KARELIA UNIVERSITY OF APPLIED SCIENCES

International Business

Zoltan Toth

THE SUCCESS OF SMES IN THE GLOBAL VALUE CHAIN

Thesis
May 2020

THESIS
March 2020
Degree Programme in International Business
Bachelor's Thesis
Tikkarinne 9
FI 80200 JOENSUU
FINLAND
Tel. +358 13 260 600 (switchboard)

Author
Zoltan Toth

Title
The Success of SMEs in the Global Value Chain

Abstract

This paper studies what the prerequisites are for small- and medium-sized companies to run a successful business as a part of the global supply chain. The study concentrates on specific small- and medium-sized manufacturing enterprises because they represent a very significant part of the global economy. The thesis states that European companies can also be competitive in the fractionalized subcontracting field, where Asian companies dominate.

First, the study concentrates on the formation of the global value chain. This is explored by examining the three unbundling steps in trade that have led to today's global market. It very specifically examines how evolving technology has helped overcome constraints.

The research then introduces some industry specific indicators that are used to measure a company's overall performance in quality, cost and lead time. These performance indicators are generally used by industry procurement decision makers to make purchase agreements. These indicators are used in the two interviews. Two companies in the same industry with different backgrounds are interviewed to gain knowledge about their comparative advantages using the performance indicators.

The research concludes that the manufacturing companies are most successful in competing with Asian competitors when the desired performance indicators are achieved. Both interviewed companies manage to have some of these comparative advantages.

Language:
English

Pages 36

Keywords

Global Value Chain, SME, Globalization

CONTENTS

1 INTRODUCTION

1.1 Background

Globalization has shaped the way in how companies structure their manufacturing base and sourcing, even their research and development. Many countries have lost, but single companies have gained from the constantly and very rapidly changing markets. The interest behind this paper comes from the curiosity to understand the possible outcomes of these changes.

1.2 Aim

The aim of this study is to investigate how two companies cope in today's globalized value chain. This paper argues that despite the general prognosis of offshoring there are specific fields of industry that have managed to find a niche market where comparative advantages still can be found in European companies.

1.3 Methods

This qualitative research explores globalization as a phenomenon that changes the behavior and operation of companies. The paper deeply dives into the theoretical research of globalization and its consequences. The research is carried out on two companies to measure their competitiveness today using an industry-standard way of measuring.

1.4 Outline

The paper first investigates the history of globalization by using Richard Baldwin's idea of the three unbundlings of globalization. It explains some of the terminology and the concept of how trade and manufacturing has changed since the 19th century. It presents what kind of changes different industries, occupations and eventually tasks have faced and how the global value chain was born. It looks at how the Industrial Revolution changed the way and costs of transporting goods and what effect this has had on the level of specialization. Then it reviews the changes

of the 20th century, as moving ideas became cheaper, which in turn enabled companies to outsource tasks instead of the full process of manufacturing. Finally, it looks at the forecast of the near future to comprehend what changes the latest and future improvement of information and communication technology will most probably bring alone.

In the second part of the research the paper introduces two case studies. The first company is a Russia-based contract manufacturing factory that supplies the plastic injection manufacturing industry. The second company introduced is a contract manufacturing factory in Finland. This SME focuses on manufacturing accuracy parts for the plastics industry. The second part outlines the major differences between the two companies' level of expertise, level of specialization, focus on markets and work force.

In the last section, the comparison shows the differences between the possibilities of the two companies to compete on the global market. The paper views the current situation of both companies by using a SWOT analysis. In the summary the paper stipulates what challenges the newest phase of globalization might generally bring along and whether the two companies have the prerequisite to survive in the constantly changing global value change.

2 THE EMERGENCE OF THE GLOBAL VALUE CHAIN

This chapter studies how the today's vast global supply chain was formed throughout history. It explores the different periods of time and examines how technology changed the prerequisites of trade ending in today's world of moving goods and ideas quite freely all over the world. The history is based on the writings of Richard Baldwin (Baldwin 2006), unless mentioned specifically otherwise.

2.1 The history of trade

Throughout the history of humankind there have been some points of progress that triggered changes in manufacturing and trade. Trade has been limited by three factors: transportation of goods, moving ideas and transportation of people.

By today nearly all three constraints have been overcome through natural and technological changes and improvements.

It is interesting to point out that for two hundred millennia, humans were very much dependent on external factors in their livelihood. The livelihood of people was driven by their very basic instinct of survival. This meant mostly that that people were gathering and hunting enough mostly to be able to provide for their very basic physiological needs.

> For something like 190 of the past 200 millennia, “production” mainly meant food that was tied to particular locales and seasons. Production and consumption were spatially bundled since prehistoric transportation made it easier to move people to food rather than food to people. Little trade occurred. (Baldwin 2006.)

The role of the globe’s geological and natural history has played a great role in the movement and living standard of humans. It was not before the first global warming that humans were able to raise their output in production. This still focused entirely on livelihood and mostly producing food. Initially, people followed the natural resources herding their non-domesticated cattle to greener and more fertile pastures. After 10.000 BCE, the climate changed and global temperature rose. This enabled people to settle down and find possibilities of producing food in the same environment.

At this point of time, the trade of goods as we know them today was minimal. Trade mostly concentrated on copper, tin and luxurious goods consumed by the ruling elite of the day. Iron and steel followed later; this enabled weapon manufacturing to evolve. Perishable goods were hardly possible to move longer distances.

The Silk Road was the highest level of trade development until the 1500s. Due to the weight and bulk limitations of the camels, this shipment lane remained to be more of a romantic set of adventure books than of trading channels in terms of value. The silk road was also limited by its infrastructure. In modern concepts most places of the silk road were more like a hiking train than a highway for moving goods. By the time of the flourishing times of the silk road, the Middle East,

the Ottoman Empire and some of Asia were the most successful nations in terms of agricultural and manufacturing outputs. The great plague and the fall of the Ottoman dynasty ended the era of the importance of the silk road.

Wage is also an important factor to view in the development throughout history. Factually, before the industrialization period of humanity, the average wage of people was slightly above the poverty level in most developed areas. Due to the lack of substantial economic growth, this level remained the same for centuries. This also put a limit on people's consumption of goods that were brought from great distances. People's consumption was mostly limited to food and goods available within a close walking distance.

2.2 The agricultural revolution

The constant need of migration in search of better crops and fertile fields for herding animals ended when tribes of people settled down. Finding the right geographical location with a suitable climate played and important role in this.

