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VALUE CO-CREATION

Applying Service-Dominant Logic to the Cutting Tool Business

Timo Koutonen

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ABSTRACT

Tampereen ammattikorkeakoulu
Tampere University of Applied Sciences
Master's Degree in Business Administration
International Business Management

KOUTONEN, TIMO:
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This thesis focused on the change from Goods-Dominant logic (G-D logic) to Service-Dominant logic (S-D logic) in the cutting tool business. The main difference between these two business logics is the nature of value creation that has traditionally been seen in exchange (value-in exchange), but according to S-D logic it is in use (value-in use). Since products or services from a provider are used by a customer, co-operation between those business actors is the essence of an effective value creation process. Hence, value co-creation is a fundamental characteristic in the idea of S-D logic.

The goals of this thesis were, firstly analyzing the recent situation of the cutting tool business, and secondly, finding the practical aspects of S-D logic that best apply to the business. The approach was examining the cutting tool business at a general level, and not focus on individual companies and their product brands. The three main topics were selected into the thesis theory section. Firstly, the key events in the industrial development that have been closely connected to the evolution of the cutting tool business, then the related principles of G-D logic, and finally, the essentials of S-D logic. The empirical part of the thesis was conducted through two main steps. Firstly, the quantitative data was collected from the cutting tool companies and at the personnel who operate at the customer interface. Secondly, the qualitative data was collected by interviewing decision makers of the customers that are influential for the future of the cutting tool business.

The main conclusion of the research was that the recent cutting tool business is polarized in relation to the S-D logic based business model. On the other hand, there is a growing demand for the value-in-use focused co-operation in the cutting tool business. Additional findings were the three research topics that are related to the strategies of individual companies, and therefore were not analyzed in this research. Firstly, how to match the strategy of an individual company to S-D logic based business development. Secondly, how to define the connection between money and value in value-in-use centric business. Thirdly, how to develop efficiency of co-operation in order to maintain profitability in the S-D logic based cutting tool business.

Keywords: service-dominant logic, value co-creation, cutting tool business

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1 INTRODUCTION

This chapter explains the objective of this research. Although the thesis process has been a very agile journey, including a lot of changes, the motivation and the purpose for the research presented in this chapter have remained unchanged.

1.1 Research motivation

Productivity development has been an essential aspect in the cutting tool business. The productivity of cutting tools has increased by a factor of 100 in the past century as a consequence of the development of the cutting tool materials. Hence, product R&D has traditionally been considered a key factor for maintaining and gaining market share in the cutting tool business. As can be seen in figure 1 the pace of development of the cutting tool materials has decreased during the past decades. Consequently, value thinking of the customers has become a new factor in the current business competition. (Handelsbanken 2017, 20; Sandvik 2017, H64.)

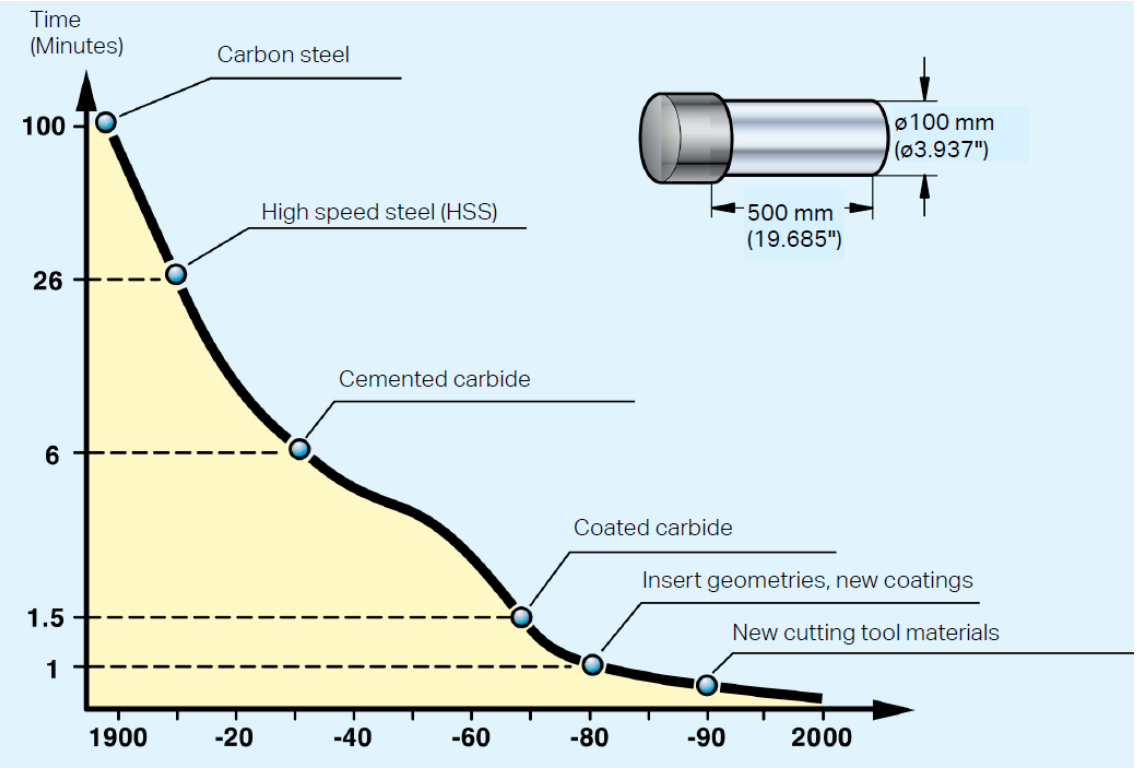

FIGURE 1. The development of cutting tool materials (Sandvik 2017, H45)

The complexity of value creation in the business has expanded, as can be seen in figure 2. Instead of focusing on pure cutting tool performance, multiple new characteristics affect the value that customers are ready to pay for. For example, machine tool utilization, value adding time and a good balance between variable and fixed costs are not directly connected to cutting tool performance.

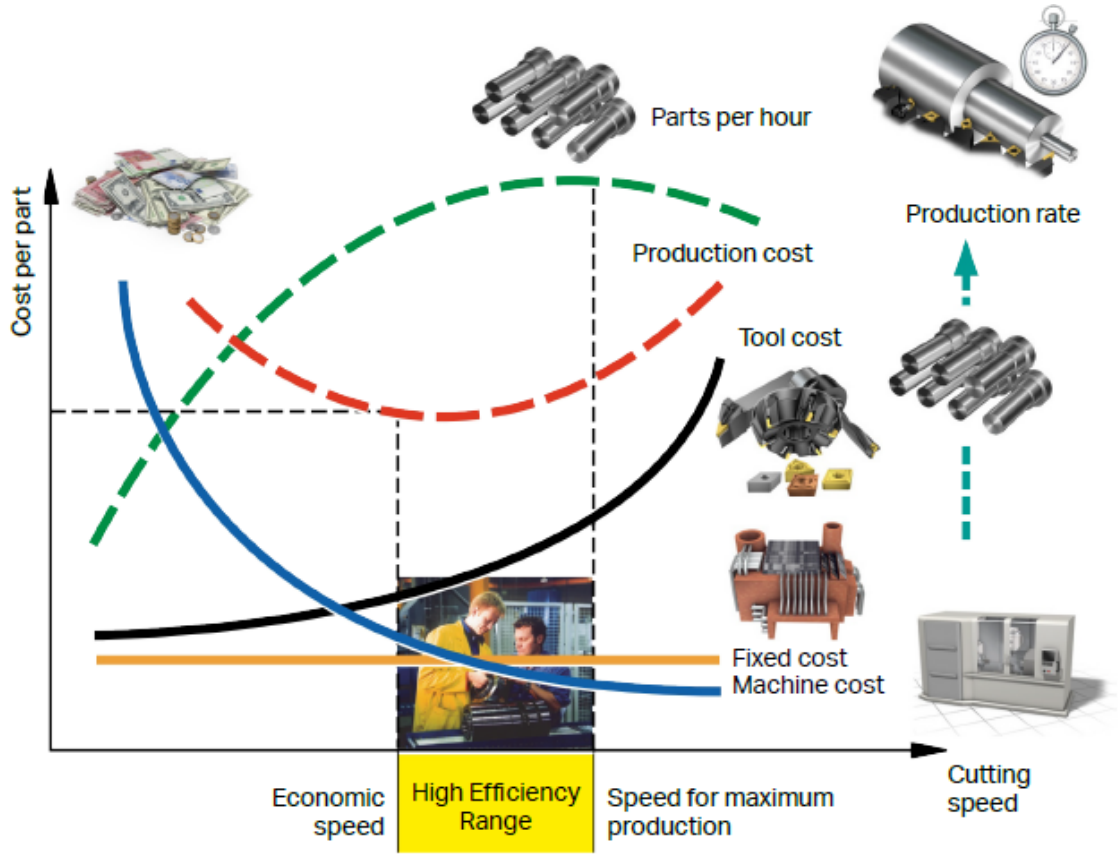

FIGURE 2. Complexity of value creation (Sandvik 2017, H70)

The main motivation for this research is to develop ways to fulfill the value creation demand in the market. Based on my own practical experience from the field, the demand for closer co-operation has increased in the cutting tool market. Hence, new opportunities have appeared but also challenges with the available resources and traditional sales processes. Because the changes in the customer demand have challenged the sales processes, the momentum for developing the traditional sales processes was the key trigger for this research.

1.2 Objective and research question

The main research question is “How prepared are the actors in the cutting tool business to exploit the business ideas based on Service-Dominant logic?” The question can be divided in two sub questions:

- What is the status of the value co-creation related business trends in the cutting tool business?
- Which aspects of the value co-creation idea best apply for the cutting tool business?

The purpose of the research is to provide a scientific basis and practical ideas for further business development. The scope of the research is limited to the direct customer interface and the focus is on human related interactions. The objective is analyzing the business logic of the cutting tool business at a general level, so the individual cutting tool brands strategies were not discussed.

1.3 Research methods and process

The first phase in the research process was studying and collecting the consistent theory basis for the research. The theory framework of the thesis firstly explains the key characteristics behind the recent status of the cutting tool business. Secondly, it defines the Service-Dominant logic and value co-creation concept at a general level and focuses on the aspects that are applicable for the cutting tool business. Understanding the main idea of the S-D logic and the cutting tool business environment were the basis for selecting the exact methods and the scope for data acquisition and analysis.

The second phase in the research process was selecting the research approach and the procedure for the exact data acquisition. Firstly, existing data from web sites of the cutting tool companies were collected for the desk research that was used for iterating the relevant variables for further analysis. Secondly, the survey was conducted to the personnel at the customer interface and statistical methods were used to define the selected variables. Finally, face-to-face customer interviews were conducted and analyzed by using meta-analysis to disclose the insights of the cutting tool business interactions.

1.4 Research content

The first chapter focuses on the research topic and it gives a general overview of the research. The three next chapters focus on theoretical basis of the research. The second chapter gives a background overview on the Goods-Dominant logic based cutting tool business and current trends in the business. The third chapter continues with the concept of value co-creation on a general level and its aspects that are applicable for the cutting tool business. The fourth chapter covers theoretical basis for the selected research methods. The fifth chapter focuses on empirical results that address the research question and the key findings from the research. The last chapter firstly covers the key findings and responses for the both addressed research questions. Secondly the discussion focuses on the additional findings and possibly new research objects that arose during the research process.

2 CUTTING TOOL BUSINESS

"Study the past if you would define the future" (Confucius). This chapter covers the economic basis for the traditional Goods-Dominant logic based cutting tool business. The development of the cutting tool business has been firmly connected to the manufacturing industry in the modern industrialization era. Hence the selected industrial landmarks from the past two centuries are covered for emphasizing the foundations of demand for cutting tools. The aim of the text is not to act as a handbook of the technology, rather it presents a sufficient framework to understanding the continuous technological transformation behind the financial aspects of the cutting tool business. In this text the cutting tool business consisted of manufacturers of the cutting tools and customers who use the tools in applications such as, milling, drilling and turning.

