. "Can you drop by? We have a problem that needs to be solved" (C17). This request comes in a lot of variations. Some customers start with nothing and they develop a product together with the engineers of the producer while others have a rough sketch of their initial idea and need feedback about the producability. Some companies enjoy the freedom of thinking together with their customers outside the box. They take great pride in developing new products for their customers and enjoy the distraction from their daily business. The distribution between the different levels depends on the company. Company 3 is specialized in small series and new products. "We are very good at the moment that the customer does not know it anymore". While other companies are careful to attract too many customers that require interaction on level 3. The core business of production companies is to produce products and therefore keep their machines running. If they invest too much time in engineering of new products their production comes to a halt and machines that do not run cost money instead of earn money.

Producers claim that is it difficult to determine how much you should invest, before getting the real order. About the costs of interaction not many strategic considerations were made. Some companies said they had thought about charging the first drawings and solutions that were necessary to make a complete offer, but they omitted it. For some offers you have to do some homework in order to compose a solid offer. This can run op to tens of thousands of euro's.

> "It is often in the building industry that we need to make an offer free of charge, because we first need a part of the concept engineering for the mould. Otherwise we can't calculate" (C9).

Although strict boundaries to the amount of free work are absent, there are some vague borders set. Company 10 claims they go quite a long way, as long as they can earn something. If they cannot earn something, it will end fast. From the sample of this research company 7 was the only company with a clear strategy considering interaction and the associated costs. They divide their customers in four groups, A+ till C, depending on their yearly turnover. If you are in group C, the level of interaction is less. The customer provides a drawing and they make an offer and a price.

> "We believe in strategies that divide customers in A, B and C categories and we believe we are better off with less customers with higher turnovers" (C7).

This even goes so far as they let customers go if they do not reach a minimum yearly turnover level. Although there is no clear strategy present considering interaction and the accompanying costs, there is a tendency to take expected turnover as a baseline.

Level 4

In level 4 we find companies who take initiative and full risks to provide solutions to customers which they did not ask for. "It is our duty to stay ahead in technology. It's fine that your engineers are also interested in this, but the main focus should be with us. We would like to guide you" (C7). There are multiple reasons why companies will apply interaction on this level. First they want to *convince* customers of their technology, second they want to *create awareness* to new technologies and last they want to *educate engineers*. Producers of complex technologies often have to convince their customers of the possibilities.

> "We have to convince the customer, that it is patented, that the process is good, that we have checked everything and we even added an additional x-ray scan to make it visual and understandable" (C7).

Technologies like for example casting or extruding are not new, but there is a lot of misunderstanding about the possibilities. People think for example that certain surface finishes cannot be reached or that casting is extremely expensive. "The ignorance in this sector is very high because they have never worked with it [this technology]" (C14). In order to overcome these prejudices producers choose to make a prototype to convince the customer of the possibilities of their technology.

> "In the end I offered to order all the tooling and if it didn't work out, they didn't have to pay. But if it will work out, they have to pay all. It was an investment of about 75.000 euro but I was convinced it would work. I only could not show it, because it was never done before" (C10).

Other technologies (or materials) are so innovative and new that customers are not aware of their existence. Producers can provide technologies and techniques that are far beyond the scope of their users. Users are not looking for these solutions because they do not know they (already) exist.

> "You have to convince your customer, by taking his place and present him the functions that the model would fulfil and which material characteristics it should have […] And then you see that your customer doesn't know how to react, because there is something in front of him of which he thought was not possible yet" (C7).

Companies can create a business case wherein they compare the original product and their prototype based on costs and functionality. Company 7 explains that they really have to make a tangible prototype to convince their customers. They do this on their own initiative and invite themselves at their customers to present the results. They are willing to go this far because (large) customers demand this kinds of initiatives. In the annual meeting with one of their customers, they and all the other suppliers, are rated on the amount of supplier ideas they have submitted.

Creating awareness of new possibilities is important, but training the engineers of your customer is evenly important. Some, more complex technologies are not familiar to engineers. Some technologies are so complex that minor changes in place- and shape tolerances can make the differences between a feasible and non-feasible business case. If engineers learn to think in certain materials or constructions the more likely they are to use that knowledge which will result to more products based on that specific technology. "We aim at the replacement of other materials […] and we want to promote this material" (C14). Therefore company 14 organizes multi-day training sessions to show what engineers can do with their technology. "In the end, it always has a commercial incentive because it binds customers with our people" (C14).

5.2 WHAT CAN EXPLAIN THE DIFFERENT VARIETIES IN UPI?

The next section focuses on levels 3 and 4 of model 1 because in these levels the initiative shifts from customers to producers. This is a key finding in relationship to the theory of Lundvall (1985). He does not fully recognize the importance initiative and only sees users or customers as a source for innovation. UPI in these levels demand vision and strategy from producers and therefore will provide the most new and interesting insights in the differences between the varieties of UPI. Companies can differentiate themselves the most on these levels. Company 13 describes multiple reasons why they choose to have a high level of interaction.

> "We realise that exactly this kind of developments in the long run, provide work for years to come. And then we think on the one hand it provides us with work, but on the other hand we are allowed to think along, so it's more interesting in production. We can influence sheet metal sizes, how to press break, how to cut, how to design optimally".

By influencing the product, company 13 can optimize the variables for production process, which will decrease failure rate and tool wear and increase their profit. This strongly connects to the statement made by Lundvall (1985, p.5) "Information obtained in relation to production and in relation to the regular flow of products, feed the innovational process". Interaction as described in level 3 or 4 is embedded, till some extend, in the strategy of companies. Companies participating in these levels take a more pro-active role "It is our duty to stay ahead in technology. It's fine that your engineers are also interested in this, but the main focus should be with us. We would like to guide you" (C7).

The extend of interaction and exchange of information depends strongly on the level of knowledge of both customer and producer and the complexity of technology. Multiple interviewees stated that they have to educate their customers. Especially the young engineers. They do not understand the technology and the specifications they should apply. They send in incomplete drawings or ask for technical contradictions. "It can't be that you combine a very strict tolerance with a very high roughness. That doesn't work together. And still you see it happening" (C8).

Model 2 describes in more detail the interaction between customers and producers on level 3 and 4. The right side of the model represents the producers who take the initiative in these levels. In the following texts the concepts that emerged from the data and their connections will be explained.

Most companies have implicit and explicit **strategies**. Some will have a thoroughly worked out strategy which is enrolled in all the divisions, while other will have a vague strategy which is only present in the head of the director.