Baldwin (2006) describes the Agricultural revolution as a crucial transformation where food production was brought to people. This meant that trade was localized – production and consumption took place in the same place. The scale of trade was small, trade was still difficult.

People now understood the importance of using animal power in cultivation and watering of lands. Fertility and success in crops were no longer limited to those river valleys that would be flooded every spring. Now, people were able to control the output more accurately than before. Some of the local manufactures of local specialties were born in this area. These goods are today's highest and rarest original delicacies.

Even though the localized developments appeared in Europe, they remained rural forms of feudalism. The true improvement was brought by the Renaissance and the Enlightenment, which mostly meant the mental growth of the European nations. The scientific and cultural development shifted from Asia and the Middle East to the curious European countries. Earlier "Backwater" European countries

swiftly developed highly efficient weaponry and armies. With the help of this the first explorers from Europe set out to find shorter and quicker routes to India and Asia, leading them eventually to the Americas, as well. This thirst for knowledge led them to explore and eventually colonize lands far away. Colonization opened new possibilities to retain commodities, but due to the still undeveloped transportation means, the costs of trade still remained high. As an example, even though the New World had plenty of fertile land for crop growing, the slow transportation of sails ships could not successfully deliver wheat or corn to the European countries.

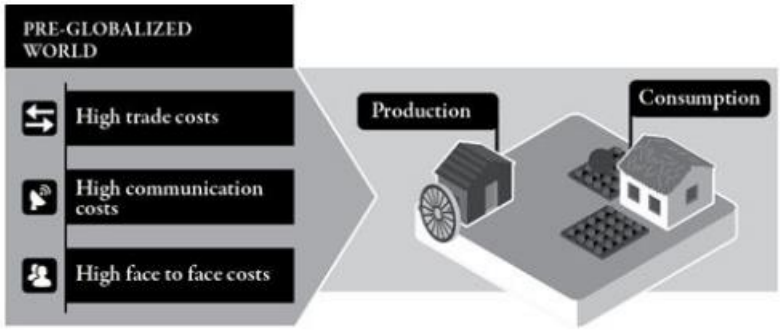

Figure 1. Production and consumption bound together (Source: Baldwin 2006).

The pre-globalized world is visualized in Figure 1. It shows how locally produced goods are consumed locally, because no constraints of trade are unbundled, yet.

2.3 The history of globalization – industrialization

With the invention of steam power in the early 1800,s humanity took one of its most advanced leaps, which was to determine the progress of development for a hundred years. The first steam engines could do no more than to operate a grinding wheel in a crop mill and the consumption of fuel (e.g. coal) hardly made it efficient in today's terms. The rapid improvement in steam power came as the high-pressured steam's flow was diverted into multiple pistons. This engine set up already provided a massive amount of torque and made it technologically feasible to be mobile. The steam engine was soon fitted to ships which had riveted

hauls and were thus lighter and stronger. The ships could now sail further and carry more cargo than before.

Transportation by land was truly revolutionized when the first stream operated locomotives were invented, and the first cross continent railways were built. Railroads could cover vast amount of territories in relatively short time. Fuel (i.e. coal and water) was available nearly everywhere, so the distance between local producers has become shorter. For the first time in human history the cost of transportation was significantly lowered.

> Radically better transportation made it economical to consume goods that were made in faraway places. As a result, production patterns shifted, and international trade volumes skyrocketed as nations started to “do what they do best and trade for the rest.” (Baldwin 2006.)

This sentence is referred to as the comparative advantage of a country. The economist David Ricardo developed a theory called the comparative advantage in 1817. The theory was developed to show that in the free-market two nations producing the same goods or commodities will both increase their consumption by exporting what they are the best at, even though they import the rest, if there is a productivity difference between them.

Great Britain was the first of the G7 to start free trade by demolishing tariffs in 1846. Most European countries also reduced their protectionism and joined the movement by 1860. This movement eventually reversed in 1880, and state governed tariffs were re-introduced to guide the economic growth and development of nations.

The Industrial Revolution triggered a very rapid development in the North. The North refers to the Northern-European countries of Britain, Germany, France and Italy (also later the US, Canada and Japan). These seven countries are later known as the G7 industrialized countries. Again, the South refers to those formerly more predominant countries of Asia, the Middle East, Africa and South America. Specific countries in this region are later named as the I7; which stands for “industrializing seven”.

The extreme speed of development enabled the North to create its own specialties on a national level. The Northern countries' local producers were now able to reach other countries' markets very quickly and efficiently. The North heavily industrialized. The wages of the North naturally rose at a quick pace, while the wages of the South stagnated or decreased. The North focused on manufacturing goods and by manufacturing goods constantly adding value. At the same time the South was merely a supplier of raw materials with no added value. This cut all possibilities of economic development in the South. The differences were continuously growing year by year. This process would continue until the First World War.

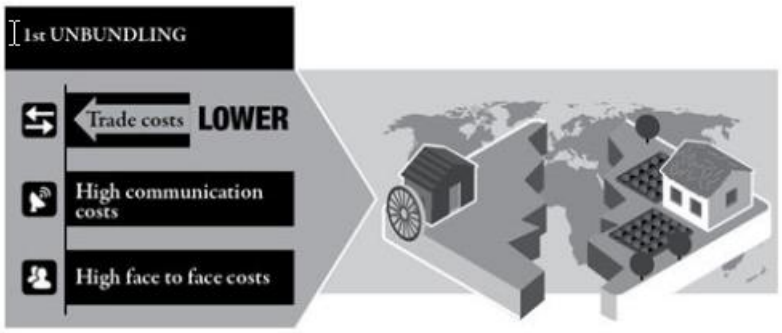

Figure 2. Trade costs are lowered by cheaper and faster means of transportation and industrialization (Source: Baldwin 2006).

The nature of trade is visualized in Figure 2. It illustrates how the local produce is no longer bound to local consumption. The physical separations of production and consumption is what Richard Baldwin calls the first unbundling of globalization. Communication costs and face to face costs are still relatively high, so moving production to low wage countries does not appear, yet.

2.4 The second unbundling of globalization (the global value chain)

Until the 1990s trade was mostly goods crossing borders – exports and imports. The balance mostly depended on nations' pro-export and anti-import policies. A domestic company that needs to compete with foreign producers tends to like

domestic import tariffs as it normally raises the price level thus giving better profits. An export-oriented company dislikes the foreign tariffs as it reduces their comparative advantage over the local companies.

As manufacturing and trade were booming in the North, so was the movement to free trade in Europe. European countries created their common market that evidently became today's European Union. The effort to govern and promote international trade began as World War II was ending. The Allies set up the first General Agreement on Tariffs and Trade (GATT).