2.1 Introduction to the cutting tool business

The size of the global cutting tool business is around 20 billion US dollars and there are over forty tool suppliers operating in the market (Handelsbanken 2017, 20). The biggest players in the cutting tool industry are original post-war companies that managed to implement cemented carbide as cutting tool material. The three biggest cutting tool companies, Sandvik, IMC Group and Kennametal, cover around 40% of the total business (Handelsbanken 2017, 20). All the three main players use multi-brand strategy to cover diverse customer segments. Significant business segments for the cutting tool business are for example: Automotive, Aerospace and Energy. (Handelsbanken 2017, 24).

Sandvik holds the biggest cutting tool supplier position with a 20% global market share (Handelsbanken 2017, 20). Sandvik is a listed engineering company based in Sweden where Sandvik Machining Solutions business area focuses on cutting tools. Sandvik Machining Solutions represents around 40% of Sandvik revenue and 59% of operating profit (Sandvik 2018). The second largest company is IMC with a 14% global market share (Handelsbanken 2017, 20). IMC is owned by Berkshire Hathaway Inc. holding company that is well-known for its chairman Warren E. Buffet (Berkshire Hathaway 2017). Kennametal is a US-based listed company with a 7% global market share (Handelsbanken 2017, 20). Kennametal operates in two cemented carbide business segments, in cutting

tools and wear parts and tools for infrastructure equipment. The share of the cutting tools from the revenue was 75% in 2016 (Kennametal 2017).

The cutting tool business is tightly linked to the raw material business because main ingredients, such as tungsten carbide, are scarce on the earth. As with many other raw material-based businesses, the access to the raw material is a key element for success. Another key indicator for the future is technology and process development to realize value to the customers.

2.2 History of mass production

The modern era industrial revolutions have been tightly connected to machinery and cutting tools. The innovations in machinery have accelerated the development of mass production that has required large number of new machines, whereas metal cutting is an essential characteristic in the machine building. This chapter covers the essential development steps that were main construction blocks for mass production.

2.2.1 The first industrial revolution

The first industrial revolution started in the 18th century, from the textile industry where there were multiple opportunities for mechanizing manual operations. The significant innovation behind the mechanizing was the steam engine, developed by James Watt in 1765 and utilized by John Wilkinson in his iron goods works of 1776. The new innovations created the economic framework that enabled the birth of the modern era mass production in centralized locations. (Hopp & Spearman 2008, 17.)

Overlapping with the invention of the steam engine there was a boost in the development of the machine tools that are used for metal cutting, as well. John Wilkinson developed a cylindrical boring machine that makes it possible to manufacture round cylinders for steam engines. American inventor David Wilkinson designed screw-cutting lathe in 1798. In the early 19th century simple milling machines were used by English gun makers. (Dixit, Hazarika & Davim 2016, 101,102.)

2.2.2 The second industrial revolution

The second industrial revolution started in the 19th century and it is also known as "The Technological Revolution". Many of the innovations that make the current economy possible were the result from the second industrial revolution.

Constant power supplies instead of season sensitive water power enabled full time, year-round production. Railroads were America's first big business. It empowered economic growth via reliable all-weather transportation for factory goods, but it also demanded large scale management hierarchies the very first time in the US history. Also, many other industrial segments took huge development steps in a very short time: the telegraph was invented, the implementation of Bessemer steel manufacturing method made it possible to produce more and higher quality machines, and commercial products with combustion engines were invented as for example automobiles. (Hopp & Spearman 2008, 20, 21.)

Machine tools development took significant steps in the late 19th century. The first turret lathe was developed for mass production purposes. Gear manufacturing and grinding methods developed due to the demand for higher speed gearboxes. The first big scale scientific study about metal cutting was published by Frederic Winslow Taylor in 1907. Moreover, in the same time period Taylor made his famous scientific research in production management techniques that is widely known with the name "Taylorims". (Dixit, Hazarika & Davim 2016, 102, 103; Hopp & Spearman 2008, 27-30.)

2.2.3 Henry Ford and assembly line

One of the most striking inventions in the technological revolution era was mass production on the assembly line by Henry Ford. From the economical point of view, Henry Ford's big invention was the insight that he could sell millions of cars at a unit price of $500. From the technological point of view, the big innovation was the way to make millions of cars at significantly lower costs per unit than ever before. (Lusch & Vargo 2014, 10/5.)

In the very beginning of 20th century hundreds of companies in Europe and North America were manufacturing cars using craft technology. Because standard gauges were not yet in use, parts for the assembly did not fit exactly. Most of the parts needed to be filed down to fit. Hence, in craft technology highly skilled craftspeople assembled unique cars by hand-fitting all the parts in the car assembly. Nearly invisible hand fittings indicated quality for the car buyers. Cars manufactured were not exactly identical, instead cars were tailored to meet the desires of individual customers. Moreover, it took excessive time to produce the complete car. So, the manufacturing costs were high and did not drop with volume. The car market was very limited because only the rich could afford a car. (Womack, Jones & Roos 2007, 19-24.)

The Ford Motor Company started to assemble cars in 1903 and managed to reach the dominant market position by the early 1920s. The key technological elements for the success were consistent parts that were easy to attach to each other, and the development of assembly technology that accelerated the speed of production. In 1913 Ford introduced moving assembly line technology that is still the most common method for assembling the car. In 1923 Ford production peaked 2.1 million Model T cars. Ford Model T was produced over 15 million units until the end of its lifecycle 1927. The record lasted almost 50 years, until Volkswagen Beetle finally beat it 1972. (Womack, Jones & Roos 2007, 24-33)

In 1906 Ford Model N was introduced at $600 that was almost half of the price of competitors. In 1916 the price for Ford Model T was $360 and in 1920 the price was fallen down to $290. The car was not any longer a luxurious product for a few, instead the market expanded to cover a massive number of middle-class consumers. Hence, by the early 1920s American automotive business had grown to one of the biggest businesses in the word and Ford Motor Company held two-thirds market share of it. By 1955 three giant companies that were early adopters of the mass production principles ruled the business. “The Big Three”, Ford, General Motors and Chrysler, possessed a 95% market share of the American automotive business. (Hopp & Spearman 2008, 25; Womack, Jones & Roos 2007, 41.)

An excessive amount of metal cutting was needed to fulfill component demand from car manufacturers. Hence, the automotive industry is continuing to represent one of the biggest business segments for the cutting tool solution providers. (Handelsbanken 2017, 46).

2.3 LEAN manufacturing

As a result, from the success in industrialization, by World War II America had more large-scale business enterprises than the rest of the world combined (Hopp & Spearman 2008, 21). Passenger car industry was dominated by "The Big Three" American manufacturers: Ford, General Motors and Chrysler. Despite that, from 1955 to 1975 Toyota Motor Corporation managed to achieve an equal market share than its American competitors. The main factor behind the success was a new manufacturing and business philosophy that now challenged the position of the traditional mass production as the best way to manufacture goods. In 2009 Toyota finally passed General Motor as the world largest car manufacturer (Washingtonpost Business 2009). (Womack, Jones & Roos 2007, 41-46.)

History of Toyota

After World War II Japan suffered from lack of financial and material resources. From the mass production perspective the situation was unthinkable. Economical effectiveness of mass production manufacturing system was based on low costs per item that can be achieved by the high production volume. The reverse side of the low cost is an excessive need for inventory that requires both financial and material resources.

Hence, Toyota developed a new concept of manufacturing efficiency: the manufacturing system for the high-volume car production, but with significantly lower need for inventory compared to mass production. The new manufacturing system got a name Toyota Production System (TPS). The basic TPS principles are, for example, focusing on the value adding actions, production flow and reducing waste. (Modig & Åhlstöm 2017, 68-74.)

A vivid example of the TPS strength was the stamping process for sheet metal parts. The change of stamping die was a complex operation that could take more than one day to complete. After World War II mass production volumes were high. To avoid production stops causes of changing the die, American manufacturers dedicated presses to a specific part, hence one press would produce millions of parts in one set-up. Under Toyota circumstances, the need for using small production patches led to developing the die changing process. By the end of the 1950s the change time of the die had dropped from one day to three minutes. Later the time dropped down to one minute that led to a widely used

production development term Single Minute Exchange of Die (SMED). (Womack, Jones & Roos 2007, 51-52; Womack & Jones 2003, 352)

LEAN

By 1980s there was a high interest in Toyota among western researchers. The term Lean was assigned by researchers for multiple concepts and applications that were originally based on TPS ideology. Nowadays the term Lean and related ideologies are widely applied, not just in car manufacturing and machinery industries, but also in service businesses such as healthcare. The focus on the value has evolved the marketing science, as well. (Modig & Åhlstöm 2017, 75-83.)

2.4 The third industrial revolution

The third industrial revolution is also called the computer or digital revolution. Practically it began when computers started to conquest manual work and it is still ongoing. The internet is one of the most visible landmarks of the digital revolution. (Schwab 2016, 1.1.)

Digitalization has dramatically changed manufacturing and the cutting tool business, as well. The digitalization in the cutting tool business started from Computer Numerical Control (CNC) that made it possible to use computer for controlling machine tool movements instead of a human operator. Another milestone was robotization of the CNC machine tools that made it possible to move towards unmanned machine utilization. The Coordinate Measuring Machines (CMM) made it possible to make repeated measurements with the outstanding precision. Furthermore, Flexible Manufacturing Systems (FMS) connected individual equipment to complete automation system that enabled maximal machine utilization. (Groover 1999.; Dixit, Hazarika & Davim 2016, 35, 36, 105.)

2.5 AGILE

Agile ideology is one of the modern methods that emphasizes co-operation between the firm and the customer. It also gives first warnings that something might be broken in the goods centric business model that has been dominant through the industrialization era.

The Agile method provides model for the co-operation when the requirements are not clear at the beginning of the project or may change during the process. Agile was originally developed in the early 21st century for software development purposes. Due to the internet boom and massive growth in the software business during the 1990s, there was a growing demand for an alternative project model for the Waterfall process where requirements are well defined in the beginning of a project and systematically verified during the process (Glaiel 2012, 2.2.). The basic constraints in the Agile and Waterfall projects are described in figure 3 by "the iron triangle" where Cost, Scope and Schedule are presented.

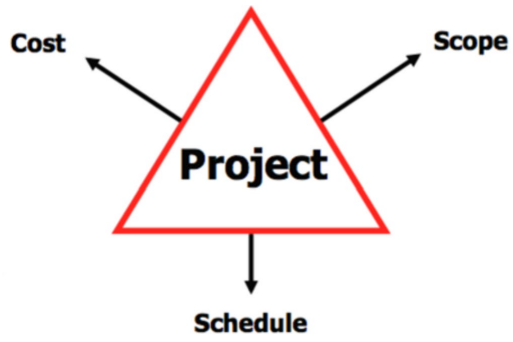

FIGURE 3. "The iron triangle" of Project Management (Glaiel 2012, 2.1.1)

In the traditional Waterfall process Scope is the most weighted feature, then Schedule, and finally Cost. The problems arise when the description of the result is not fully fixed or might change during the process. In the software business in the 1990s the problem was vivid as a result of the rapidly developing business. Often the customer did not exactly know what the final product should be. The projects grieved from delays, exceeded costs and lack of fulfilling the described scope. (Manifesto for Agile Software Development; Glaiel 2012, 2.2)

In the Agile progress the "iron triangle" constraints order is Schedule, Cost and Scope. Firstly, schedule gives an idea of the duration. Secondly, cost gives an estimation for the costs. The final constraint is scope. The final result will sharpen during the short development loops or "sprints" with close co-operation with the customer. (Glaiel 2012, 2.1)

Recently also traditional manufacturing industry has adopted parts from the Agile principles due to constant changes in the business environment that make forecasting the future difficult. The three laws of forecasting are presented on the following list:

1. Forecasts are always wrong.
2. Detailed forecasts are worse than aggregate forecasts.
3. The further into the future, the less reliable the forecasts will be.