> "We believe in strategies that divide our customers into four categories and we think that it is better to have less customers with high turnover […] than a lot of customers with lower turnover. […] I could have ten customers of 100.000 euro or one of 1 million. I have to make ten appointments with the whole team to meet up with the customer, or I meet with one customer and I can present our total story and see what we can do for each other on a higher level" (C7).

Business strategies are based on **incentives**. The data revealed a set of four incentives mentioned by one or multiple companies; 1) business expansion, 2) create dependence, 3) decrease workload and 4) improve status. These incentives give direction to their strategy according UPI. "In the end it is important to make profit together. And be so efficient as possible" (C12). Producers help to check drawings, improve products and innovates together with the customer, in order to increase sales opportunities. This will benefit them too, because it creates a new source of income.

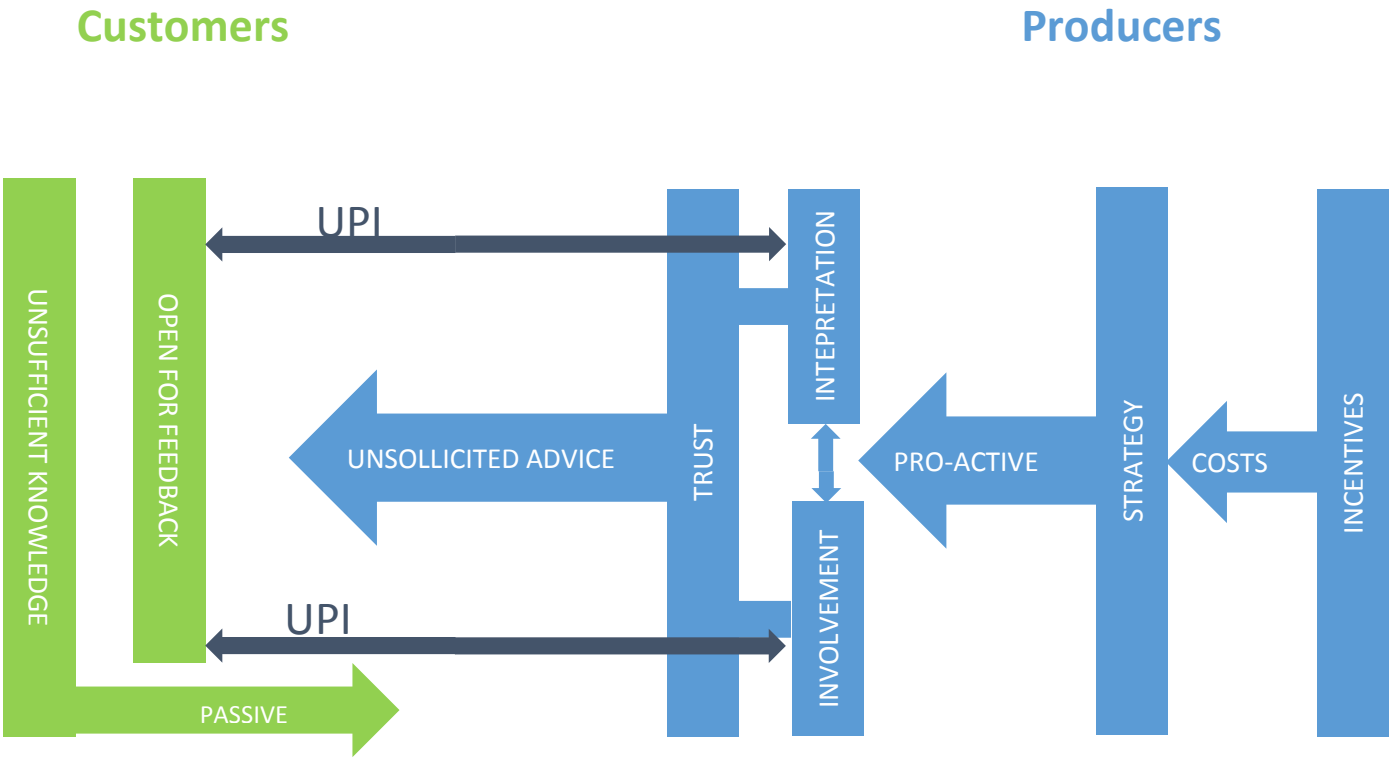


Figure 5.2: Model 2 - a detailed representation of UPI on level 3 and 4

Multiple companies expressed the desire to **expand their business** and improve the relationship to their customer. This can be seen from two point of views. First it can relate to an increase in orders, hence turnover. Second, it can be interpreted as the reinforcement of their collaboration. The optimum form of business expansion was said to be upgraded from producer to partner.

> "First we did assembly work, then they asked if we could repair […]. The repair work led to the production of a single piece and now we run production… and also do the engineering" (C5).

> "We want to be part of the discussion so we integrate more and more with the customer in the primary stage" (C7).

> "We are emphatically looking for companies that see us as their partner, as part of their enterprise. That we are part of their production. Really part of their production chain" (C13).

The following incentive has a close relation with the business expansion. Intensifying the relation between producer and customer can **create dependence**. Dependence can be based on e.g. knowledge, stock or investments in machinery and tools. A customer is less inclined to leave a producer if he is highly depending on them. Producers can increase this dependence by withholding crucial process innovation. "What we do with our machines, we don't share" (C8). Dependence can also be created on a personal level. There are not many people who have to nerve to leave a producer who put a lot of effort in their product. It feels like a moral obligation to stay with this party. Hence, none of the interviewees were concerned about customers premature leaving before the deal was closed.

> "First we were their supplier, now we are their partner, because we do all the engineering. We have a lot of influence and therefore a certain level of security [..] they need us" (C5).

The third incentive mentioned is to **decrease the workload**. Multiple companies stated that it is helpful if users will learn from their previous flaws or mistakes and deliver input of higher quality. Some companies try on the one hand to improve the input from their customers and on the other hand decrease the workload for their back office both by providing technical background information on their website.

The former three incentives are applicable to existing customers while the last one is more relevant for attracting new customers. By sharing knowledge and therefore exposing their expertise, they would like to **improve their status** to attract more customers. “We want to look confident, like we know it all” (C1). Some companies do this actively while other companies are more passive at this point. A number of interviewees indicated that they were involved in voluntary trainings and lectures to spread their knowledge and to increase their level of authority.