The agreement's aim was to improve living standards with a focus of sustainable development. International trade between the member states was given a fundamental road map with a set of rules. Promoting international trade meant to reduce tariffs between countries. As Baldwin (2006) describers, the reductions would have to be "mutually advantageous and reciprocal".

The most interesting assumption of the GATT was namely reciprocity. It meant that any nation entering the agreement will treat all nations reciprocally the same way (i.e. tariff applied to any should be applied to all). In the interest of growth, now heavily industrializing countries also joined the agreement. To promote even further trade possibilities there was a huge loophole left in the system of reciprocity for these developing nations. This meant that these nations would not need to reciprocate, even though other nations did. GATT became the World Trade Organization (WTO) in 1995.

By the time the WTO was established there was a vast revolution in the Information and Communication Technology (ICT). Computing technology grew at astronomical speeds every year. The speed of computing processes reduced computing time to fractions of what it had been just a few years earlier. The possibility to store and handle data also took huge leaps forward. As a comparison, the mobile phones of the early 2000s had the same computing power as all onboard computers together on the Apollo's Lunar Module, The Eagle, had in 1969.

This ICT revolution gave more speed to means of transferring knowledge, thus loosening the constraints of information flow in the earlier days. This change and rapid development in moving information enabled businesses and companies to interact in a way never seen before. Baldwin calls the elimination of the second constraint - namely movement of knowledge - the Great Convergence.

The Great Convergence does not comprehend worldwide free-trade and utilization of national comparative advantage. Here is why: While higher levels of IT allows companies to use automation, the development of CT fractionalizes processes into smaller tasks. To set up automation is capital- and knowledge-extensive. When factories set up robots, they want to make sure that the automation covers as many traditional low wage jobs, as possible. Factories, for example that use robotized set ups of gathering the ready workpieces from the production halls tend to build vast systems of pick-up robots, delivery carts, conveyor systems and inventory sorting robots. The setup of this system requires capital investment and an extreme amount of know-how. The operation of this will, however mean that a handful of highly skilled people keep an entire factory’s internal logistics running twenty-four hours, seven days a week. When such a system is running well there is a little amount of incentive to fractionalize tasks for offshoring.

Communication technology, on the other hand makes it possible to move knowledge and monitor basic tasks that are fractionalized into smaller bits and pieces from jobs that earlier required a profession. Companies that earlier outsourced comprehensive assembled units now split those up into simple components. This makes it possible to create guidelines, so low-wage low-knowledge workers are able to manufacture them. The full process, however, demands a knowledge-based high-wage headquarters responsible for monitoring the overall outcome. Fractionalizing usually means a higher need for a logistics web. Either the final assembly is made simple enough to be offshored, or in some cases the components are shipped to the users’ headquarters, where final assembly is made. Offshoring component manufacturing took its first maiden steps in electronics. The way of how the electronics industry works set the path to many different industries.

Instead of nations, large G7 firms were now giving their know-how to low wage firms in different nations. The process could be split up between many several companies – networks in different nations. National comparative advantage was replaced by international production networks. The large G7 companies focus on setting up an running those value stream networks regardless of countries or regions.

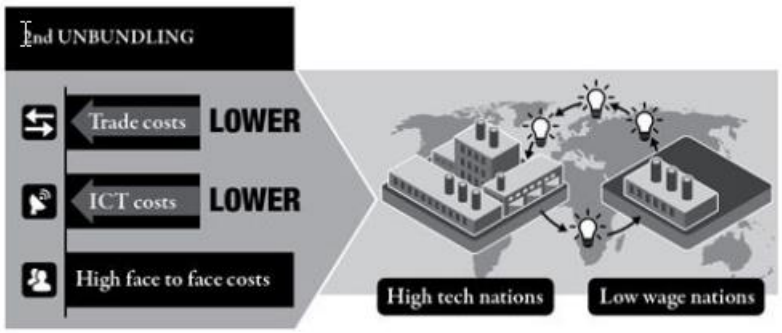

Figure 3. The second unbundling of globalization (Source: Baldwin 2006).

The contours of industrial competitiveness are now increasingly defined by the outlines of international production networks rather than the boundaries of nations. Figure 3 shows the lower trade and ICT costs.

It is no longer easy to distinguish between the winners and losers of globalization. Winners are no longer nations, not even occupations. The ultimate winner is the global value chain and the owner of the global value chain. This must create some caution for policy makers in how to focus on future challenges in the trade policy government.

2.5 Globalization history continues – the cost of moving people

The third unbundling of globalization is still yet to come. Even though some of the technology already exists, availability is low and costs are still very high, so they are not yet in use. The near future does not offer the possibility of teleporting

people to locations. The nearest solution is the so-called telepresence. In fact, there are two ways how this technology will cut the costs of moving people.

The first application is, already somewhat in use in some industries. In the near future, engineers from far away locations will be able to maintain and correct machinery by using robots operated through the internet. An earlier form of this already exists, where machine manufacturers can connect to machines by remote connections and make basic software or parameter corrections without being present. According to Andrea Rosetti at Lizzini Ltd., TeamViewer software is used nearly daily for changing machine parameters remotely on customer machines. This will be evolving further to yet unimaginable spheres.

Another application of telepresence is a much higher level of Skype. It is very well known that Skype meetings and negotiations have failed many times due to the low quality of picture and sound feed. People's micro-expressions happen in fractions of a second and have more value than any spoken word. It is not uncommon that people prefer to set up actual meetings instead of online discussions, because it is considered high risk that most of the message of the parties might by lost due to the poor connection and lack of resolution. As Baldwin also mentions, some of the leading communication technology companies like CISCO already have technology that use high-definition cameras and screens with auto-adjusting sensitive sound systems. These systems are not yet reachable for all. It is more than certain that the current COVID-19 or coronavirus situation will speed up the launching of new communication technologies. Sales efforts of the existing systems of different manufacturers are already filling up the ad space online. These are still not of the quality of the future telepresence equipment, but most companies are now ready to spend money on even less sophisticated ones.

In a way, the COVID-19 pandemic is now underlining the cost of moving people or being present. In industries where remote work is not an option, a very difficult situation quickly arises. Air-travel, for instance is seeing some of the first bankruptcies as liquidity problems appear due to flight restrictions and cancellations. The first airline to go bankrupt was FlyBe (Perper and Slotnick, Business Insider, 2020), and Norwegian Air Shuttle is trying to apply for state bailout with the help

of issuing bonds. The free movement of people (one of the three basic freedoms of the EU's Maastricht Treaty) has just caused a situation that is extremely difficult to control. Tourists from all over the world flooding European destinations and possibly changing countries three to four times a week are very difficult to track. In the time of an epidemic this gives authorities a hard job to deal with.