Since forecasting is not always reliable, the firm's ability to change has become a new factor in the competitiveness. Lately, the term Agile Manufacturing has been taken in to use when referring to manufacturing firms' flexibility and ability to adapt quickly to the changing environment. (Hopp & Spearman 2008, 441.)

2.6 The fourth industrial revolution

During the Hannover Fair in Germany 2011 the term "Industry 4.0" was adopted the first time. "Smart factories", the term that is used to describe the fourth industrial revolution, creates the world where physical and virtual systems cooperate with each other in a flexible way. Industry 4.0 has progressively revealed that the deep co-operation between the business actors, in so called business ecosystems, is an increasingly vital part of the business. (Schwab 2016, 1.1; 3.2.4)

In 2015 Tom Goodwin condensed some striking phenomena from the revolution in progress: "Uber, the world's largest taxi company, owns no vehicles. Facebook, the world's most popular media owner, creates no content. Alibaba, the most valuable retailer, has no inventory. And Airbnb, the world's largest accommodation provider, owns no real estate. Something interesting is happening." (Goodwin 2015.)

The speed in business has escalated, whole new business ecosystems arise due to the technological evolution. For example, the handheld device application ecosystem started in 2008 when Apple allowed external suppliers create applications for iPhone. In 2015, the global application economy for Apple and Android generated $100 billion revenue, clearly surpassing the film industry that have been exist over a century. (Isaacson 2015; Schwab 2016, 3.1.2.)

Platforms, Data and Analytics, and IoT

Thanks to the digital revolution, interactions between the actors are cheaper and more in volume than ever before. The digital platforms act as communication hubs between ac-

tors. For instance, Alibaba provides a platform where actors in the global business ecosystem can interact. Tremendous amount of data flows through the platform, such as customers' feedback, business interactions, and web browsing behaviors. The advanced data analytics is used to provide valuable data for platform users and building the trust, for example the best products from the rest can be presented for the customers, and the need for the inventory can be predicted in excessive accuracy for the goods providers. (Schwab 2016, 2.1.2.)

Furthermore, smaller, cheaper, and smarter sensors are essential construction blocks to the Internet of Things (IoT), that is descriptively called as "Internet of All Things", as well. IoT empowers excessive communication and data transfer, not just between humans or computers but between everything we can imagine. (Schwab 2016, 2.1.2.)

Industry 4.0 is increasingly bringing new factors to the cutting tool business. 3-D printing challenges the traditional cutting tools-based manufacturing methods. Connected equipment provides needed technology not just for data-based monitoring, but for smart adjustment of the traditional cutting techniques, as well. Enormous data traffic opens opportunities for the new type of the business platforms that empower the new actors engage in the cutting tool business ecosystem. (Dixit, Hazarika & Davim 2017, 168; Schwab 2016, 2.1.1.)

2.7 Goods-Dominant logic

Goods-Dominant logic (G-D logic) is the business model that has been dominant during the previous three industrial revolutions. This chapter focuses on the essential business structures in G-D logic that are in contradiction with Service-Dominant logic (S-D logic), but are in sync with the reasons why G-D logic has started to lose its dominant position as the most efficient business strategy. The S-D logic framework is described in more detail in chapter 3.1.

As a result, from the three industrial revolutions, goods and the manufacturing effectiveness have taken a key role in the business ecosystems. The fundamental assumption in G-D logic is that goods are the basis of exchange. Figure 4 illustrates the goods centric

system, where a firm can operate in business as an individual cell. Exchange with others realizes primarily through the goods. (Lusch & Vargo 2014, 1/3.)

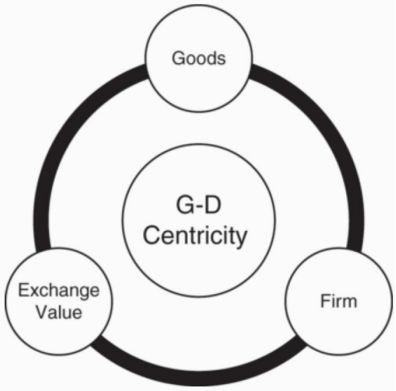

FIGURE 4. G-D Centricity (Lusch & Vargo 2014, 1/3)

From the mass production stand point, G-D logic makes great sense. More products indent more business since goods are the dominant instruments for exchange.

2.7.1 Value in G-D Logic

In the goods centric concept, value is included in the end products, so goods can be used to convey value to customers. Both tangible goods or intangible services can be handled on a similar basis, as an item of the value exchange. The value creation process is called "a value chain", which is a linear sequence of events where value can be embedded in products. For instance, a steel blank is machined by using cutting tools or additional services are provided with the products as an "added value". (Lusch & Vargo 2014, 3/12)

2.7.2 Marketing in G-D Logic

"The market exists" is a basic presumption in the G-D Logic. In other words, there are demanding customers out there who are waiting for their needs to be fulfilled. Therefore, a firm needs to be market or customer driven. In practice, a firm needs to do a market analysis where the customers' needs are defined, and then respond to those needs. So, actions of the firm are reactive, the objective is to respond to the demand. (Lusch & Vargo 2014, 1/7.)

The foundation of the goods centric marketing science is “marketing mix” that is often called to “four Ps”. It states that Product, Price, Promotion and Place are the basis for maximizing the performance of a firm. From the “four Ps” viewpoint goods are the heart of business, as illustrated in figure 4. (Lusch & Vargo 2014, 4/4.)

3 VALUE CO-CREATION

This chapter covers the foundations of Service-Dominant logic and furthermore focuses on value co-creation that is an essential part of service ecosystems. The perspective is based on the S-D logic meta-idea that was originally published by professors Robert F. Lusch and Stephen L. Vargo 2004. The fundamental idea of S-D logic is that service exchange is the basis of all business.

The purpose of the S-D logic meta-idea is not to act as a new business theory, rather it acts as a lens that shifts the focus back on the very fundamentals of the business exchange. Furthermore, S-D logic employment to the present business is work in progress and under development by scholars and business consultants worldwide. (Lusch & Vargo 2014, 10/1.)

More than 2000 years ago some of the ideas of the exchange, which are elementals of the S-D Logic, were already described:

> A State, I said, arises, as I conceive, out of the needs of mankind; no one is self-sufficing, but all of us have many wants. Can any other origin of a State be imagined?
> There can I be no other.
> Then, as we have many wants, and many persons are needed to supply them, one takes a helper for one purpose and another for another; and when these partners and helpers are gathered together in one habitation the body of inhabitants is termed a State
> True, he said.
> And they exchange with one another, and one gives, and another receives, under the idea that the exchange will be for their good. (Plato, The Republic, Book II)

Moreover, the words of king Solomon aptly describe the idea of shifting the business focus back on the very fundamentals of exchange:

> “Is there anything of which one can say, “Look! This is something new”? It was here already, long ago; it was here before our time.” (Ecclesiastes 1:10, The Committee on Bible Tranlation, New International Version.)

3.1 Service-Dominant logic

The following statements represent the fundamentals of the S-D Logic: Service is a basis of exchange. All businesses are service businesses. Therefore, all economies are service economies. Even though goods have a key role in many businesses, service exchange is a common determination of all businesses. So, goods act as a visible appliance for service exchange. When money is involved, it represents entitlement for the future services. (Lusch & Vargo 2014, 1/5.)

The service-based exchange can be demonstrated by using sequences as described in the following example: A mining company has the knowhow and ability to mine and enrich virgin raw materials, such as iron that is needed for production of steel. A steel foundry acts as a customer for the mining company, since it has the knowhow and ability to manufacture cast components as engine blocks. A machinery firm acts as a customer for the foundry, since it has the knowhow and ability to process the casts to make them suitable for car assembly. A car firm acts as a customer for the machinery firm, since it has the knowhow and ability to assemble cars. Finally, a car buyer acts as a customer for the car firm, and moreover serves as a link between the previous manufacturing sequences and another service ecosystem where further services, such as transportation are needed.

3.1.1 Service ecosystems

Service ecosystems are comprised of network connections between service exchanging actors. The previous example described vertical service exchange, so the sequences consisted of a linear chain of events that enriched raw material to a final product. Besides that, the ecosystem consists of multiple vertical actors who have their own service exchange companions. For instance, between ten actors, up to 45 unique connections are possible. As a result, a sophisticated triad network between actors provides a root mechanism of business. (Lusch & Vargo 2014, 1/7; 8/1; 8/2)

Viewing business structure as simply as supply and customer or as a demand driven market, oversimplifies the dynamics of the business ecosystems. It can also lead to losing the business. A vivid example of a loss is the devices based mobile phone business around 2010s, when it took steps to the direction where multiple new actors were able to enter

into the mobile phone business network. The former Nokia chief executive officer condensed the situation in 2011, in the so called “Burning platform” memo: ”Our competitors aren’t taking our market share with devices; they are taking our market share with an entire ecosystem. This means we are going to have to decide how we either build, catalyze or join an ecosystem.” (Siilasmaa 2018, 8/1.)

Service economy is not a new concept, service ecosystems have existed between actors through the business history. As described in chapter 3.1, the mindset makes a difference between G-D and S-D Business, when viewing the existing business. Furthermore, because there is no new service economy, many of the practices that have targeted to sifting the companies from product sales to service sales have failed. For instance, producing added value services on top of the products misses the point that the services themselves are in a very centric role in business exchange. (Lusch & Vargo 2014, 1/6)

3.1.2 Value in S-D logic

In the S-D logic idea, value is in-use rather than in-exchange. There is a clear ideological distinction between value in G-D Logic, that is discussed in chapter 2.7.1, and S-D Logic. In S-D logic the traditional value in-exchange scheme is changed to value in-use. For instance, when a customer consumes a product, value potential is realized and is changed to value-in-use. A simple exchange of the goods does not guarantee that the value is genuinely conveyed to the customer, since the goods provide only value potential. Hence, value cannot be included in the products, only value potential. Value-in-use represents the value realization to the customer. Moreover, the term “added-value” does not represent the nature of the value exchange since only value potential can be embedded in the product. (Lusch & Vargo 2014, 1/4; 1/5; 1/7; 4/4)

3.1.3 Marketing in S-D logic

There are no markets out there, where customers are waiting for products that fulfill their needs. Instead, markets for service exchange need to be created. In S-D Logic, the primary function of enterprise is service itself by serving others. In practice, that happens by combining internal and external resources to a new resource that benefits actors in a business

ecosystem. So, marketing cannot be treated as a function separate from other business activities. Rather, it is the very nature of the business process. (Lusch & Vargo 2014, 1/6)

The business view where service exchange is in focus challenges the traditional value-in-exchange based marketing-mix theory. As described in chapter 2.7.2, in the traditional 4 Ps marketing mix Product, Price, Promotion, and Place are the basis for maximizing the performance of a firm. Unfortunately, the relevant market research-based data for applying 4 Ps becomes outdated rapidly. Therefore, S-D logic promotes the movement from the market demand driven business to the co-creation of value, thus ability to learn is more important than the detailed market information. Hence, the S-D logic philosophy provides a striking new view for the business processes. For instance, traditional business logic suggests that before a market launch the new product idea should be carefully screened and prototype tested. Despite all the effort, the failure rate of launching new products is remarkable. In contrast to that, S-D logic focuses on co-creation between a firm and a customer. In other words, business actors co-create markets where they wish to exchange their services. (Lusch & Vargo 2014, 4/4; 9/5; 9/7)

3.2 Value co-creation

Value co-creation is in the very center of the S-D logic idea. The traditional idea of value creation states that a firm can create value, for instance, by satisfying the need of customers with products, relieving the customers responsibility, or simply solving problems of customers. In other words, value can be transferred from a firm to a customer in exchange. In contrast, S-D logic states that use of value by a customer is the momentum when the value is really created. So, a firm as an individual cell, can only create value potential that preferably will be used and benefits the customer during value creation process. Therefore, from the firm's standpoint, co-creation is essential for participating in value creation. In the following two chapters the differences between value-in-exchange and value co-creation are illuminated in more detail. (Grönroos & Voima 2012, 135.)