In order to achieve those incentives, **costs** need to be made. The allocation of those costs is stipulated in their strategy. “At first sight other companies are less expensive, but if people get to know us, they only want to work with us” (C5). Companies that think along with customers and provide already an initial solution to their problem in the offer process are initially often on a higher price level than their competition. However, when customers get to know the producer and do more projects together, they will value their extra input and do not get scared away of a (slightly) higher price. Some companies use contracts to ensure their costs, others work preliminary on trust.

> “This is a nice example of innovation that we have reached by using each other’s knowledge and that we are open for collaboration without having a contract on the table with the costs of each hour” (C13).

Companies that recognises the importance of interaction are looking for long term relations with customers that are not bound by contracts. Based on their strategies, companies that interact on level 3 and 4 of model 1, will have a **pro-active** attitude towards their customers. Their pro-active attitude can be focused on their current project, or can be deployed to look for additional jobs. By looking at the current workflow and product portfolio of their customer new possibilities can emerge. For example one company noticed that their customer was making extra holes in products by hand and suggested to take over that job. It took their customers three hours, instead of the half our they needed. The pro-active attitude of producers is characterized by their willingness to look further that the initial request. They want to sit down with the customer and discuss the complete project from design to producability and they are actively involved at decreasing costs. The more complex the technology is, the higher expectations customers have regarding being pro-active. They state that it is the task of producers to stay ahead on new technological developments. Sometimes producers are fully convinced of their solutions that they offer to pay the initial costs with no risk for the customer.

> “In the end I offered to order all the tooling and if it didn’t work out, they didn’t have to pay. But if it will work out, they have to pay all. It was an investment of about 75.000 euro but I was convinced it would work. I only could not show it, because it was never done before” (C10).

In order to give (unsolicited) advice you have to **get involved** and know your customers, and their customers. You have to know what is important to them. Do they prefer quick deliverance, low costs or high quality? What markets are they targeting? What are the problems that they experience with your current products. It is sometimes pretty difficult to find the real need of your customers because the purchase manager you speak is not always the same person who handles the product and experiences the problems.

> “Each time our products were delivered, the first thing the people in the production did was shortening the shackle by grinding it in half and welding it back together. And it turned out they were already doing this for three years. I asked them why? “Well this

> shackle is too long". But you could have asked us to make the shackle a bit shorter!? "Oh well, yes that would be a possibility"" (C10).

In this case their contact person was not aware what was happening in his own factory and did not notice all the superfluous work. If you know your customer you can think ahead for them and give them unsolicited advice that will be appreciated. A high level of involvement will gain you **trust** and valuable information. "Doing business all revolves around trust" (C3). Producers should have an open relation to customers and strive to that level of trust that customers have faith in their knowledge and problem solving skills, so they will trust their opinions and give them freedom to perform at their best. Some customers work with a Non-Disclosure Agreement (NDA) which is a contract that prohibits the producer to share or use information given by the customer. None of the interviewees found that NDAs influenced interaction.

Information gathered from customers' needs need **interpretation** because customers on level 3 or 4 are most of the times not aware of their problem and therefore have no specific question or need. The interaction between involvement and interpretation provides input for **unsolicited advice.** Based on their technological knowledge and years of experience producers see opportunities to make products cheaper or better. This advice can shaped in the form of knowledge or physical products like prototypes and materials. "We try to give them extra knowledge, but also present a finished product" (C7). This can be presented as a business case or a supplier idea.

Producers can send valuable information to customers but successful implementation depends on the attitude of customers towards this unsolicited advice. The data showed that not all customers are **open to feedback**. "We let them know, but if they don't want to listen we make it like they want it" (C5). Their reluctance to unsolicited advice can be translated into multiple barriers, like liability, attitude and underlying processes.

Users are often afraid to proceed with new technologies and solutions. This can be traced down to **liability**. If you try to change a good working product into a better working product, there is a risk it will fail. Not all people that work at the customers' firm are willing to sign their name under these kind of processes. They do not want to get involved in any potential problems.

> "I would have liked to sit down with somebody of the production so we can think together about a solution. But they refused it. No it is on your risk, you have to figure it out yourselves" (C9).

Sometimes people are willing to try something new but they are held back by practical reasons. A company made a prototype with a new and optimized internal cooling channel structure. This changed the flow of air and therefore new technical calculations were needed. Because the system was so new, there were no suitable calculations yet available. And although the engineer saw the benefits, he was not able to proceed because he could not calculate the risks and therefore could put his approval on it. If you work with multiple parties each contributing to product innovation, grey areas may arise, where it is difficult to determine who was responsible for that particular part that failed.

> "In this case it had a negative impact. The original concept was no good. [..] We changed some things, but we should have started over again" (C9).

Other often overlooked risks of a pro-active attitude towards UPI are the **underlying processes** in the production chain. If you do not know your customer well enough you may invest in a solution that does not fit their chain of process. For all different reasons customers are not able to make changes in their product even though they can clearly benefit from it. Some end-users, like governmental institutions prohibit changes to their products. Other products are subject to strict test certificates and may not be changed without redoing the whole certification process. Another reason why improvements are turned down is that customers cannot free resources to redesign the product and start a new validation process. One company describe a case that, even though both parties agreed on the

technical solution, “an offer you can’t refuse” (C7) the user could not implement it and chose willingly for the old, 30% more expensive solution.

> “Larger customers don’t want to adapt their technical drawing, because they can’t overlook the impact. If we change one dimension, what will that do to the rest of the system?” (C8).

Another result that emerged from the data was the **attitude** of some users. This can be connected to insecurity “He just don’t get it and doesn’t want to admit it. He says yes, I understand it, but in the end he clearly missed the point” (C15) or stubbornness. Producers know the possibilities and limitations of the technology. Still they do not always get the chance to give suggestions in order to improve the overall quality of the product. Customers are sometimes too stubborn to listen. “If they had tested their product and followed our advices, this [problem] could have been prevented” (C1).

Seen from a producers point of view, users have insufficient (technological) knowledge and therefore have a **passive** attitude. They lack input and preparation and rely heavenly on the producers. Company 9 is asked to make a mould based on drawings of the finished concrete product. They do not get any input about the mould itself. The customer keeps them responsible for the engineering of the mould and is only interested in the concrete product that can be made with the mould. This is also recognized by company 3. “They get a specification, but they really don’t care, as long as it works”.

> “I think it is all very easy-going. In the past they sorted all the steelwork, nowadays you get all the files of the entire project and you have to sort out your own information. […] 300 PDF drawings at once, while I only need 10 of them” (C17).