Whatever the latest technology might bring to this equation, it is clear that this third unbundling of globalization will affect mostly service jobs. Technology will enable low-wage workers to engage in service providing sectors and carry out service tasks from a far distance.

3 RESEARCH FRAMEWORK

The research idea of investigating small subcontracting companies is based on the professional interest of the author. In the last nineteen years subcontracting companies in his network have faced large and very rapid changes. Some of these changes have been excruciating, some have meant the end of business for those companies. At the same time these changes have enabled other companies to grow.

In Finland, the end of the Nokia era brought very difficult times for several industries that were supplying Nokia or were part of the value-chain. As Maija-Liisa Kämppi wrote in her analysis, in the area of North Karelia mold making and injection molding suffered the greatest losses (yle.fi, 2017). Some of the large suppliers in the Nokia value chain were quickly sold to an Asian company and was physically moved to Asia. There was an immense amount of knowhow and capacity in this network of what they referred to as the Plastic Valley, so why was it inevitable to replace this entire supply chain with Asian companies? What strengths should be the focus to generate new businesses and what were the weaknesses to overcome? These questions are very relevant today.

Many of the remaining smaller businesses of this network analyzed these questions to find out how they could fight for survival. Some of them survived, changed profile and managed to grow. The author was employed by one of the companies in this network. The company was able to successfully re-profile and sell its capacity on different export markets. Some of the other companies never recovered.

3.1 Analysing SMEs

This paper analyses two different SMEs belonging to the same company group. The research has a special focus on their actual market position in the global supply chain. Globalization research has focused on giving a picture of general trends of industries and nations. The following case studies will use the general trends as performance indicators, and the companies will be compared to those.

Why are SMEs worth analyzing? SME's have a key role in any country's economy. According to statistics published by Daniel Clark (2018) there were 25.1 million enterprises in the European Union alone. The same data shows that almost 100 million people have been employed by these companies. In the opinion of the author the analysis of these companies is highly interesting, as it covers a large representation of companies and employers.

According to the European Bank for Reconstruction and Development (2020), SMEs are often a more interesting option for large customers to subcontract work to, instead of insourcing. In many cases the outsourced work requires specialized know-how or technology. If the customer decided to manufacture the similar parts or assemblies in house, it would mostly mean incorporating a new production unit, cost unit or branch of the organization. Initially, this has costs of the investments for the physical background. It means pre-mapping processes, designing and building premises, designing and purchasing equipment and creating the human resource foundation of the unit. The set-up of a specialized unit that is not directly connected to the core-business can be costly, inefficient and clumsy.

The European Bank for Reconstruction and Development also points out that customers will prefer to use SMEs because they are flexible. SMEs are created

by entrepreneurial type owners, which drives these companies with a high energy and a large need for creativity. The hunger for success makes SMEs faster and more agile in adapting to new market situations. SMEs are also highly specialized in certain skills and machinery, which in turn cuts the overhead costs of manufacturing, as it is dispersed between several customers.

From the SMEs' point of view, the few large customers have a high impact on their order books. By default, SMEs are more customer-oriented in their processes. They tend to keep lower fixed personnel costs by creating customized ways of handling paperwork and services.

3.2 Measuring indicators of success in subcontracting

The key performance indicators of the success of a subcontracting company have long been price, quality and lead time. The order of importance of the three factors might vary with different customers. This approach was first used by the British automotive industry (Imai 1997). It is also commonly referred to as the "Bermuda" triangle of success in subcontracting. The term subcontracting means basically manufacturing parts according to customer design. The SME possesses suitable machinery and technology that is deemed necessary by the ordering customer; hence, the SME is chosen for the job after it passes all three criteria of price, quality and lead time. This is used in the analysis of the two chosen SMEs in the case studies of this thesis.

Price – cost

Price is often referred to as the cost of a unit produced by and SME. Some might argue that it represents the value of the unit manufactured. Others might say that it is just the assessment or the calculated target by procurement. All three approaches are equally right in the correct circumstances. Price – as is in other industries – is determined by supply and demand. In subcontracting work, it normally depends on the difficulty of the parts to be manufactured and/or the availability level of manufacturing technologies suitable for the part. The more machines available, the lower the price expectation will be. As an example, the everyday

presence of modern automatic bar-feeder technology on 11-axis turning machines have driven unit prices of certain type of workpieces down that were earlier made in several set-ups. On the other hand, a one-off nozzle to be made by additive manufacturing is still very pricy, due to the lower number of machine hours available. The cost calculation of subcontracting SMEs also depends on many factors. SMEs with lower amounts of loans on their machinery tend to sell with lower hourly rates, while SMEs with new machines and high amount of loans still to be paid are driven to try to get the highest prices. In the end, price (in addition to lead time) is one of the factors easily compared by procurement specialists.

Quality

The importance of quality is emphasized by several authors. Joseph Berk (2010) gives a hands-on approach to qualities role in cost reduction in his book *Cost Reduction and Optimization for Manufacturing and Industrial Companies.* Quality requires higher sets of tools to give and apple-to-apple comparison. Quality is often understood as physical quality, visual quality or dimensional accuracy of the parts to be procured. The customer data of the parts to be manufactured state the crucial information of the design of the parts. It communicates issues like dimensions, shape, raw material, tolerances, etc. Measuring quality, however, means much more. While most of the crucial data is available on the drawings, many important factors are lost between the designer and the user of the part. It is not so uncommon that drawings miss crucial pieces of information about certain quality demands of certain features. In some cases, the designer herself does not have the knowledge of this necessity, but often the featured quality is just simply supposed or expected.

In modern subcontracting concepts quality is understood and measured in a much broader way. The communication capability between the subcontracting SME and the customer becomes even more important as the geographical distances grow. This ensures that errors are kept unrepetitive and rare, or at least decreasing. The mindset of an SME about its own attitude towards skilled workers, operational standards and processes also play a key role. The mindset is the single most crucial and difficult property to teach to new workers, yet the success

in this will affect the SMEs rating in the long run. Overall quality cannot be achieved without workers and the management's joined commitment to working according to the same rules. Depending on the customer, there might be more sophisticated ways of measuring a subcontractor's performance in quality. The advantage of a system is the transparency that it provides to the customer's organization. It is indisputable and available for decision making. Very often this needs an equally high level of input and commitment from the customer and the subcontracting SME to provide a sufficient amount of data for evaluation. A feeling-based quality assessment by the SMEs technical or procurement counterpart might be very fruitful on the short term, but it might as well quickly be demolished as people change jobs within or outside the customer's organizations. After organizational changes it can be difficult to get reliable assessment of performance. This may cause disturbance and confusion in cooperation.