3.2.1 Value-in-exchange

As can be seen in figure 5, co-operation between the firm and the customer is very limited in the value-in-exchange model. Value creation is customer driven, so value creation setting is temporal, and the actors do not necessary use the full potential of each other's resources. Moreover, a good value offer does not guarantee the status as a selected provider, there might exist multiple similar firms where a customer can select from. In the worst scenario, the customer does not ever use a product, or another type of the value potential purchased. So, a potential threat is that money can be the only valuable in the exchange between the actors. (Grönroos & Voima 2012, 136,137)

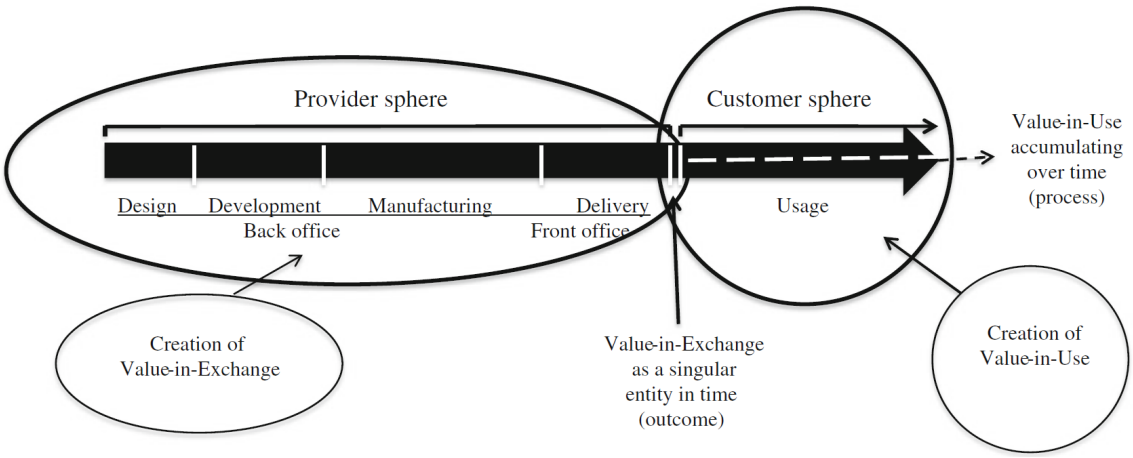

FIGURE 5. Value-in-exchange (Grönroos & Voima 2012, 136)

3.2.2 Value-in-use

Figure 6 presents the S-D logic approach to value creation. Since the customer is the value creator, the only opportunity for the firm to participate in value creation is co-operation with the customer. Accordingly, the term "value co-creation" is used to define the process. Due to co-creation, a customer has a hand on the steering wheel in the process and a good understanding of the resources and services a firm can deliver. The scope from the traditional firm driven process is shifted to the customer-driver process. Therefore, the probability to create potential value that will never be used declines. Because of close interaction between actors, a firm can co-create markets in a very influencing and operant

way, rather than just predicting or adapting resources and services to the existing markets. As a result of close co-operation described in this chapter, the understanding for the nature of marketing differs fundamentally between S-D logic and G-D logic (chapter 3.1.3). (Grönroos & Voima 2012, 137,138; Lusch & Vargo 2014, 9/5.)

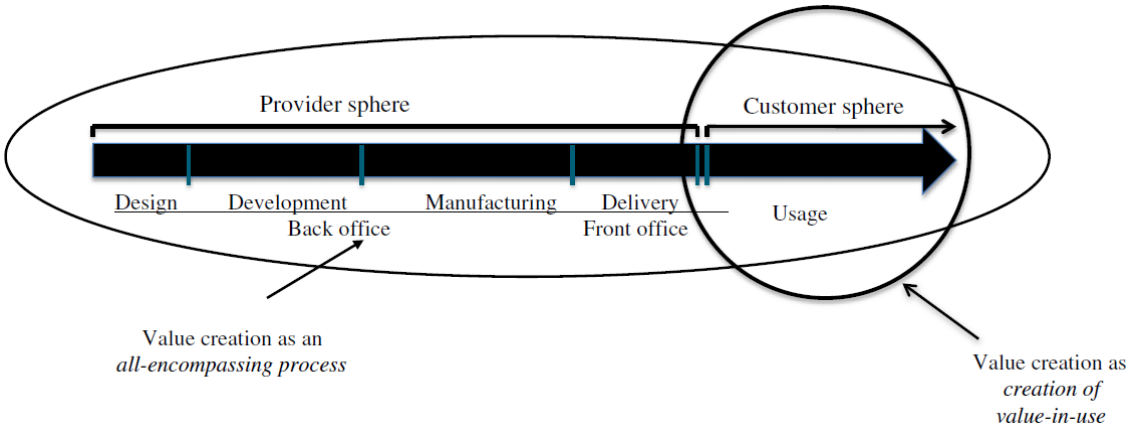

FIGURE 6. Value-in-use (Grönroos & Voima 2012, 137)

4 RESEARCH METHODOLOGY

This chapter explains the research methods used in general level. The corresponding research actions are explained in chapter 5.

4.1 Research context

The empirical part of this thesis firstly focuses on defining the status of the development in the cutting tool business. Secondly, the research focuses on finding the relevant elements of S-D logic that can be applied to the development of the cutting tool business. The review of the industrial development in chapter 2, and two contrasting business logics compared in chapters 2 and 3 provide theoretical framework for the research.

The geographical context of the research is the cutting tools business in European Nordic markets and similar environments. Although the business trends such as S-D logic and Lean are global phenomena, the focus on industry and business reviews in the text is on the western economy. Furthermore, the sources of the data for the research are mostly originated from Nordic countries. Even though the cutting tool firms included in the research are global players, they all have a strong market share in the European markets and they present a clear majority of the cutting tool providers especially in the Nordic market. As explained in chapter 2.1, the three biggest cutting tool firms use multi brand strategy to increase the market coverage. The research views the firms on the brand level. The scope is the main brands in the Nordic market because of a good public information availability, and a sufficient human resource for interactions with the customers.

4.2 Methods

As mentioned in the first chapter, quantitative and qualitative methods were both used in this study. The quantitative research is typically used to test hypotheses that are based on existing theories, whereas the qualitative approach can usually be used to develop a theory from the data collected. The strength of the quantitative research is deductive reasoning where magnitude and difference can be measured and compared based on the theory

framework. The strength of the qualitative research is inductive reasoning that focuses on making purer sense of foundations. (Weathington, Cunningham & Pittenger 2012, 16/2). In this research the quantitative method was used for answering to the first research question presented in chapter 1.2: “What is the status of the value co-creation related business trends in the cutting tool business?”. The collected data was mirrored to the theory presented in chapters 2 and 3 in order to highlight the recognizable patterns of variables that are relevant for further examination.

The qualitative method was used for answering to the second research question: “Which aspects of the value co-creation idea best apply for the cutting tool business?”. The aim was to highlight the insights of the value creation process and create data that can be used for further research and development in the cutting tool business.

Avoidance of bias was crucial in this research. As explained in chapter 2.1, the cutting tool business is a relatively small part of the manufacturing industry and the actors know each other personally on the local level. When the questioner is well known, the possibilities to get altered answers is obvious. Furthermore, objective research is particularly challenging when the subject is very familiar. Hence, Sir Francis Bacon’s “four idols”, that represent the main sources of bias, were selected to act as a guideline for this research (Weathington, Cunningham & Pittenger 2012, 1/5). For instance, the “four idols” guidelines were taken into account in formatting the questions in the survey and providing careful explanations of the terminology in face-to-face interviews to ensure coherent perspectives to the topics. The “four idols” and short explanations are presented in table 1 below.

TABLE 1. Bacon's four biases (Weathington, Cunningham & Pittenger 2012, 1/6)

Idols of the Tribe	Biases due to overreliance on common sense and the tendency to make errors in logical reasoning
Idols of the Cave	Biases due to dependence on personal experience to explain why things occur the way they do
Idols of the Marketplace	Biases due to how we use specific words to describe things
Idols of the Theatre	Biases due to uncritical acceptance of explanations that people in authority tell us

The balance between measurement validity and reliability is a challenge for the research design. Lack of validity or reliability can both lead to incorrect results. For instance, biases may lower reliability of the research although the validity of the measurement is

good. On the other hand, reliable data that misses the point of research might lead to a wrong conclusion. Because the aim of this research was to provide the basic knowledge for further development, validity of the measurement was essential for the purpose. If the research results are valid enough, reliability can be improved by further measurements. (Weathington, Cunningham & Pittenger 2012, 3/7.)

4.3 Data acquisition

An overview of the data acquisition process is illustrated in figure 7. For the quantitative data two sources were used. Firstly, public information available in the web, such as search engine result statistics and web page content of the cutting tool firms. Secondly, the on-line survey was conducted to clarify individual's conception of the prevailing business climate. (Weathington, Cunningham & Pittenger 2012, 3/8)

The qualitative data was collected by conducting interviews for selected personnel of the customers. The interviews were well structured on the topics level, but the exact questions and the conversation structure were open. Careful preparing and planning of the interviews proved to be in an important role to avoid the bias from interviewees possible intention to adjust comments to the direction that is affected by interviewer's presence. (Weathington, Cunningham & Pittenger 2012, 8/5.)