According to the producers, this passive attitude is due to a combination of **unsufficient (technological) knowledge** and lack of time. There is a high turnover of people, where experienced engineers are replaced by graduates. They lack (practical) knowledge and experience. Producers have to educate them, especially when they provide a complex technology. “20% has never seen it before and maybe 80% has only some knowledge of our technology” (C4).

Customers are not always aware of possibilities to improve their product or process and therefore they can miss out on interesting opportunities that could differentiate them from competition. If producers know their customers, they can provide them with valuable knowledge. If customers are open for feedback, both customer and producer can benefit.

> “If customers would take more time to sit down with their production partners and are not afraid to go back to the drawing board, they will have a better product in the end” (C1).

> “Traditional supplier – customer relations are going to disappear. It will be about collaboration, collaboration, collaboration” (C4).

5.3 THE NEGATIVE SIDE OF UPI

Some companies commented about the battle between **improving the product** for your customers and the **retaining of production activities**. What should you do if your customers demand lighter product and you charge them by the kilo? One company confessed that, in the spur of the moment, they advised an easier and cheaper way of production that led to structural loss of work for their company.

> “ I was talking to the purchase manager and told him you could better divide your product in multiple parts, so the [..] process is easier. “That’s a good idea. Why haven’t we done it

> before?". And since that moment I haven't done any [work] for them at all. I could have kicked myself" (C18).

Another, often heard struggle was the **alternation of people**. With replacement of the old technical staff by young people, fresh from college a lot of knowledge leaves a company. In some cases this can result in situations where the MTO company is not aware of the possibilities and impossibilities of their own production facility. Company 15 describes a situation whereby their contact person was not experienced enough to get all the technological details right, while the people who had to work with their product were not educated enough to think along on a more abstract level. Producers rely sometimes on input of their customers, but it turns out, this input is not always usable. Producers fear the moment their contact person leaves the customer, because they risk losing all their precious build up trust and privileges. It appears that UPI in practice is only conducted on personal level and not at company level. "It is really dangerous for us if contact persons at big companies leaves. […] Because they don't share our history. They can very easily change to another producer" (C15).

Most companies strive to a very close relation with their customers to create a level of mutual dependence. Hence, a **too close relationship** can cause friction, because it is difficult to determine where the collaboration ends and the buyer – seller relation starts.

> "Sometimes you are so intertwined, you're about to lose feeling with the market. What is competitive? There should be a healthy distance between both parties. In the end you are still client and supplier. […] We would like to do a lot together, but on the other hand they need a low price while we would like to do business" (C13).

UPI is defined according to Nahuis et al (2012) as "an interactive learning process between users and or producers leading to or aiming at the reduction of uncertainty about the relation between product and demand characteristics" (p. 1122). This interactive learning process implies that both users and producers should learn. From the data the concept of **one-way learning** arised. All companies were asked whether they had learned from their customers and what they did learn. The majority, said they had not learned anything from their customers. "It may sound arrogant, but ehm No [we do not learn from our customers]" (C10). This can happen if the knowledge level of producers is (much) higher than the knowledge level of customers. Some stated that although they had not learned something about the technology, they had indeed learned something about the market and the customers of their customers. Only a few companies indicated that they, sporadic, did learn from their customers.

> "We make bridge railing and there was a man working at our customer who had a lot of knowledge of bridges. He could tell us exactly why something was like it was. [..] We are lucky with our clients, they like to teach us something. They grant us that" (C5).

> "It [learning] happens sometimes, but not that often. It is more the other way around. The customer brings less knowledge or practice but would love to gain some of ours" (C3).

All the above situations have a negative influence primary on producers. The following one effects the customers negative, according to the producers. Some, often large, customers do not want to be reliable of one supplier and therefore work with **multiple suppliers**. This situation can lead to several problems concerning technological information sharing. Therefore, it is impossible to receive two exactly the same products if producers do not share their process information, or even worse, do not know of each other existence. "Please put the two co-suppliers of your choice together and do all the smart things together" (C8).

Producers often do not mind sharing product innovations, but are hesitated in sharing process innovation because that is their way to gain profits. "The experience you have in processing the material, you keep to yourselves" (C7). One company described a knowledge leak whereby innovative solutions first flowed to their customers and from there leaked to other producers.

6. DISCUSSION

The article of Lundvall (1985) is considered as a seminal work on UPI. It served as an excellent starting point of my research. This article is also the background of my discussion. The scope of both researches have similarities but also differences. Both my research as the paper of Lundvall have an exploratory character. Lundvall tries to "demonstrate the usefulness of applying a user-producer perspective to innovation"(p. 1) while my research takes one step back and tries to map and explain the different varieties of UPI and understand their variety in relation to the company's objectives and strategies. Lundvall depicts producers mainly as artefact producers while my focus is specified to MTO component producers, where process innovations are a key aspect. Nonetheless we both focus on the professional user instead of consumers. Lundvall focuses on product innovation as a result of innovation activities, where products should be seen as complete artefacts consisting of multiple parts. Process innovation is considered to be only for internal use. MTO component producers are not involved in the actual innovation of the artefact. They innovate at part and process level. MTO component producers focus on the parts (of products) they produce, hence their innovative additions are focussed on producability, production costs and dimension tolerances and do not reach to the function of the final product. They, for example, know the limitations of laser cutting concerning tolerances and therefore suggest an alternative technology that could reach the requested tolerances. Hence, they do often not know if the requested tolerances are necessary for the final product

However, my research revealed some results that add a deeper understanding of the statements made by Lundvall. In this discussion I will highlight some of my results and compare them to his. The main theoretical contributions of my research are 1) the different levels of UPI, 2) the concept of initiative, 3) task-oriented collaboration 4) UPI on personal level and 5) the negative sides of UPI.

Different levels of UPI

My research revealed four distinctive levels of interaction. Each with their own criteria and output. These levels of UPI are to some extent embedded in the strategy of producers. Level 1 does not require much strategic input, while interaction on level 4 is accompanied with large amounts of time and money and therefore is embedded in the strategy of producers. Such a strategy could entail a dedicated budget for interaction and innovation related to the annual expected turnover of the customer. Multiple levels of interaction can be available in one company, because the unit of analysis is the interaction between one customer and their producer. Lundvall does not recognize different levels of UPI and also does not go in to the possibility that multiple levels of interaction can be available in one production company. Each level of UPI has its own producer incentives. Lundvall describes that costs and effort are always involved in obtaining information about user needs. What those costs and efforts entails and which underlying strategic thoughts are available stays unclear. The concepts of involvement, trust and interpretation provide more detailed information about the efforts that need to be made in order to gain information about user needs. My research adds more insights in the multiple roles and incentives producers could have in combination with the different levels of UPI and refines the concept of efforts with the notion of involvement, interpretation and trust.