Lead time

Lead time, as the other simply quantifiable fact of the triangle, is becoming more often a decisive factor. It is often said that the lower we continue in the supply chain, the more the pressure builds up in terms of lead time. As subcontractors are lower down the global value chain, they have no influence over the customer's design and project management processes that occur before their work. This might often mean that the time lost in the design and project management process needs to be compensated in the manufacturing phase, often in the manufacturing phase of the subcontractor.

As Imai (1997) points out, lead time is given – depending on the industry – with the accuracy of a day or even an hour. Customers demand to keep the lead times and are keen on setting KPIs for reaching targets. The measuring of delivery performance is quite easily manageable. Visualizing it also motivates the subcontractor to improve its processes to reach targets.

3.3 Measuring Quality, Delivery, Cost (QCD)

In the case studies, the factories will be analyzed by looking at their strengths, weaknesses, opportunities and threats per “type of work” (TOW). In all four factors the Quality, Delivery, Cost (QCD) aspect will be used the most. This will generate the ideas for the discussion part of this paper. The expectations and performance is visualized on triangle graphs. The overlapping of the customer expectation of Quality, Cost and Lead-Time is shown in Figure 4 as the performance of the SME compared to the customer expectation. The better the triangles overlap, the better the factory achieves the expected level. Failure to create overlap means room for improvement.

Figure 4. Illustration of Quality, Delivery, Cost of type of work (Source: Imai 1997)

The interviews with each company’s management provide the data in percentages of their perceived success rate. For this purpose, the interviewed parties use their success rate in offers given out and won or lost on the specific customer accounts. This is used as a comparison value against their competitors’ performance (i.e. Eastern-Europe and Asia) to give a comprehensive picture of the competition.

4 CASE STUDY – FACTORY 1

The first case study is a steel-working factory in Russia. Their business is manufacturing steel components as a subcontractor. This case is used, because the wage level of the workers is relatively low in comparison to Factory 2. A cross-examination using the QCD triangle was carried out to see what factors this factory must meet to compete in today's global value chain (GVC).

4.1 The history of Factory 1

The company has a long history of manufacturing steel parts, as Mr. Alexander Sidorov, the company's sales manager, explains. Throughout history this factory used plenty of manual machines for producing parts. Due to the manual set-up and old machinery, there was a high demand for skilled workers due to the basic accuracy demanded in the parts. This led to competition between the workers, because the fixed salary was based on skills, and the variable salary was determined by output.

From the early 2000s some development was made in tooling. The appearance of harder and more durable tools made of hard metal on the shop floor closed the gap between the old craftsmen and the newer generation. The startup of new CNC machines completely changed the field. The new automatic machines replaced some of the old-fashioned manual machines.

4.2 The markets of manufacturing for Factory 1

The factory operates mostly on the domestic market. The markets are mostly bound by the local financial system, i.e. new orders are part of larger projects that very much depend on the availability of short and mid-term loans from banks. Most of the parts this factory manufactures are relatively simple, so the market expects a relatively short lead time as well.

Export has been mostly limited to material with little added value. This has been mostly a cause due to the specialized capacity's use on the local market. Local demand has been high enough, so most of the capacity could be sold locally. Excess capacity was created in the pre-work, so raw material dealing could be enabled. Manufacturing wages in Russia are still quite low compared even to their East-European counterparts. A CNC programmer's average wage in Russia is less than half of a fresh graduate's wage in the West (Salaryexpert 2020). Wages are also interpolated to output to a certain extent, so lower months mean also lower costs.

4.3 QCD of the four main types of parts

The QCD values are derived from an interview with the sales manager, Mr. Alexander Sidorov. Sidorov's (2020) replies to the questions of their factory's quality, price and lead time have been very helpful in creating the values of triangles.

Part type 1

These parts are very price-sensitive, due to the its standard nature. The share of raw material is quite high in these parts. Users of these parts can easily compare prices with competitors.

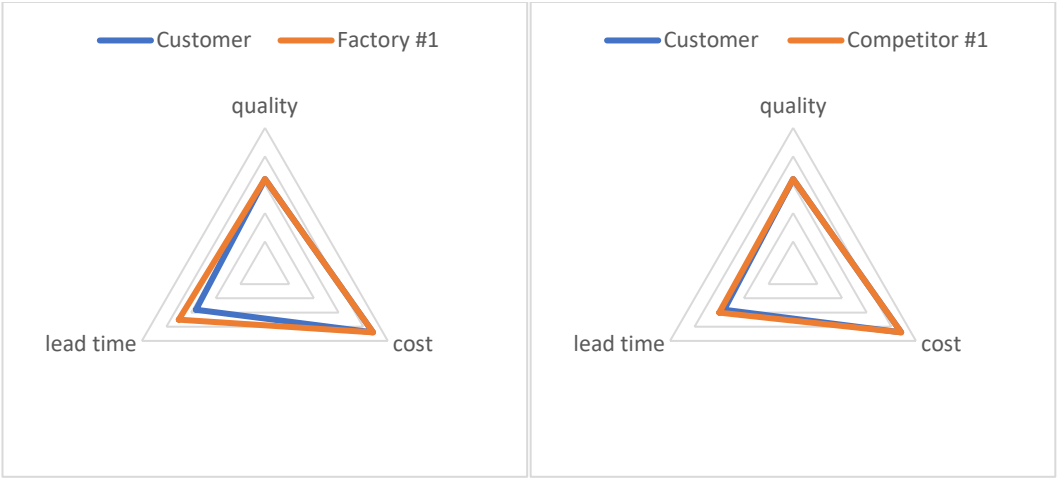

Figure 5. QCD of part type 1 for Factory 1 and Competitor 1.

Figure 5 illustrates how Factory 1 reaches customer expectations on costs and quality. Lead time is extended from the expectations. Figure 6 shows the fluctuation in capacity and the willingness to stretch lead times to customer limits. The lead time is still within the customer's flexibility and it gives some possibilities for premanufacturing other parts with shorter lead times. This is therefore a bit of a trade-off.

Competitor 1 from Eastern Europe wants to enter the market and build a higher market share. The set-up concentrates fully on part type 1, so they comply completely with the customer's lead time expectations. Prices are also adjusted very near or slightly below the prices of Factory 1.