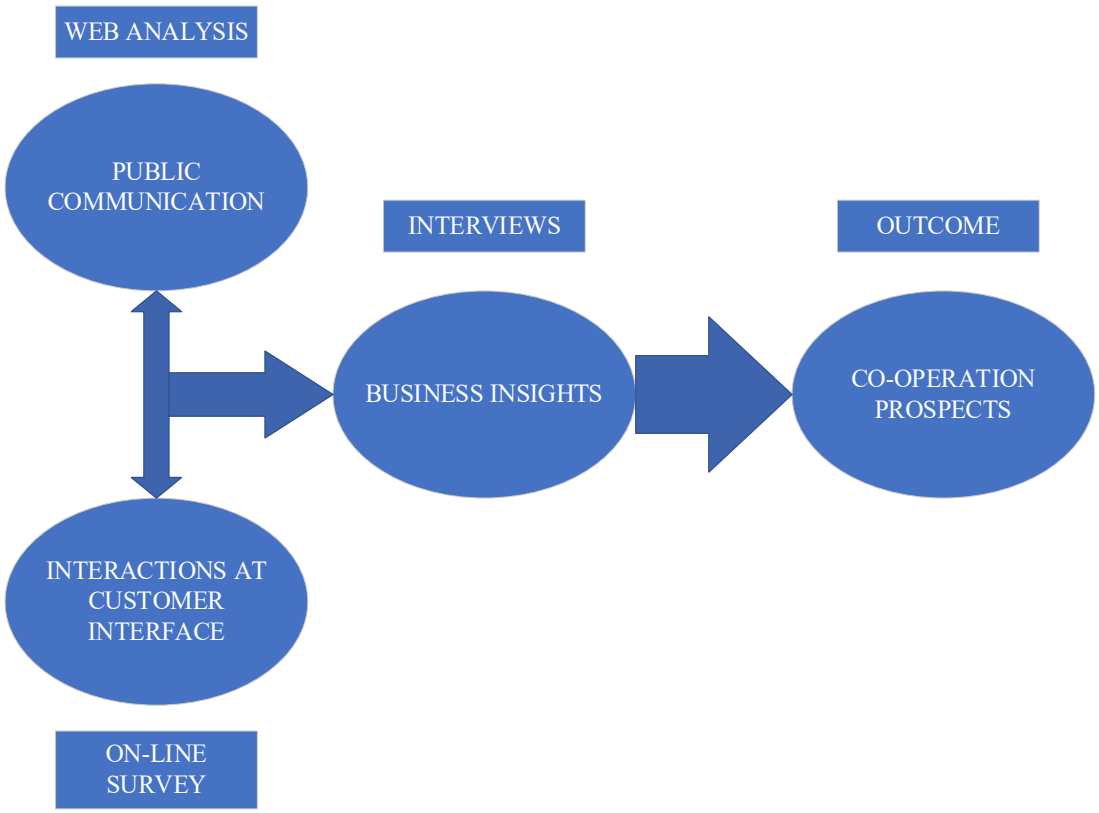

FIGURE 7. Research process diagram

4.4 Analysis

Firstly, the statistical methods were used for finding recognizable patterns from the data. The web pages of the companies gave an open view to the public business communication. The public presence represents the business framework that was used for defining the relevant variables for the on-line survey. Secondly, both data groups were compared in order to define similarities or differentiations between the public presence of the cutting tool companies and the human interactions on the customer interface. The quantitative data samples were assembled to scorecard forms. Standard error of the mean and confidence interval methods were used to improve and estimate the reliability of the analysis (Weathington, Cunningham & Pittenger 2012, 7/4, 7/7, 7/8).

The results from the interviews were investigated by using meta-analysis. Firstly, the quantifiable patterns were recognized by analyzing the full data from the interviews. Secondly, the insights were enriched by analyzing the details of the interviews. (Weathington, Cunningham & Pittenger, 2012, 4/8.)

5 RESEARCH RESULTS

As described in figure 7, empirical research was divided into three steps. All the research actions gave interesting information, but from different approach angles. Firstly, the review of the public communication of the cutting tool companies proved the validity of the used variables. The further on-line survey at the customer interface produced similar results, but also highlighted some classifiable deviations in perspectives of the respondents. Finally, the interviews proved a very eye-opening insight, and also proved to be the most valuable method for the research. This chapter covers the research results of the three methods used.

5.1 Desk research: public presence of the cutting tool companies

The research reveals that awareness of the business and technological trends covered in chapter 2 are visible in the public web-communication of the cutting tool firms. On the other hand, the processes, such as Agile and Lean that are used for matching technical knowhow with customer value seem to get less space in the public communication. Based on the results, the biggest variation in the public communication profiles of the companies were linked to the processes and the latest hi-technology. The brand positioning inside the cutting tool parent companies can partially explain the variations between the reviewed companies. When looking at the business actors on the parent company level, the communication matrixes are more homogenous. Moreover, each one of the brands has a clear communication profile that seems to complement the communication coverage of the parent company. A further analysis between the brands was not conducted within this research, since the main focus was on the business itself, not differentiation between the cutting tool companies.

The data acquisition for the public communication research was conducted by using internet search engines to quantify the trigger words found on the web pages of the specified companies. The searches were conducted on 21st August 2018. The cutting tool companies selected to the research were IMC Group, Kennametal and Sandvik Machining Solutions. As mentioned in chapter 2.1, the selected three companies represent a clear dominant market share of the cutting tool business. Because of multi brand strategy, a total of

ten product brands from the three selected parent companies were used for the data acquisition. Sandvik's brands are Sandvik Coromant, Dormer Pramet, Seco Tools and Walter. IMC-Group's brands are Iscar, Taegutec, Tungaloy and Ingersoll. Kennametal's brands are Kennametal and Widia. The statistical weight estimation for measurement is passed since the business size of each brand is not exactly known. Hence, each product brand was considered equal to others. An additional important function of the web measurement was to confirm the validity of the selected variables for the on-line survey that was the next step in this research.

Google Search was used as an internet search engine for the data collection. The occurrence of a selected search word in a specific web site can be found by using formulas where both, the search word and the web site, are defined. For example, a search script for a key word "automotive" on the Sandvik Coromant web sites is presented below:

https://www.google.com/search?q=automotive+site%3Awww.sandvik.coromant.com

The spreadsheet-based search tool that was created for conducting the data collection was published in the web, so it is possible to redo the searches. (Appendix 1).

The search words were selected from the three research viewpoints that were technical-, process-, and business awareness. The selected search words, the corresponding theoretical references in this paper, and the research objectives are presented in table 2 below:

TABLE 2. Search words, theory basis, and purpose of the website research

Search word	Theory basis	Research objective
Automotive	2.2.3 Henry Ford and assembly line	Technical awareness / Test
Lean	2.3 LEAN manufacturing	Process awareness
Digital	2.4 The third industrial revolution	Technical awareness
Agile	2.5 AGILE	Process awareness
Industry 4.0	2.6 The fourth industrial revolution	Hi-technical awareness
IoT	2.6 The fourth industrial revolution	Hi-technical awareness
Added value	2.7.1 Value in G-D Logic	Business awareness
Co-operation Partnership	3.1.1 Service ecosystems	Business awareness

Results of the internet research

Table 3 provides the search hit results in the matrix format, where variables in the vertical axel are the search words and the variables in the horizontal axel are website addresses of the selected cutting tool companies. The volumes of the search results are not comparable horizontally because of variations between the website designs, and the total amount of the content on each site. The vertical columns display the weights of each variable on the website. For instance, the variable "automotive" has got a high number of hits from each website, that is aligned with its importance for the cutting tool business. The singular search hits are cleaned from the results to prevent the random occurrences bias the results.

TABLE 3. Numeric volume search results from the websites

Variable	www.sandvik.coromant.com	www.dormerpramet.com	www.secotools.com	www.walter-tools.com	www.iscar.com	www.taegutec.com	www.tungaloy.com	www.ingersoll-imc.com	www.kennametal.com	www.widia.com	Total number of hits
automotive	3860	61	1100	1090	10300	378	181	368	545	102	17985
lean	42	61	4	-	2	-	-	-	71	3	183
digital	1310	138	159	423	236	2	309	25	37	55	2694
agile	63	-	62	-	-	-	-	-	6	-	131
industry 4.0	351	-	-	165	39	-	59	-	-	6	620
IoT	117	-	-	-	-	-	6	-	-	-	123
added value	85	48	35	313	68	64	8	-	70	49	740
cooperation	293	68	26	214	9	35	165	3	84	33	930

The weighted results are presented in table 4. Automotive variable was removed because of different magnitude zone and the data was converted to percentage format. The purpose of the percentage format conversion was presenting the data in a format where horizontal and vertical dimensions are both comparable. An Additional vertical column on the right shows averages for each key word and can be used for ranking the most widely used key words.

TABLE 4. Weighted search results from the websites

Variable	www.sandvik.coromant.com	www.dormerpramet.com	www.secotools.com	www.walter-tools.com	www.iscar.com	www.taegutec.com	www.tungaloy.com	www.ingersoll-imc.com	www.kennametal.com	www.widia.com	Average
lean	2 %	19 %	1 %	-	1 %	-	-	-	26 %	2 %	9 %
digital	58 %	44 %	55 %	38 %	66 %	2 %	56 %	86 %	14 %	37 %	46 %
agile	3 %	-	22 %	-	-	-	-	-	2 %	1 %	7 %
industry 4.0	16 %	-	-	15 %	11 %	-	11 %	3 %	-	4 %	10 %
IoT	5 %	-	-	-	-	-	1 %	-	-	-	3 %
added value	4 %	15 %	12 %	28 %	19 %	63 %	1 %	-	26 %	33 %	20 %
cooperation	13 %	22 %	9 %	19 %	3 %	35 %	30 %	10 %	31 %	22 %	25 %

The search results in the binary digital format are presented in table 5. The binary digital format clarifies the actual findings from the data. Since volumes of the results between the company websites were not directly compatible, binary digits are bias-free form unspecified variations in the magnitudes.

TABLE 5. Binary digit search results from the websites

Variable	www.sandvik.coromant.com	www.dormerpramet.com	www.secotools.com	www.walter-tools.com	www.iscar.com	www.taegutec.com	www.tungaloy.com	www.ingersoll-imc.com	www.kennametal.com	www.widia.com	Average
lean	1	1	1	0	1	0	0	0	1	1	60 %
digital	1	1	1	1	1	1	1	1	1	1	100 %
agile	1	0	1	0	0	0	0	0	1	1	40 %
industry 4.0	1	0	0	1	1	0	1	1	0	1	60 %
IoT	1	0	0	0	0	0	1	0	0	0	20 %
added value	1	1	1	1	1	1	1	0	1	1	90 %
cooperation	1	1	1	1	1	1	1	1	1	1	100 %

5.2 On-line survey to customer interface

Based on the production from the internet research, three subjects were selected for the second quantitative research conducted by online survey. The selected subjects were technical-, and business-awareness, and processes. The survey consisted of six multiple choice type questions and an additional field for free comments. In order to avoid the bias from respondents' inclination to adjust the answers to the desired outcome, the questions were formatted so that they could be easily answered but would not directly reveal the subject of the questioning (Weathington, Cunningham & Pittenger, 2012, 8/8). The on-line survey questions and format are presented in Appendix 2.

The scope of the survey was personnel who communicate together, so the results were not divided by the source. In order to maintain a representative number of the respondents from the population, all survey recipients were selected from Finland.

Regarding the estimation made during the research, approximately 60 persons work in the cutting tool field sales in Finland, distributors are excluded from the number. Based on acceptance of the regional manager of each company, the survey was distributed approximately to 30 field sales engineers. The representatives of the customer companies were firstly selected by using a free-of-charge, web-based Fonecta Finder business data service. A total of 122 companies were found by using "machining" as industry segment and company personnel size of above or equal to 10. Some technology companies who have well-known machining departments were added in the company list. Secondly, individual survey recipients were selected by using the web sites of the selected companies and LinkedIn searches. One recipient was selected from each company. The aim was to select individuals who presumably have regular communications with cutting tool sales engineers. The most common job title of the selected recipient was "method engineer". The survey was distributed to the cutting tool providers and the customers in August 2018. Total distribution was 150 where 27 responses were submitted in two weeks' response time. 14 of the responses came from the cutting tool companies, and 13 from the customers.

Results of the survey

The responses from the survey are presented in figures 8 to 11 and reviewed in this chapter. In order to maintain reliability of the results, standard error of the mean and confidence intervals for proportion were defined and included in the two first column graphs. Rank-size distributions are included in two later column graphs that represent rank-order type questions. Because of a low number of responses, the results cannot be considered statistically significant. Therefore, only clear differences were examined when analyzing the results, small variations are a potential result from the sampling error.

Awareness ratios of the Lean and Agile processes are presented in figure 8. Based on the theory review in chapter 2 and results from the internet research, the selected processes are considered influential to the cutting tool business. A clear majority of the respondents were aware of the Lean process. On the other hand, Agile knowledge was on a very low level and it was remarkable that not a single one of the respondents have the Agile awareness without the Lean knowledge. The result corresponds well to the public communication profiles of the cutting tool companies presented in table 5.