Initiative

The four levels of UPI in model 1 are based on the concept of initiative. In level 1 all initiative lies with the user and this shifts gradually till in level 4 all initiative comes from the side of the producers. In higher levels, where more innovation takes place, customers are considered more passive. Which is represented in their lack of initiative. This seems to contradict the following statement of Lundvall. He

expects that the professional user is active in his search for new ways to solve his problems and that they are willing “to adapt their behaviour and qualifications when new technical opportunities come forward” (p. 5). From this we can conclude that the behaviour and attitude of customers towards searching for and adapting of new technologies varies in different sectors and circumstances. This particular statement of Lundvall therefore cannot be seen as a general statement and is not applicable in the case of MTO component producers.

It is also interesting that Lundvall never mentions the pro-active attitude of producers as a part of UPI. The analysis of Lundvall relates to the interaction between units innovating and other units, therefore suggesting that only one party is involved in innovation activities. He describes a process wherein producers monitor and observe the actions and progress of their users and wait till new possibilities pass by. This indicates that the initiative is with the customers while in level 3 and 4 of my model the initiative is clearly with the producers. “Relating technical opportunities to user needs involves a logical problem” according to Lundvall (p. 4). This could be the reason why producers on level 4 turned things around and took the initiative by not looking for user needs, but presenting technical opportunities that could fulfil potential user needs that users were not yet aware of. Instead of following the developments of their customers they propose new solutions and technologies that steer customers in a certain direction. Customers provide an initial set up with their request but deliberately leave room for the producers to suggest suitable process innovations. Customers strongly rely on the knowledge and capabilities of producers and producers take the opportunity to improve the process for two main reasons. One the one hand, producers invest in process innovation in order to create better products for their customers. On the other hand, they take the initiative so they have the possibilities to steer the production process in such a direction that in fits their own internal processes and decrease their internal costs, thus being able to decrease selling prices while maintaining or increasing gross margin. In this case, both parties could benefit from this peculiar form of UPI.

The concept of initiative is the central concept of my results and adds a whole new perspective to the theory proposed by Lundvall. It would be interesting to know if customers can recognize themselves in these four levels and if these levels are also applicable outside the Dutch steel processing industry. One should keep in mind that my findings are biased because the opinions about customers is solely based at the point of view of producers. Additional research based on the customers point of view could yield more insights about their supposed passive behaviour.

Task-oriented collaboration

Both Lundvall and my research emphasise the importance of interaction when innovation takes place. However we differ on the scope concerning innovation. Lundvall solely focus on product innovation while innovation within MTO component producers entails innovation on process and part level and is strongly intertwined with technological possibilities and limitations. The emphasis for MTO companies lies on knowledge exchange and interactive learning concerning processes and technologies in order to build knowledge together about one specific task.

Because both parties can benefit from optimized production processes, the aim of UPI in the context of my research is task-oriented collaboration. This can be described as users and producers working together to solve one specific problem. This can for example be connected to the cost price of the product, the dimension tolerances or the durability of the part. When customers know how the production process is set, they can fit their design choices to the production process which can result in lower production costs or better products. Likewise, when producers can influence the design decisions of their customers, they can avoid e.g. product failure, tool wear and long preparation time. Both parties are working together to a mutual goal, each based on their own expertise.

UPI on personal level

It takes a lot of effort and costs to create relationships and build channels of information between users and producers. Therefore Lundvall believes that once these relationships and channels are realized, they will last. Unfortunately this is not the case in my research. Although changing suppliers could have negative effects for customers, some do not hesitate to change. Especially when it concerns standard technologies in combination with a cost focus. Producers would like to achieve interaction at company level, whereby exchanged knowledge and information is evenly distributed along the whole company. The results show that this is rarely the case. Multiple producers feared the leave of their contact person because it will endanger their precious built up relationship with their customers. Once their contact person is exchanged for someone else, the process of UPI and creating a relationship starts all over and the possibility exist that the new contact person favours another producer. My research revealed that UPI is mostly limited to personal relationships and does not often exist on company level. This should be taken in account concerning company strategies about UPI. Based on my research, two lines of strategy can be considered. First, producers should pay special attention to changes in staff at their customers' companies and actively introduce themselves with their new contact persons in order to (re)establish their existing relationship. Second, they can try to improve and increase their relationship, and have personal contacts with multiple employees in order to spread their knowledge and added value through the company. Further research could gain more insights about strategic options to upgrade UPI from personal level to company level.

The negative sides of UPI

Lundvall emphasizes on the positive effects of UPI for producers as well as users. The only critical notes concerning UPI are seen from an users point of view. Lundvall mentions the unbalanced relationship wherein producers have too much influence and therefore can make too optimistic promises and the rise of unsatisfactory innovations which don't live up to the customers' expectations. My research revealed a number of negative effects of too much UPI for producers. First, if producers get too interwoven with their customers it is difficult to determine where the collaboration ends and the buyer – seller relation starts. Second, they could find themselves in a moral battle between improving the product or retaining production activities. Third, is the concept of one-way learning. Although UPI can be defined as an interactive learning process, producers do not get knowledge in return for their input. In addition to Lundvall another negative effect for customers emerged. Whenever customers work with multiple suppliers, which is often the case with MTO component producers, knowledge is not shared between them which lead to non-identical products. There is interaction and interactive learning between one producer and the customer, but there is no such relationship between the two producers, who in the end should be able to deliver identical products. Information about process innovation should be transferred from one producer to another, but since they do not interact, this knowledge exchange depends on the customer, who is often not capable of discussing process innovations in detail. Next to that, producers often do not reveal process information and deliberately keep the details for themselves. In an ideal world, all the producers involved in producing the same component should combine their power and knowledge in order to create better products. Unfortunately, this is currently not the case in this sector. Customers who regularly work with multiple suppliers for one product should be aware of this risk and implement measures in their strategy to improve interaction among co-suppliers.