Part type 2

Just like part type 1, part type two is also very price sensitive on the market. It is highly standardized and requires basic machinery. A comparison made by a customer is very simple on B-2-B WebShops.

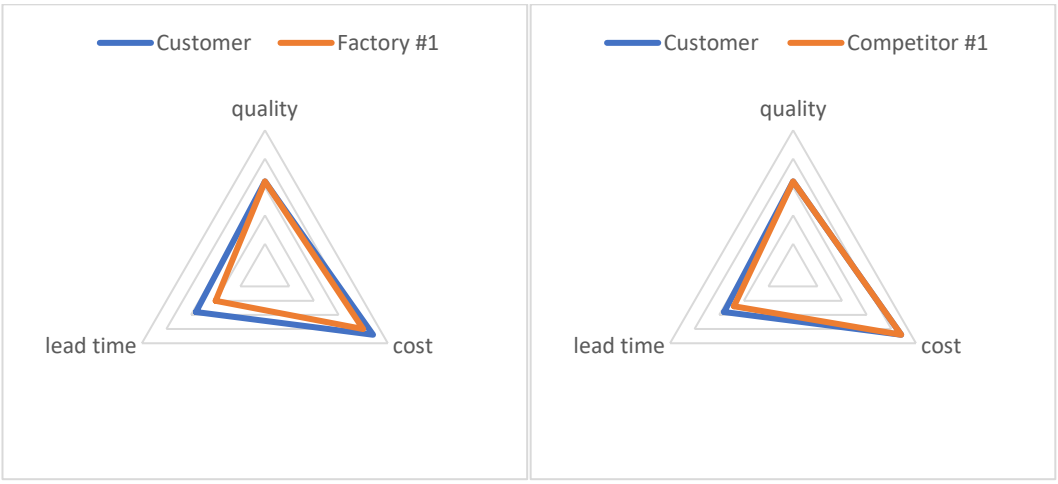

Figure 6. QCD of part type 2 for Factory1 and Competitor 1.

As Figure 6 shows, Factory 1 reaches and exceeds the quality expectations of the customer. Raw material availability for a stable process is ensured locally. The customer's cost expectation is based on the price level that Competitor 1

maintains. Competitor 1 claims to use an automatic set up, hence the price level. Factory 1's price level is based on the existing older machinery and set up. This does not have any capital costs, but it still enables a reasonable total manufacturing time. It causes a small difference between the price level. The gap between the price level can be often overcome by Factory 1's capabilities of manufacturing type 3 parts that may be bundled with type 2.

Factory 1 struggles to keep the lead time that the customer demands. This is due to the manual equipment set-up that is unable to cover the high order peaks, thus resulting in longer lead times. Competitor 1 maintains a stock in its company that helps them deal with the higher peaks. Competitor 1 has this comparative advantage as long as no tailoring of the parts is needed by the customers.

Part type 3

Part type 3 is always manufactured according to customer drawings. This part type cannot be kept in stock. The share of material from the finished part is much lower, and the competency of the workers has a much higher impact on the end result. This type also needs a great set up in pre-manufacturing "project-engineering" and the quality measurements used in after sales.

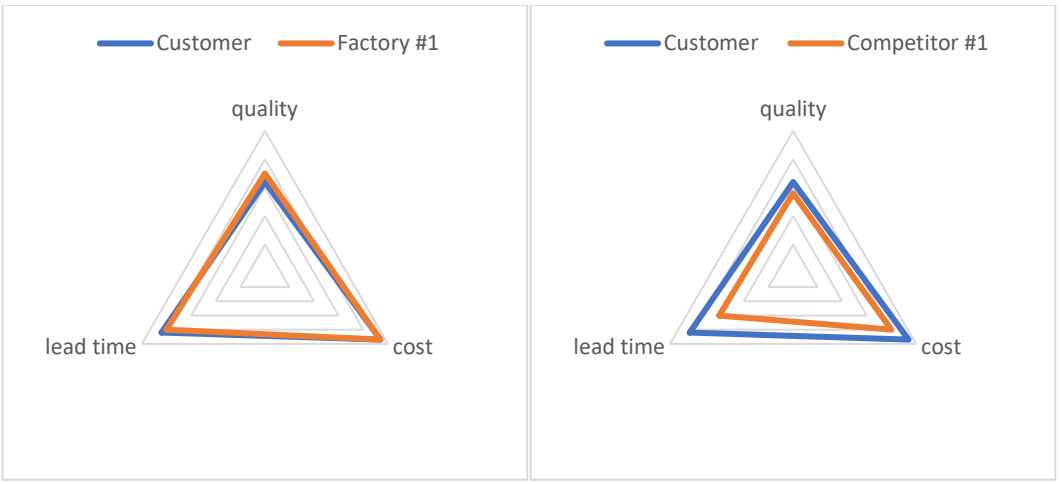

Figure 7. The QCD of part type 3 for Factory 1 and Competitor 1.

As Figure 7 shows, in these parts Factory 1 exceeds the customer expectations. The factory has the right material types mostly in stock. The ensuring of correct material is on a high level, and this is appreciated by the customers. The engineering team is well trained and educated. Quite often they are asked by the customer to review the part design from manufacturing point of view. After the discussions the manufacturing tolerances are decided together with the customer. This is perceived as a vital add-on on the quality Factory 1 provides in type 3 parts. Another well-perceived and liked after sales service is that the parts are measured with a 3D coordinate measuring machine after manufacturing. The measuring results are saved and documented. If there are any deviations to the maximum allowed tolerance of the pieces, then the measuring report shows this. In these cases, the customer is always contacted and informed about the values exceeding the tolerance zones. The customer has the full decision power regarding whether something is approved, reworked or remanufactured.

Part type 4

These parts are also manufactured according to customer data. The parts are different in the machinery needed in manufacturing. Some of the parts require heat treatment and further machining afterwards. Due to the complexity of the parts, the worker's impact on the end result is high. Many parts need to be manufactured in multiple steps.