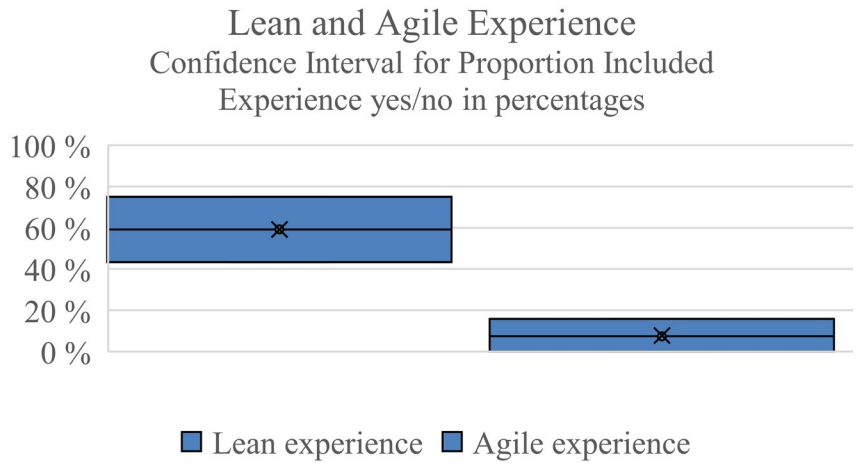

FIGURE 8. Process awareness results from the survey

As can be seen on figure 9, the cutting tool development and the development in co-operation were seen influential technological variables for the business. On the other hand, hi-technology related Industry 4.0 was not seen as a game changer. Magnitude differences of the Co-operation and Industry 4.0 variables correspond to the web search results presented in table 5.

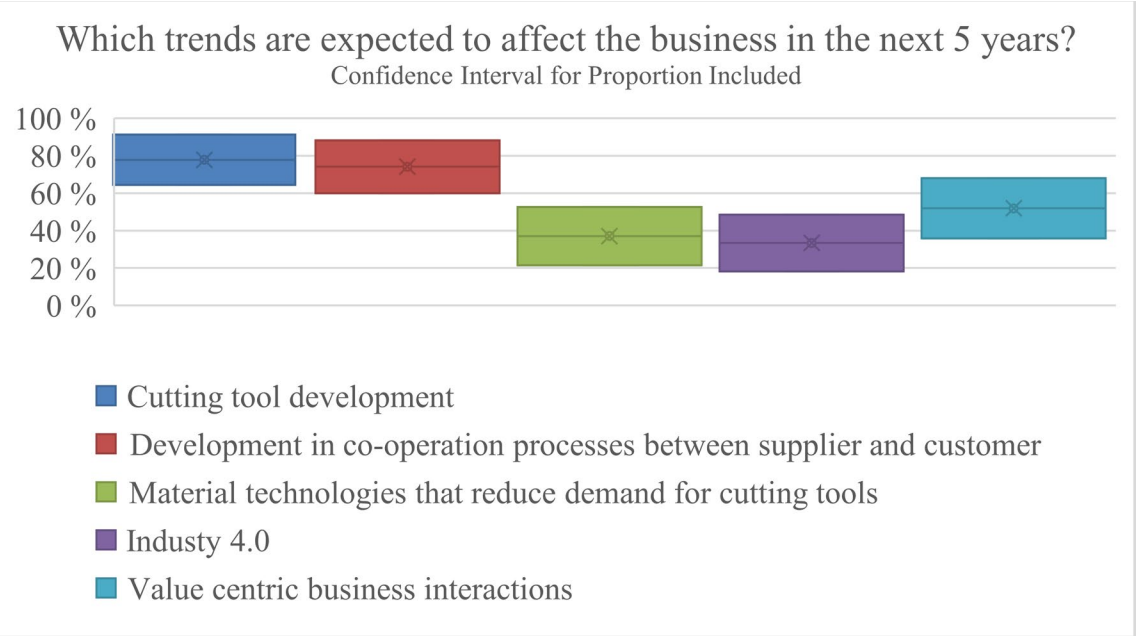

FIGURE 9. Technical awareness and co-operation results from the survey

Based on the results in figure 10, manufacturing knowledge was selected as the most valuable feature of the cutting tool provider. Another clear pattern can be found from the smooth daily ordering processes that got the least beneficial advantage from the choices. Due to a big variation between the responses, the differences between most of the variables were relatively small and therefore not analyzed.

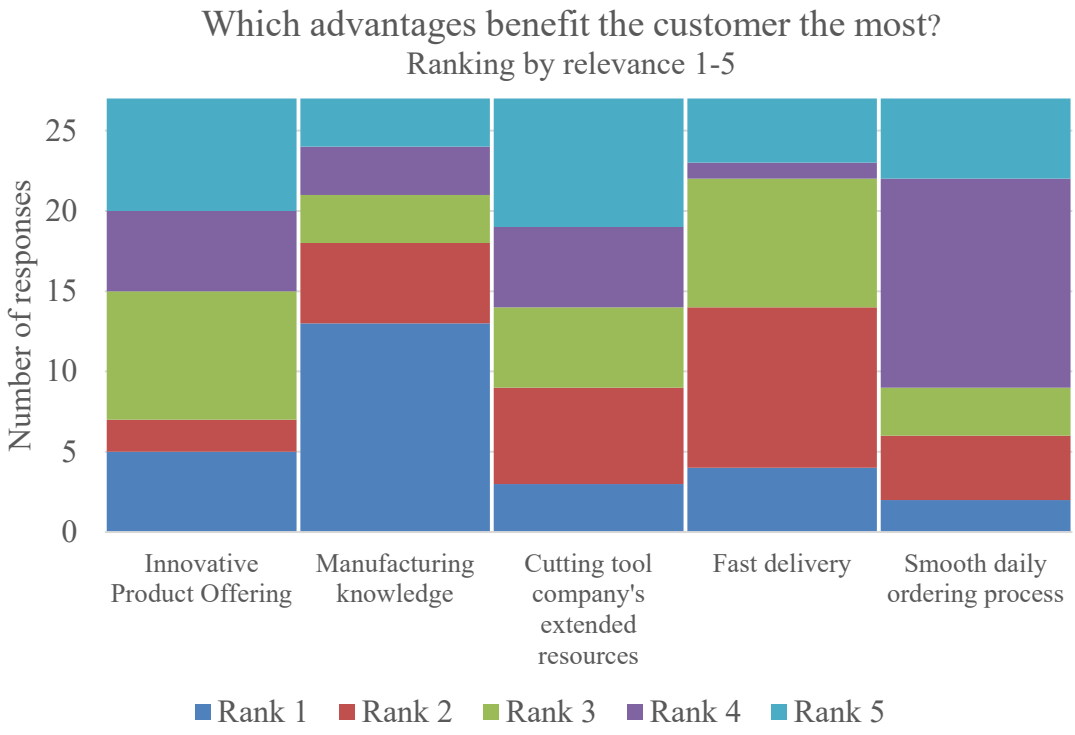

FIGURE 10. Business awareness results from the survey

Based on the results in figure 11, traditional channels such as trade fairs and recent business networks are the most common sources for new connections. The new channels such as social media were not common networking channels for most of the respondents. On the other hand, a few individuals ranked the variables in the opposite order compared to mean, so that social media was on the first and trade fairs in the last position. Based on that, social media and traditional communication channels seemed to divide the opinions.

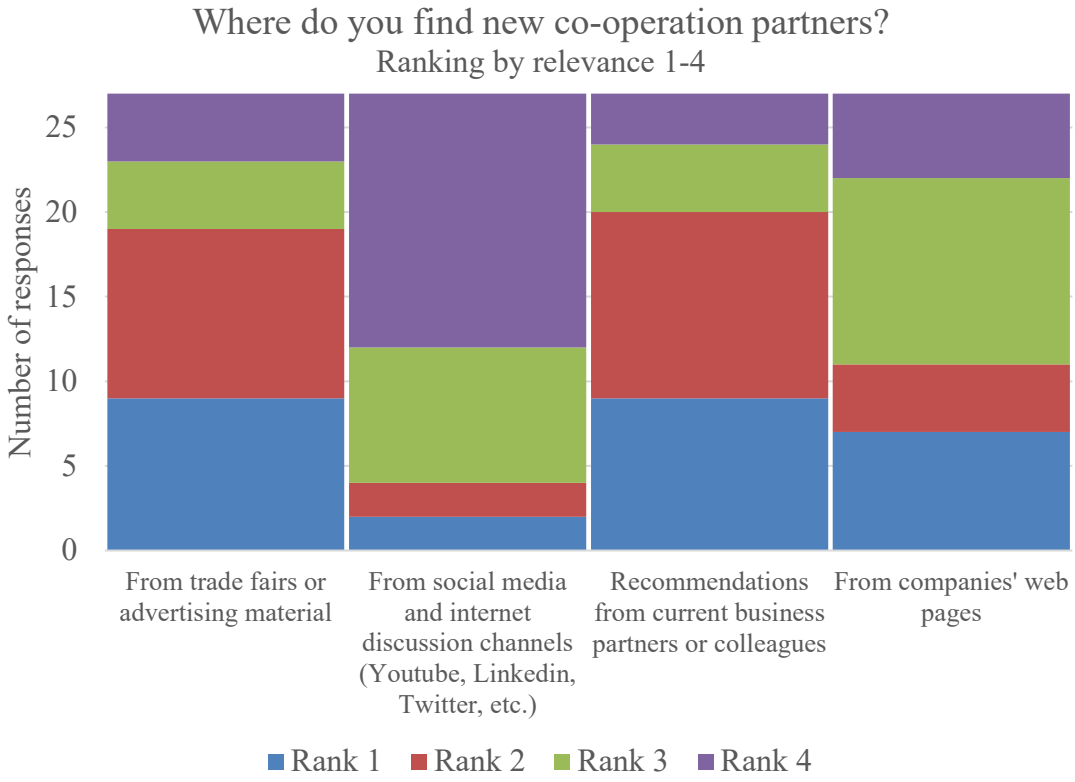

FIGURE 11. Business and network results from the survey

5.3 Interviews

The face-to-face interviews gave a uniform message that there is a demand for the value-in-use style co-operation model that is described in chapter 3.2. The analogous product offerings between the providers, combined with the value focused customers, steer the business spotlight from value-in-exchange to value-in-use. The interviews were conducted in September 2018.

The interviews were conducted by using a topics level framework, but without formal questions or a strict procedure. In order to set up uniform ground for the interviews, the viewpoints and used terms were carefully explained before entering into each of the topics. The topics are presented on the following list:

- Differences between the cutting tool providers
- Industry 4.0 or IoT influence to the cutting tool business
- Sales engineers' process and project competence
- Co-operation, ecosystems and value

The durations of the interviews were between 15 and 30 minutes. The interviewees were selected from eight different companies. Company sizes and selected interviewees' positions were chosen in purpose to collect data about changes in the near future, which might not yet be obviously visible in the daily cutting tool business. An average number of machines in the company was 35 and the most typical job title was Development Manager. Contrasted to the Finnish market, the machining operation sizes in the included companies were clearly above the average and therefore were considered to possess decent resources for future development.

The data from the interview recordings were first transcribed on sentence level, that made it possible to quantify occurrence of the comments. Frequent and related ideas of different interviewees were the basis of the meta-analysis that was one of the selected methods for this research (Weathington, Cunningham, Pittenger 2012, 4/8). The quantified comments also gave the possibility to estimate the saturation point of the interviews, after which completely new ideas are rare. The eight interviews conducted were estimated to reach the saturation point for the scope used.

The consolidated data from the interviews is presented in figure 12. Single perceptions that occurred just once during the interviews were excluded from the chart. On the other hand, similar comments were consolidated to representative topics. The detailed outcome and samples from the interviewees' comments that represent the consolidated topics are presented in the following four chapters 5.3.1 to 5.3.4. The topics in figure 8 are grouped by color to match the chapters.