To conclude, the original theory of UPI proposed by Lundvall needs some additions to suit my specific case of MTO component producers in the steel processing industry. These additions provide a better understanding of the interactions that take place. The introduction of the concept initiative delineates UPI into multiple levels whereby in contrary to the theory of Lundvall the producer plays an important role in the interactive innovation process. Model 2 provides a more detailed insight in the costs and

incentives of producers and matches this to their strategy. These topics are briefly noted by Lundvall but lack in-depth information. UPI takes place through channels of information which are costly to build. Lundvall therefore expects that these relationships between companies once firmly established will last a long time. Unfortunately this is not the case for MTO component producers because UPI takes place at personal level and not at company level. The final addition is a critical note about the negative sides of UPI. Too much UPI can work against producers.

Limitations

However, there are some limitations to this research. First one should be aware that the research is done from a producers point of view. Results and concepts that describe customers are based on their opinions. Research from a customer point of view could add some interesting insights to the results. Next the generalizability of this explorative research is limited. It is based on a small sample of Dutch MTO component producers with very divergent characteristics. For this particular case saturation was reached and yielded theoretical reliable results for Dutch MTO companies in the steel processing industries. Generalizations beyond the Dutch companies or other type of MTO companies has not been made yet. Further research could verify and expand the results from my research and give more insight whether characteristics like age, size and level of technology would influence the different types of UPI available.

7. CONCLUSION

The main research question of this thesis is: "*Which varieties of UPI exist among MTO component producers and what explains these differences?".* In order to answer this main question, two sub questions are proposed.

The first sub question: "W*hich varieties of UPI exist among MTO component producers*?" can be answered by model 1. The model shows four levels of interaction. Level 1 describes a situation that can be summarized as 'you ask, we deliver'. The initiative lies with the customer. They send in an order and the producer delivers it to specification. Interaction on level 2 shows some more initiative from the side of the producers. They provide, often unsolicited, feedback to improve the product based on their technological knowledge. In the next level, level 3, the emphasis lies on the initiative of the producer. Customers ask for a solution instead of a product and they provide a problem instead of a drawing. In order to interpret this question a producer should know his customer and their business. Within this level the amount of investments like thinking along, re-designing products and adjusting drawing differs greatly. The last level describes the situation wherein producers take full initiative to provide their customers with new solutions, materials or technologies without any question from them. This is mostly done in the form of business cases. Customers are not looking for these solutions because they do not know they (already) exist.

In order to explain the differences in these levels and therefore answer the next sub question the second part of the result section zoomed in on levels 3 and 4, because from a producers point of view, they ask the most input and strategy. Interaction is an interplay between the producer and the customer. Each player has their own set of motives and incentives. Producers are willing to put effort and money into interaction for multiple reasons. First they want to expand their business to get more orders or to strengthen their relationship with their customers. Next they would like to create some level of dependence of their customers. This dependence can be based on knowledge, moulds, machinery or at moral level. Not many people dare to turn their back after a producer helped them to solve their problem. A third reason that was mentioned by producers was the decrease of workload. If they educated customers about their technology and delivery specifications, it could save them time in the production preparation. The former three incentives are applicable to existing customers while the last one is more relevant for attracting new customers. By sharing knowledge and therefore exposing their expertise they would like to improve their status to attract more customers. The success of UPI depends on the willingness of customers to receive and apply feedback. The data showed three reasons why customers refuse to take the advice from producers into account. Liability, underlying processes and attitude. Liability refers to the fact that customers are afraid to change things and be held personally accountable for problems that may occur. Products, especially on a component level, are part of a larger production chain. Changing one aspect can influence the whole chain with their underlying processes. Apart from all the practical barriers, the attitude of customers was mentioned the most. Some customers are just not interested.

The findings of my research implicate that producers can benefit from UPI if they have the right information. This can be secured by a high level of involvement. Producers have to know their users. Often this implies high investments of time and risk on the side of the producers. They have to share their (technological) information and trust on the reliability of their customers. They have to step up and convince their customers of their expertise and added value, sometimes by providing free prototypes and business cases. UPI can be the solution to differentiate as a producer in the strongly occupied playing field to attract and bind customers and create a pleasant work relation.

Based on my findings I propose the following hypothesises that should be tested in further research with a larger sample.

H1. UPI is more beneficial if the gap in (technological) knowledge between customers and producers is large.

If the knowledge level of the customers is equal to the level of knowledge of the producers there is no need for interaction. Customers do not want to waste valuable time on discussions and producers cannot add any new information that will improve their image. If the producer is ahead of the customer on technological knowledge, the customer will notice and be open for discussion so both parties can benefit.

H2. UPI is less successful for MTO producers if customers are cost oriented.

Companies that are cost oriented buy their products from the cheapest supplier. They are not looking for any long-term commitments and they have no problem switching producers. They only focus at the cost in the purchase process and have no eye for additional costs that could have been prevented by UPI.

H3. UPI requires a dedicated budget in order to yield results.

Producers have to be selective. They cannot give every customer the same amount of attention because the costs will outweigh the benefits. They need to have a vision which needs to be translated into a strategy with complementary budgets in order to be able to execute the right level of UPI.

H4. UPI can only be successful if involvement and trust is available among customers and producers.

Producers have to trust their customers and customers have to trust their producers. A producer invests a lot of time, money and knowledge in a customer and he has to know that the customer will not leave before the order is signed. Customers on the other hand, have to feel free to share classified technical information of their product and clients in order to receive appropriate advice.

H5. UPI increases the loyalty of customers and therefore increase the turnover of producers.

If both parties know each other and can count on each other, a long-term relation can develop. This implies less expenses on acquisition, more certainty and therefore higher turnover.

H6. UPI takes place on personal level, not on company level.

UPI is about interaction between people, not companies. Often when a contact person leaves the company most connections are gone. Although producers aspire a commitment on company level, the reality is that it depends on the people they interact with on a personal level. Knowledge and input from producers is not evenly distributed through the company of the customer.

One of my initial goals was to gain some attention of innovation scholars for the ‘ordinary’ companies, like the steel processing companies that are still an important part of the Dutch economy. I hope that this thesis inspires scholars not to look only at the ‘extraordinary cases’ and that this will lead to more research in this area that could complete the theory of UPI and MTO component producers. These hypothesis could serve as a starting point for further large scale quantitative research.

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This thesis is the final piece of my master Science and Innovation Management at the University of Utrecht. At the start of my master I had one main goal as an owner of a small designing company. Implementing innovation management into my daily business and making it tangible for the companies with whom I work. I strongly believe that innovation is not only a thing for high tech fast growing companies, but can be interesting for all companies. The subject of UPI proved to be an interesting starting point to investigate the MTO component producers in the Dutch steel processing industry and created an interesting and relevant case for my thesis.