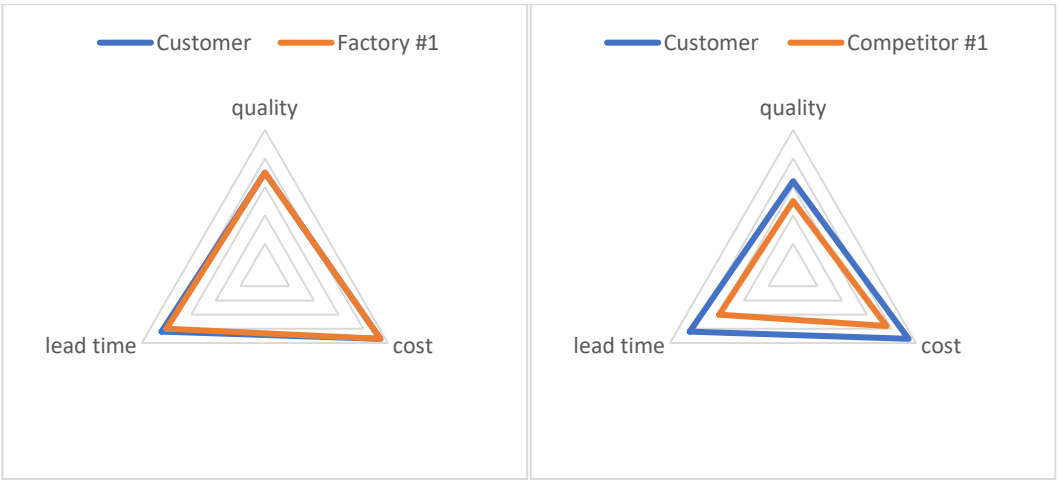

Figure 8. The QCD of part type 4 of Factory 1 and Competitor 1.

As Figure 8 illustrates, Factory 1 manages to achieve and exceed the customer expectation in quality of part type 4. Due to the skilled labor on the semi-automatic machines, the quality level remains high. The packaging of the parts also plays an important role in the quality perception, as it makes customers' efforts to unpack and sort the parts upon incoming inspection very easy.

Factory 1 manages to keep the costs low with the help of older type machinery that is already paid. As the machines are relatively simple, their maintenance and repair are also made simple. This helps to keep the machinery functional for a long period. The prices are sensitive but are still manageable.

The lead time of Factory 1 is still accepted by the customer, but clearly there is pressure to shorten the lead time. Fluctuations in projects mean fluctuations in capacity. There is only a small amount of capacity buffer in the system that does not manage to cope with flow of the projects. There are no forecasts available, which also means a certain amount of reluctance towards new investments.

4.4 Recommendations in light of GVC for manufacturing, Factory 1

The SWOT analysis looks at the GVC point of view of the factory's future success. The overview represents the niche market possibilities in the value chain.

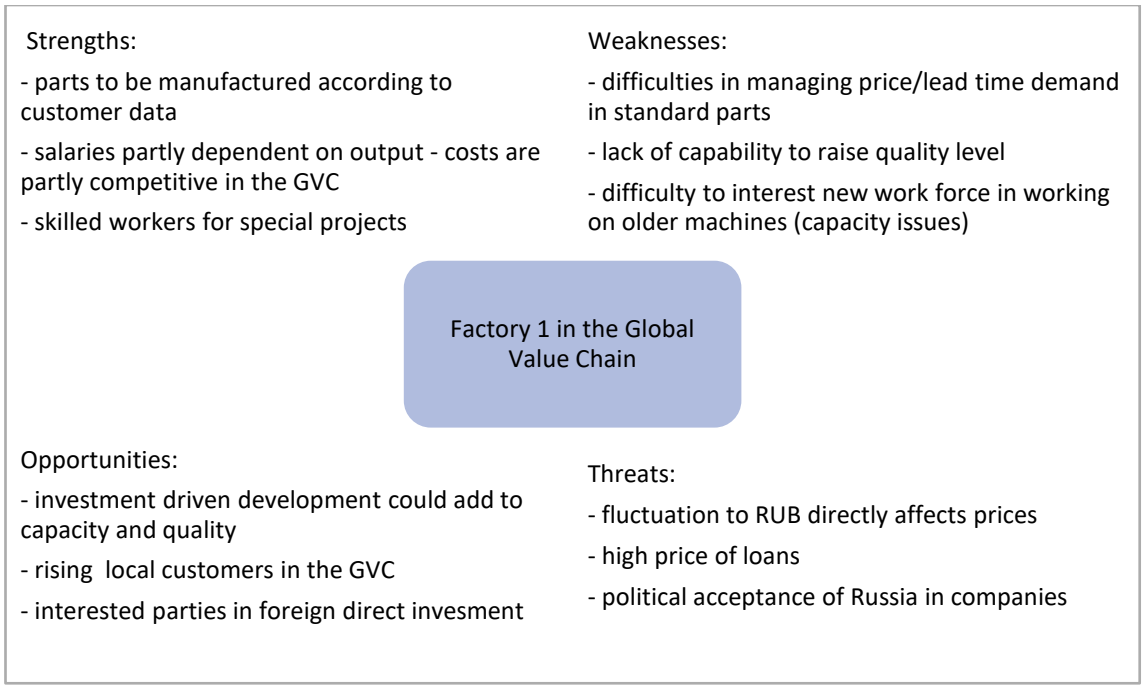

Figure 9. SWOT analysis of Factory 1 from the GVC point of view.

Factory 1 clearly has some offerings to the global value chain. Its customers are mostly companies that are active on the local market. Only some customers are a part of the truly global value chain. The advantage of being a supplier to those companies is the possibility of higher order amounts. On the other hand, due to the high fluctuation in that demand, it also means that a high amount of buffer is necessary, or lower months must be accepted. The price level in those deals is also lower, because the offers are compared directly to those of Asian companies. Even though proximity allows for a shorter lead time, the price bar must still be met first.

Entering the European GVC requires a high amount of modernization to pass the customer audits of quality assurance and other matters. It is very much recommended that Factory 1 start systematically investing in the future technology of CNC machines. The reliability of the pricing method must also be developed, and true milestone goals must be set.

5 CASE STUDY- MANUFACTURING FACTORY 2

Factory 2 is a European subcontractor of parts needed in injection molding tools. The Factory has new facilities and a set of world class machinery, as Mr. Ville Tahvanainen (2020) points out in the interview. The factory specializes in extremely high accuracy in its manufacturing. It does not possess any self-marketed products – the factory focuses fully on manufacturing parts based on customer data.

5.1 The history of manufacturing Factory 2

The factory was set up in the early 2000s to supply parts to a local customer's cluster in Europe with a fairly short lead time. The manufacturing process was set up fully to serve the standard flow of parts, even though every part might be different. The idea was to manufacture single parts with mass-production principles. The cluster in question was completely moved to Asia (mostly China) just a few months later, as Factory 2 was no longer competing in prices or lead time.

The next step was to harvest the high level of accuracy the factory had. There was a clear demand in another value chain that was just being born. The participants of this value chain greatly welcomed the new capacity in parts manufacturing. Lead times were competitive, but on the edge, as usual. Two years later the factory was presented a new scenario that encouraged massive new investments in even higher accuracy machinery. This path was taken to serve the long-term goal of supremacy in accuracy.