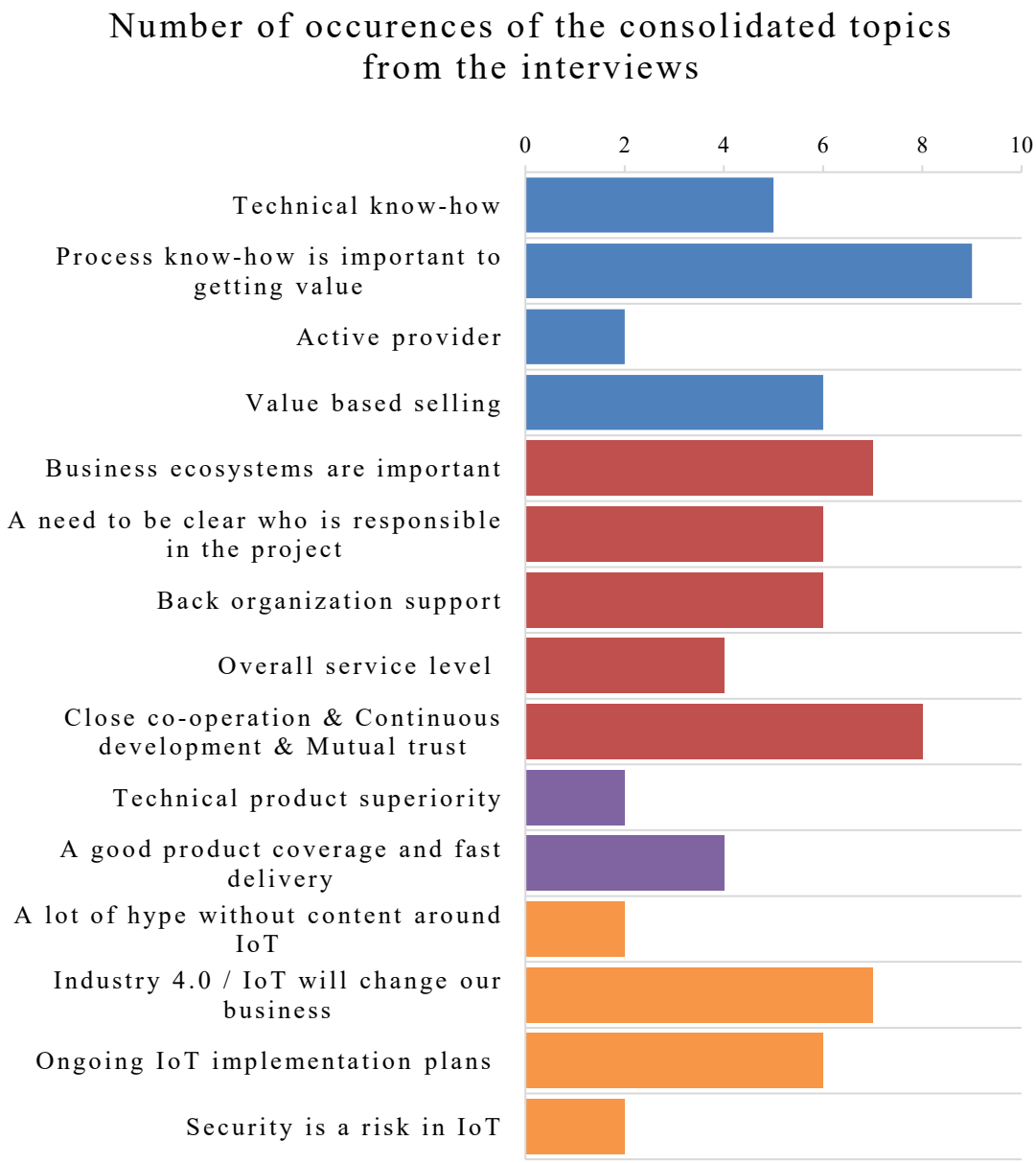

FIGURE 12. Consolidated topics from the interviews

5.3.1 Direct communication

Face-to-face communication and professional presence were appreciated as important elements of communication for the interviewed cutting tools customers. The following four topics in figure 8 represent the preferred qualities of the sales personnel: “Technical know-how, Process know-how is important to getting value, Active provider, and Value based selling”. The following comments provide some insights of the interviews:

> "There are a lot of providers in the market, but technical know-how has gone down, nowadays, there is a lot of hustle in sales." (CEO of a medium-sized company 1st interview)

> "Knowledge of the customer's production is important, as well as knowledge of their own products. Attractive product offers do not help a lot if we do not have a need for them." (Manufacturing System Manager 2nd interview)

> "Profession of the sales people includes technical- and sales skills. It is common that a sales representative imposes irrelevant products, although the specific need of the customer has just been reviewed." (Manufacturing Manager 5th interview)

> "It gives a very good impression when a sales representative actively offers valuable services that fit to the customer needs, for instance, product training for the users." (Development Manager 8th interview)

> "Technical know-how might be on a good level, but there is a lack of understanding of the complete process. Value realization focused projects are very rare." (Manufacturing System Manager 2nd interview)

> "Ability to demonstrate the concrete value for the customer is important. (Development Manager & Manufacturing Manager 6th interview)

> "Some of the cutting tool sales representatives do not even know what they are selling, that kind of sales people should not be in the business." (Development Engineer 4th interview)

5.3.2 Business processes

In this review, the objective is business processes at the customer interface. The following description of the favorable cutting tool provider describes the essence of the results: the most valuable cutting tool providers for the interviewees were described as trustworthy and they have convenient recourses for continuous development. In figure 8, the following five topics represent the business processes: "Business ecosystems are important, A need to be clear who is responsible in the project, Back organization support, Overall service level, and Close co-operation & Continuous development & Mutual trust." Some samples from the interviews are presented below:

> "A wide contact interface to the resources of the cutting tool provider is important. It is also important that a customer communicates clearly what brings value for

them, because needs between the customers vary a lot." (CEO of a medium-sized company 1st interview)

"Mutual trust is essential. Despite of sometimes projects fail, continuous in development is important." (CEO of a medium-sized company 1st interview)

"Depth, intensive and target-oriented co-operation that includes back facilities works. Mutual understanding is vital. It is hard to develop by looking only at your own production." (Development Manager & Development Engineer 7th interview)

"Partnership style services and co-operation that focuses on continuous development, not just for a single solution, are very valuable." (Manufacturing Manager 5th interview)

"The public image of the provider company affects the top decision makers, for instance company's public position in the new technological development." (Development Manager & Manufacturing Manager 6th interview)

"Complete solutions are better than singular fixes. Well-done ground work grants bigger benefits." (Manufacturing Manager 5th interview)

"Co-operation between the suppliers would be precious in big-scale tooling projects. Unfortunately, in some cases changes to the original tooling were needed after the implementation, because of insufficient complete solution just from one supplier." (Development Engineer 4th interview)

"Co-operation between the cutting tool providers and the machine tool manufacturers is constructive. For instance, it empowers the tool provider to offer the best combination that support the features of a specific machine." (CEO of a medium-sized company 1st interview)

"When using organization support of the cutting tool company it is important that it is clear who is responsible, for instance, a sales representative can act as a coordinator." (Development Manager & Development Engineer 7th interview)

"Overall service level distinguishes the companies from each other." (Development Project Engineer 3nd interview)

5.3.3 Importance of products

The interviews revealed that quality products are a basic assumption in the co-operation. Hence, without products there is no cutting tool business. On the other hand, the product

offerings were experienced very identical between the providers. Interviewees' comments below represent the following two topics in figure 8: "Technical product superiority, A good product coverage, and fast delivery".

> "Cutting tool products are very similar, some providers have a narrower product portfolio. No supplier has exclusive delivery rights to any single product category." (Manufacturing System Manager 2nd interview)

> "We have found some variations between the providers in the coating technology, other differences are small." (Development Project Engineer 3nd interview)

> "Fast and reliable delivery is important for us." (Development Manager & Development Engineer 7th interview)

> "Our aim is to find the best possible technical solutions, but from a limited number of providers." (Manufacturing Manager 5th interview)

> "Product lifecycle thinking separates providers from each other." (Development Manager & Manufacturing Manager 6th interview)

5.3.4 Industry 4.0 and IoT

Awareness of the latest technological development was distinct for most of the interviewees. In contrast to the on-line survey, Industry 4.0 and IoT were considered as "real game changers". On the other hand, the hype without tangible content around the Industry 4.0 was experienced frustrating. The IoT topic seemed to be very attractive, and often led to vivid discussions. The following quotations represent some of the comments that are connected to figure 8 topics: A lot of hype without content around IoT, Industry 4.0 / IoT will change our business, Ongoing IoT implementation plans, and Security is a risk in IoT.

> "IoT will make our jobs more attractive and easier for workers of the next generation. We have already started a project with remote connected machines, but we are still in the very beginning. Future opportunities are enormous." (CEO of a medium-sized company 1st interview)

> "Unfortunately, the cutting tool industry is not as far in IoT development as some other industry segments." (Manufacturing Manager 5th interview)

> "IoT will change the world, and it is already doing that." (Manufacturing Manager 5th interview)

“There is a lot of hype around IoT.” (Development Manager & Manufacturing Manager 6th interview)

“IoT will change the product lifecycles from time-based to load-based.” (Development Manager & Development Engineer 7th interview)

“Security is a significant risk that can slow the implementation of the IoT devices.” (Development Manager & Development Engineer 7th interview)

“IoT empowers the extended communication between a cutting tool provider and a customer, as for example, cutting parameters and logistic can be automatized and fine-tuned remotely by the provider.” (Development Manager 8th interview)

6 CONCLUSIONS AND DISCUSSION

This chapter firstly covers the key findings and answers to the two research questions defined in chapter 1.2. The final subchapter focuses on the further three development objects that arose during the research but were not analyzed in this research.

6.1 The status of value co-creation in the cutting tool business

Based on the research, the status of value co-creation is polarized in the cutting tool business. Deviations were found on both the cutting tool companies and personnel level. Therefore, the selected approach strategy of the cutting tool brand cannot gratify all business participants. The research identified both product focused and value-in-use focused business mindsets. Despite that, the actual business interactions seemed to be mostly value-in-exchange orientated. Deeper co-operation and focusing to value-in-use were seen as promising development objectives.

The empirical research presented in chapter 5 considered the cutting tool business from three different viewpoints that were: public communication of the cutting tool companies in the brand levels, daily face-to-face communication at the customer interface, and near future visions of the customers. The public communication profiles revealed the brand positioning in the cutting tool market. Some of the brands were clearly more focused on the latest business trends, such as IoT and Agile that were, in this study, considered as hi-end topics in the cutting tool business. The results from the survey in the customer interface were very similar with the results from the public communication. Some individuals were deeply aware of technological trends and were actively using, for instance, social media for networking, but a majority of the sample group prefer the product centric cutting tool business and traditional communication channels. At the customer interface, the future expectations were remarkably open for traditional development sources in the cutting tool business, such as technological development of the cutting tools. Interestingly, it was not possible to find a big difference between the data from the providers and the customers. So, the business participants of the immediate customer interface have mainly similar mindsets that can potentially lead to the status quo effect and slower the develop-

ment. The most revealing results came from the interviews about customers' future visions. The results from the interviews revealed a high demand for development of business processes and value-in-use focused co-operation. Based on the results from daily customer interface and interviews of the future influencers, it seems that the farther away you are from the daily routines, the more you see room for improvement. One of the interviewed development managers commented felicitously: "It is hard to develop by only looking at your own production."