Without the help of some people, this thesis could not be written.

First, I would like to thank all participating companies for their precious time and their trust. You were very open and elaborate in answering my questions and provided me with much useful information that lead to the construction of the two models describing UPI in your sector. Without your help it was not possible to gain insights in such detail. You inspired me to look at your companies and the sector from another perspective and I sincerely hope that the results of this research would inspire you to do the same.

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IMAGE CREDIT

Figure 2.1 composed of:

http://www.s-5.com/clamps/index_71.cfm

http://www.allround-printing.nl/zeefdruk.html

http://www.cadcamatic.be/functions/listd406.html?Lid=10&pnav=;29;&item=36

https://www.machinetools.com/en/companies/1852-henri-azaria-pal-ltd

APPENDIX 1: INTERVIEW OUTLINE

0. Interview outline

Allereerst bedankt dat u tijd heeft vrij kunnen maken om deel te nemen aan dit onderzoek. Zoals ik al in de email had aangegeven ben ik bezig met mijn thesis voor de Master Science and Innovation Management aan de Universiteit van Utrecht. Naast mijn studie ben ik fulltime ondernemer in de techniek. Mijn werktuigbouwkundige achtergrond heeft mij dan ook geïnspireerd om onderzoek te doen naar de toeleverende staalbedrijven. Doel van dit onderzoek is om te onderzoeken hoe en op wat voor manier er interactie is tussen klanten en bedrijven en in hoeverre deze interactie kan worden ingezet om innovatie te stimuleren. Hierbij kijk ik speciaal naar staal bedrijven die geen eigen product hebben en dus volledig toeleverancier zijn.

Alle resultaten zullen vertrouwelijk en geanonimiseerd worden behandeld. Ik zal niet bekend maken welke bedrijven mee hebben gewerkt aan dit onderzoek.

0.1 Hoeveel tijd heeft u beschikbaar?
0.2 Heeft u er problemen mee dat ik het gesprek opneem met mijn telefoon zodat ik het naderhand rustig kan uitwerken?
0.3 Als u tussendoor vragen heeft dan kunt u die gewoon stellen.
0.4 Ik heb een aantal vragen voorbereid, maar mocht u zelf nog onderwerpen hebben die van toepassing zijn op dit onderzoek dan hoor ik dat natuurlijk graag.

1. Algemene gegevens (algemeen)

Ik zou graag willen beginnen met wat algemene vragen over u en het bedrijf.

Persoonsgegevens

1.1 Wat is uw naam?
1.2 Wat is uw huidige functie?
1.3 Wat houdt deze functie in?
1.10 Heeft u in uw huidige functie veel klantcontact?
1.4 Welke functies heeft u nog meer gehad binnen dit bedrijf?
1.5 -

Bedrijfsgegevens

1.6 Wat is het gemiddelde opleidingsniveau in het bedrijf?
1.7 Hoe groot is het bedrijf?
1.8 Wat is de verdeling (%) tussen kantoor en productie?
1.9 Hoe oud is het bedrijf?
1.11 Is het een familie bedrijf?

2. Technologie (algemeen)

Ik zou nu graag wat meer willen inzoomen op de werkzaamheden die het bedrijf uitvoert en de producten die u levert.

2.1 Wat doet het bedrijf? Wat levert het bedrijf?
2.2 Welke productietechnologieën biedt u aan?
2.3 Wat de hoofdtechnologie / core business?
2.4 Zijn er veel bedrijven die dezelfde werkzaamheden / technologieën aanbieden?
2.5 Waar beginnen de werkzaamheden binnen dit bedrijf?
- Ontwerpen
- Tekenen
- Construeren
- Sterkteberekening
- Materiaalkeuze
- Offerte voor productie

2.6 Waar stoppen de werkzaamheden?
- Levering onderdeel
- Levering assemblage
- Prototype
- Oppervlakte behandeling
- Afmontage (monteren van inkooponderdelen zoals bedrading, lampen, accu's)

Innovatieniveau

2.7 Hoe innovatief vindt u uw bedrijf?
2.8 Bent u meer of minder innovatief als uw concurrenten?
3.8 Heeft het bedrijf een aparte afdeling verkoop? Of heeft iedereen evenveel klantcontact?
3.19 Hoe verloopt de kennisoverdracht tussen afdeling verkoop en afdeling werkvoorbereiding?

3. Klantcontact (algemeen)

Klantomschrijving

3.13 Hoe ziet u ideale klant eruit?
3.1 Heeft u veel vaste klanten of veel eenmalig klanten?
3.2 Zou u mij een omschrijving kunnen geven van uw gemiddelde klant?
- Aantal werknemers
- Branche
- Industrieel / Consumenten producten
- Producent / Engineering / Toelevering

Kennisniveau

3.16 Wat is het kennisniveau van uw klanten over uw productie techniek / mogelijkheden?
3.17 Wat doet u eraan om het kennisniveau te verhogen?
3.22 Komt u veel misverstanden tegen over uw werkzaamheden / technologische mogelijkheden?

Achtergrondinformatie

3.20 Weet u altijd waar het product wordt toegepast / voor wordt gebruikt?

Klantcontact

3.3 Hoe houdt u contact met uw klanten?
3.18 Hoe vaak heeft u contact met klanten?
3.21 Zou u uw omgang met klanten formeel of informeel noemen?
3.4 Wie neemt het initiatief om contact op te nemen?
3.5 Maakt u onderscheid tussen klanten op het gebied van service / interactie?

Betrokkenheid

3.9 Welk type klant moet u het meeste adviseren?
3.10 In welk stadium worden jullie vaak betrokken bij een project?
3.11 In welk stadium zouden jullie graag betrokken willen worden bij een project?

Beleid

3.6 Heeft het bedrijf een beleid omtrent klant contact?
3.7 Hoe belangrijk vind u klantcontact?
3.12 Heeft u ook aanvragen of producten waarvoor u geen offerte schrijft?

Geheimhouding

3.13 Hoe vaak heeft u te maken met geheimhoudingsverklaringen?
3.14 Beinvloeden deze constructies de interactie met de klant?
3.15 Verzwijgen klanten weleens informatie?

7. Serie versus Prototypes

7.1 Wat is de gemiddelde serie grote bij jullie?
7.2 Maken jullie ook prototypes?
7.3 Wijken aanleverspecificaties af bij prototype?
7.4 Zit er verschil tussen interactie met klanten bij uitgewerkte producten en prototypes?
7.5 Hoe ver gaan jullie met het meedenken met prototypes? Er bestaat immers een risico dat de vervolgserie niet bij jullie wordt gemaakt?