6.2 The value co-creation ideas that best apply to the cutting tool business

Value focused processes close to the customers are coming increasingly important for the cutting tool business. Due to the speed of the industrial development, the targets of the projects are not as detailed any more, and they can vary a lot between the customers. Because of that, the trust on the outcome of the good processes seems to be the most relevant business strategy in the future. The recent situation in the cutting tool business reminds the development of the Agile processes that has changed the IT business starting from the early 21st century (Chapter 2.5). The research revealed that value focused and product connected activities were emphasized as most beneficial for the customers. Not a single sign of the platform business was found during the research, so the conclusion is that currently there is no cutting tool business without a tangible product. Although products seemed to be in a central role in the business interactions, it was quite clear that the products themselves cannot convey the entire value to the customers. Hence, the results revealed potential contradiction between the mindsets and actual value realization. From the cutting tool providers' point of view, understanding of the actual value realization of the customer can promote the improved value offer.

The following conclusions are based on the interviews that are covered in detail in chapter 5.3. Service ecosystems, for instance between the cutting tool firms and the machine tool builders, were recognized valuable for the customer. For example, a good business network can provide important information needed to mate the cutting tools to a machine tool. Also, the investment projects, especially machine tool investments, were mentioned as situations where the extensive networks are precious. Value realization, in other words value-in-use, was mentioned multiple times during the interviews. Contrarily, it was interesting that product prices were not mentioned at all in the interviews. At the same time,

every one of the interviewees mentioned some form of value realization. A positive attitude to value co-creation was another regular characteristic of the interviewees. One of the interviewed development managers put the concern of many into words “Unfortunately, closing the deal still seems to be the only focus for most salespeople”. The back-organization support from the cutting tool providers was identified as a valuable asset, although the responsibilities between stakeholders should be clear to the customer.

6.3 Further research subjects

When to make changes in the traditional business logic seems to be an open question in the cutting tool business. Based on the research, great business opportunities will become available for cutting tool providers who are willing to focus on value co-creation. Moreover, complete new business platforms that challenge traditional providers are still missing from the cutting tool business (Chapters 2.6; 3.1.1). On the other hand, the short-term benefits from the change of the business logic might be limited because of very traditional business environment close to the customer interface. Furthermore, so far, the traditional cutting tool business has been doing very well: In 2008 Warren Buffet, the chairman of Berkshire Hathaway, the parent company of the IMC group, commented on the acquisition of one of the largest cutting tool manufacturers Iscar: “It’s been a dream acquisition” (Marketwatch 2008). Ten years later, and during this research, the business views are still very bright. As for example, Sandvik Machining Solution reported the “record-high level” for revenues and operating profit in Q2 interim report (Sandvik 2018).

Another undefined subject is the relationship between value and money. At some point a customer may want to know the value they are getting for their money. Usually cutting tool customers are charged for products (value-in-exchange), but based on the research, value realization revealed to be a much more complicated process (value-in-use). So, a clear connection between the value and money seems to be missing or undefined. One of the interviewed development managers’ comment hits the point: “The ability to demonstrate the concrete value for the customer is important”.

The third challenge is the efficiency of the cutting tool provider. In order to maintain profitable business, the cutting tool companies need to be able to deliver more value from less work in the future (Denning & Hamel 2018, 1). So, what kind of cutting tool companies can survive in the future? The S-D logic type approach seems to be attractive to the customer but delivering it can require excessive effort from the cutting tool provider, especially if the business logic and processes are not well defined. The development strategies familiar from the current industry, such as Lean, Agile, and Design thinking could be considered as development strategies to the customer interface of the cutting tool providers, as well (Denning & Hamel 2018, 1 Box 1-2).

REFERENCES

Manifesto for Agile Software Development. Beck, K., Beedle, M., Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R. C., Mellor, S., Schwaber, K., Sutherland, J., Thomas, D. Manifesto for Agile Software Development 2001. www.agilemanifesto.org.

Berkshire Hathaway 2017, Annual Report 2016.

Denning, S., Hamel, G. 2018. The Age of Agile. AMACOM.

Dixit, U., Hazarika, M., Davim, J. 2016. A Brief History of Mechanical Engineering. Springer.

Confucius. https://www.quotes.net/quote/1260. Read 30.6.2018.

Goodwin, T. 2015. TechCrunch. The Battle Is For The Customer Interface. Read on 8.7.2018. https://techcrunch.com/2015/03/03/in-the-age-of-disintermediation-the-battle-is-all-for-the-customer-interface/

Glaiel, F. 2012. Agile Project Dynamics: A Strategic Project Management Approach to the Study of Large-Scale Software Development Using System Dynamics. Working Paper CISL# 2012-05, http://web.mit.edu/smadnick/www/wp/2012-05.pdf.

Groover, M. 1999. Automation. Encyclopedia Britannica. Read 1.7.2018. https://www.britannica.com/technology/automation

Grönroos, C., Voima, P. 2012. Critical service logic: making sense of value creation and co-creation. Academy of Marketing Science 14 July 2012.

Handelsbanken 2017. Capital Markets Equity Research Sandvik May 16, 2014.

Hopp, W. Spearman, M. 2008. Factory physics. Illinois: Waveland Press Inc.

Isaacson, W. 2015. Technology is not a job killer. CNBC. Read on 8.7.2018. https://www.cnbc.com/2015/02/26/technology-is-not-a-job-killer-commentary.html

Kennametal 2017. Annual Report 2017.

Lusch, R., Vargo, S. 2014. Service-Dominant Logic. Cambridge: Cambridge University Press.

Marketwatch 2008, read 26.1.2018, https://www.marketwatch.com/story/buffett-says-is-raels-iscar-is-dream-acquisition

Modig, N, Åhlstöm, P. 2017. This Is Lean. Stockholm: Rheologica Publishing.

Plato, The Rebublic. Trans. Jowett, B. The Floating Press. 2009.

Sandvik 2017. Annual Report 2016.

Sandvik 2018. Interim Report Second Quarter and first six months 2018.

Sandvik 2017. Training handbook metal cutting technology.

Schwab, K. 2016. The Fourth Industrial Revolution. Portfolio Penguin.

Siilasmaa, R. 2018. Transforming NOKIA McGraw-Hill.

The Committee on Bible Tranlation, Moo, D, Strauss, M., Williams, J., Blomberg, C., Boda, M., Brown, K, Gathercole, S., Hess, R., Instone-Brewer, D., Mounce, B., Shead, A., Swarup, P., Waltke, B., Barker, K., Fee, G,. Jobes, K., Liefeld, W., Longenecker, R., Madvig, D. Walker, L. The Bible - New International Version. 2011. New York Bible Society. Read on 14.07.2018. https://www.biblestudytools.com/niv/

Womack, J., Jones, D. 2003. Lean Thinking. New York: Free Press.

Womack, J., Jones, D., Roos, D. 2007. The Machine That Changed The World. New York: Free Press.

Washingtonpost Business 2009. Toyota Passes GM as World's Largest Automaker. Read on 29.06.2018. http://www.washingtonpost.com/wp-dyn/content/article/2009/01/21/AR2009012101216.html??noredirect=on

Weathington, B., Cunningham, C., Pittenger, D. 2012. Understanding Business Research. New Jersey: John Wiley & Sons.

APPENDICES

Appendix 1. Data acquisition by using internet search engine

The table was developed during the research process to simplify the process. The web-based table can be used for repeating the web-searches done during this research. Permanent web address for the table is:
https://drive.google.com/drive/folders/1852P3HTTRKRFLJbSA0XRT7tGPAllVREL?usp=sharing

SEARCH HIT FORMULAS For instance automotive from www.sandvik.coromant.com = https://www.google.com/search?q=automotive+site%3Awww.sandvik.coromant.com

	Sandvik				IMC				Kennametal	
https://www.google.com	www.sandvik.coromant.com	www.dormerpramet.com	www.secotools.com	www.walter-tools.com	www.iscar.com	www.taegutec.com	www.tungaloy.com	www.ingersoll-imc.com	www.kennametal.com	www.widia.com
automotive	automotive	automotive	automotive	automotive	automotive	automotive	automotive	automotive	automotive	automotive
lean	lean	lean	lean	lean	lean	lean	lean	lean	lean	lean
digital	digital	digital	digital	digital	digital	digital	digital	digital	digital	digital
agile	agile	agile	agile	agile	agile	agile	agile	agile	agile	agile
"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"	"industry 4.0"
IoT	IoT	IoT	IoT	IoT	IoT	IoT	IoT	IoT	IoT	IoT
added value	added value	added value	added value	added value	added value	added value	added value	added value	added value	added value
partnership OR cooperation	partnership OR cooperation	partnership OR cooperatio	partnership OR coopera	partnership OR cooperat	partnership OR c	partnership OR coop	partnership OR coop	partnership OR cooperat	partnership OR cooperat	partnership OR cooperation

RAW DATA

Variable	www.sandvik.coromant.com	www.dormerpramet.com	www.secotools.com	www.walter-tools.com	www.iscar.com	www.taegutec.com	www.tungaloy.com	www.ingersoll-imc.com	www.kennametal.com	www.widia.com	Total
automotive	3860	61	1100	1090	10300	378	181	368	545	102	17985
lean	42	61	4	1	2	0	0	0	71	3	184
digital	1310	138	159	423	236	2	309	25	37	55	2694
agile	63	1	62	0	0	0	1	0	6	1	134
industry 4.0	351	0	0	165	39	0	59	1	0	6	621
IoT	117	0	1	1	1	0	6	0	0	0	126
added value	85	48	35	313	68	64	8	0	70	49	740
partnership OR cooperation	293	68	26	214	9	35	165	3	84	33	930
	2261	316	287	1117	355	101	548	29	268	147	3759

Appendix 2. Questionnaire used for the survey

Cutting tool business development

Thank you for participating in the research!
The survey is conducted on the topic "interactions between cutting tool providers and customers".
No personal identification information will be recorded or used for the research.
The survey consists of 7 questions and it takes less than 5 minutes on average to fill and submit it.
Questions regarding the research can be sent to timo.koutonen@sandvik.com
The results will be published in www.theseus.fi by the end of 2018 and can be found by using the author's name "Koutonen Timo".

* Required

1. Please select your role related to the cutting tool business *

Select your answer

2. Please select the description that best fits your personal knowledge about Lean Manufacturing or Six Sigma *

Select your answer

3. Please select the Agile activities you can recognize in the company you work, You can select multiple choices. *

- [ ] I haven't noticed the term Agile being used in the company I work.
- [ ] The company I work in uses the term Agile in management communication
- [ ] I've participated in Agile style projects or activities
- [ ] I've been in an active role in Agile related projects or other activities

4. From your perspective, which trends do you expect to affect the business in the next 5 years? *

Please rank the topics below from Low to High.

	Low	High
Cutting tool development (3d-printed cutting tools, developed coatings, grades, geometries and other technologies)	○	○
Development in co-operation processes between supplier and customer (Ordering, technical support, communication and information sharing platforms)	○	○
Material technologies that reduce demand for cutting tools (additive manufacturing, casting, welding etc.)	○	○
Industry 4.0 (connected cutting tools and devices, data analytics)	○	○
Value centric business interactions (less focus on cutting tool features)	○	○

5. Which advantages benefit the customer the most *

Please place the most important features at the top and the least importance at the bottom

- Cutting tool company's extended resources (advanced support, production flexibility)
- Smooth daily ordering process
- Innovative product offering
- Manufacturing knowledge
- Fast delivery

6. Where do you find new co-operation partners *

Please sort sources by relevance, the most probable at the top and least common at the bottom.

- From social media and internet discussion channels (Youtube, Linkedin, Twitter, CNCzone etc.)
- From trade fairs or advertising material
- From companies' web pages
- Recommendations from current business partners or colleagues

7. (optional) Free comments and ideas for developing interactions in the cutting tool business.

Comments can be written in Finnish / Swedish / English. The ideas could be included in later interviews.

Enter your answer

Submit