4. Klant contact (Klant-producer koppel)

Omdat het klantcontact verschilt per klant zou ik u willen vragen om één van uw vaste klanten in gedachten te nemen. U hoeft mij geen bedrijfsnaam te noemen, maar ik zou u graag een paar vragen willen stellen over de samenwerking.

Algemene omschrijving

4.1 Kunt u deze klant omschrijven?
- Leeftijd
- Omvang
- Producttype
- Duur van relatie

4.2 Kunt u omschrijven hoe het offerte aanvraag traject verloopt?
- Aanlevering bestanden
- Frequentie van contact
- Via welke kanalen
- Detail niveau gegevens offerte aanvraag (materiaal, toleranties)

Klantcontact

4.12 Hoe verloopt het eerste contact met nieuwe klanten?
Mail, telefoon, bezoek
4.13 Zit er verschil tussen klantcontact met nieuwe klanten of bestaande klanten?
4.9 Voorziet u nieuwe klanten standaard van technische informatie m.b.t. jullie productiemethoden? Soort van handboek?

Missende gegevens

4.6 Staan alle benodigde gegevens altijd in de aanvraag of op tekening?
4.7 Zo niet, hoe gaan jullie daar mee om?
Eigen interpretatie, of gelijk contact opnemen?
4.8 Stel jullie maken een paar aanvullingen of wijzigen een paar dingen. In hoeverre koppel je dit terug naar de klant?

Offertetraject

4.3 Zijn er afspraken gemaakt over aanleverspecificaties?
4.4 Hoeveel werk heeft u aan een offerte aanvraag?
4.14 Hoe vaak komt het voor dat er wijzigingen optreden in een offerte?
4.15 Hoe signaleert u deze wijzigingen?

Investering

4.10 Bent u niet bang dat u kostbare tijd en informatie weggeeft aan klanten met het risico dat het geen order wordt?
4.11 Heeft u dat in het verleden al eens meegemaakt?

Evaluatie

4.5 Neemt u na levering nog contact op met uw klant om de geleverde producten te evalueren?

5. UPI (Klant-producer koppel)

5.15 Wat verwachten klanten van u (wat betreft meedenken)?

Kennisdeling

5.1 Deelt u veel technische kennis met klanten?
5.16 Waarom deelt u informatie met klanten?
5.33 Is dat een bewuste keuze? Staat dat in het beleid?
5.39 Nodigt u wel eens klanten uit bij u op het bedrijf?
5.18 Welke klanten moet u het meest adviseren?
5.2 Wijst u klanten op nieuwe innovaties / productiemogelijkheden?
5.3 Wijst een klant u op nieuwe innovaties / productiemogelijkheden?

Product / Proces innovatie

5.36 Ligt bij u de nadruk op product innovatie of proces innovatie?
5.37 Deelt u product innovatie met uw klanten?
5.38 Deelt u proces innovatie met uw klanten?

Bereidheid

5.4	Heeft uw klant vaak hele specifieke eisen / voorwaarden / toleranties waar u zich eerst op moeten inlezen/voorbereiden?
5.21	In hoeverre helpt u een klant met opstarten / inrichten als ze hele specifieke eisen hebben?
5.22	Hoe ver gaat u voor een klant als de aanvraag nog geen order is? Zijn daar interne afspraken over gemaakt?
5.8	Ziet u meedenken als een kostenpost of als een service?

Risico

5.24	Bent u niet bang dat u een klant heel veel informatie en advies geeft en dat hij vervolgens bij een concurrent het product besteld?
5.25	Is dit wel eens gebeurd?
5.26	Heeft dit invloed gehad in uw huidige interactie met klanten?

Leermoment

5.5	Heeft u iets geleerd van deze klant (of andere klant) wat u nog steeds toepast of zelfs inmiddels ook bij andere klanten toepast?
5.32	Geeft het geen problemen om oplossingen van één klant bij een andere klant in te zetten?
5.17	Van welke klanten leert u het meest?
5.11	Geeft u wel eens ongevraagd advies aan klanten?
5.12	Hoe reageren ze daar op?
5.6	Heeft u iets aan uw klanten geleerd wat ze nu vaker toepassen?
5.15	Van wie leert u het meest? Klanten, leveranciers, concurrenten?

Te weinig interactie

5.7	Kunt u een situatie herinneren waarbij extra klantcontact / informatie / interactie heel veel vertraging / kosten had kunnen voorkomen?
5.16	Waardoor is deze situatie ontstaan? Onwetendheid, onkunde, bewust achterhouden van informatie.
5.34	Kunt u zich een situatie herinneren waarbij klanten niet wilden luisteren naar uw advies?
5.35	Wie heeft hier het meeste nadeel van ondervonden?

Teveel interactie

5.39	Vragen klanten vaak zelf om technische details?
5.14	Kunt u zich ook situaties herinneren waarbij klanten zich teveel met de (technische) details bemoeiden?
5.40	Voelt u dit als een gebrek van vertrouwen?
5.9	–

Samenwerking

5.19	Moet er meer samengewerkt worden met klanten?
5.13	Bij wie zou het initiatief moeten liggen?
5.10	In hoeverre denkt u dat interactie met klanten kan bijdragen aan innovatie?
5.23	Wie ondervindt de meeste schade aan te weinig interactie? Klant of producent?

Proactief

5.27 Benaderen jullie klanten ook proactief om aanvullende diensten of oplossingen aan te bieden?
5.28 Hoe komen jullie aan deze informatie?
5.29 Kunnen klanten dit waarderen?
5.30 Wie heeft hier het meeste voordeel aan? U of uw klant?
5.31 Zoekt u ook klanten die aansluiten bij uw kennis?

6. Afsluiting (Algemeen)

Dit waren mijn vragen voor zover. Als u verder geen aanvullingen heeft stel ik voor om het interview af te ronden. Ik wil u bij deze dan ook heel hartelijk bedanken voor uw medewerking en uw tijd.

6.1 Zijn er nog meer mensen binnen uw bedrijf die aanvullende informatie kunnen hebben over de besproken onderwerpen?

6.2 Vindt u het goed als ik u een samenvatting stuur van dit gesprek zodat u het kunt nalopen op eventuele onjuistheden?

6.3 Kent u nog meer bedrijven, klanten of toeleveranciers die passen binnen mijn doelgroep en eventueel zouden willen meewerken aan dit onderzoek?