5.2 The markets of manufacturing Factory 2

The factory operates on a completely global market. Customers and competitors are all over the world. On most markets the factory must compete with Asian competitors, most of them in China. The factory also competes with other companies in Europe, but here the apple-to-apple comparison is a little bit foggy, as customers are ready to accept some lower quality in exchange for lower prices.

5.3 QCD of three main types of parts

The QCD values are derived from the interview with the production manager, Mr. Tahvanainen. His replies to the questions of the factory's quality, price and lead time have been very helpful in creating the values for the triangles.

Part type 1

Part type 1 represents parts that have a very high demand in quality, but the required amounts set a limit to their traditional way of manufacturing in European countries. The demanded accuracy and repeatability also set a challenge to the machine tools. Factory 2 is specialized in possessing machinery that enables manufacturing with extremely high accuracy in a processed-based, automatized manner.

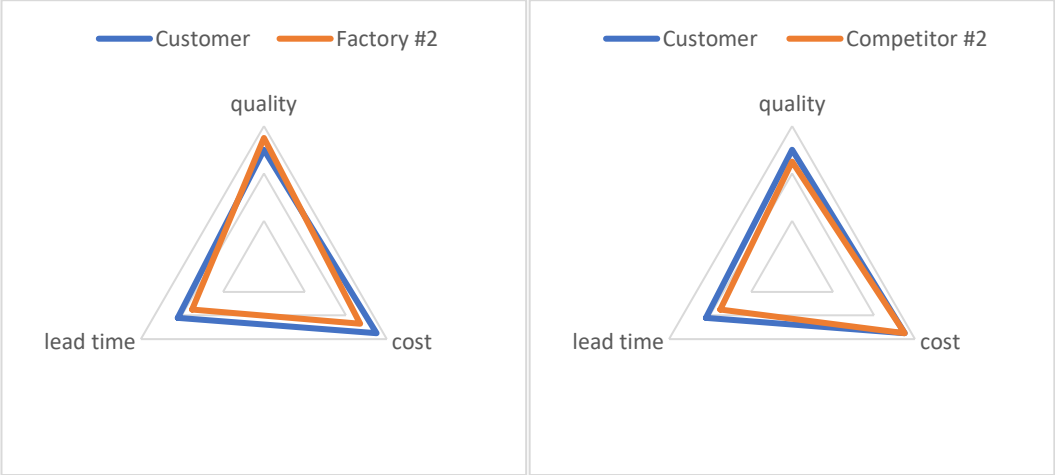

Figure 10. The QCD of part type 1 for Factory 2 and Competitor 2.

As Figure 10 illustrates, Factory 2 manages easily to exceed the customer expectation in the quality of type 1 parts. The specialization in full traceability means status quo of quality supremacy compared to the competition. Customers very much appreciate the full certainty of raw material sources and have no reason to measure parts in their incoming inspections other than a few test measurements.

Especially the smaller batches tend to exceed the price expectation of customers. In these cases, however, a favorable capacity situation might provide the tipping

point for scoring the order. Capacity has a limited amount, so lead time expectations of customers are not always met, and this sometimes minimizes success in getting orders.

Part type 2

These parts represent the highest volume of Factory 2. They also require the highest amount of machinery. Parts are manufactured nearly from scratch and they represent some of the most demanding work in the industry. There is very little room for error in accuracy; otherwise parts are not approved. Every part is measured 100% (professional term in component manufacturing), which means that all tolerated dimensions are measured and documented. Reports are saved for full transparency and traceability.

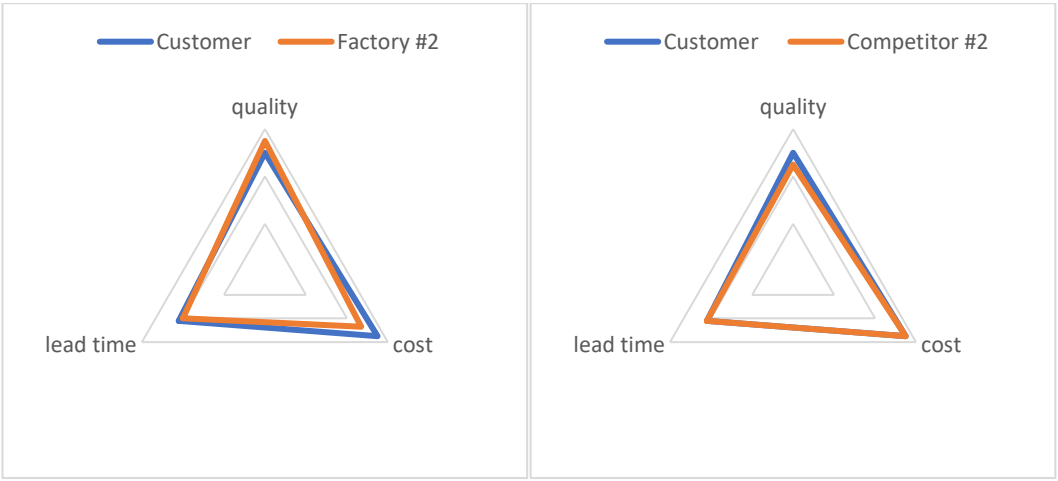

Figure 11. The QCD of part type for Factory 2 and Competitor 2.

Figure 11 shows that the factory exceeds the customer expectations in most quality related customer demands. The accuracy of the machines and the set up give good possibility for success. It is important to mention that in the accuracy demand, tolerances are getting smaller every year. Designers of tools tend to rely more and more on ultimate, nearly “zero-tolerance” accuracy. As machine building companies and some machining companies irresponsibly claim, such accuracy is possible in today’s technology. This is, however a very theoretical approach and is easily debunked when measuring parts with accurate enough technology. Lead time is a constant challenge due to the fluctuation of parts. Some

customers demand up to three weeks of shorter lead times than others. If other customers manage to place a lot of orders with a longer lead time, then serving those who demand shorter lead times becomes increasingly difficult. This often leads to losing those orders and eventually losing those customers.

Price expectations are reached in most single projects. In higher series the competition in Asia is often blinded by the potential and ends up quoting an unsustainable price level.

Part type 3

These parts are partially made externally in the factory's own supply chain. Parts are then further machined in house. The difficulty and properties of the parts define the level of further added value needed in the factory. Some parts are made with minimum added work, and some might be limited to measuring and documentation.

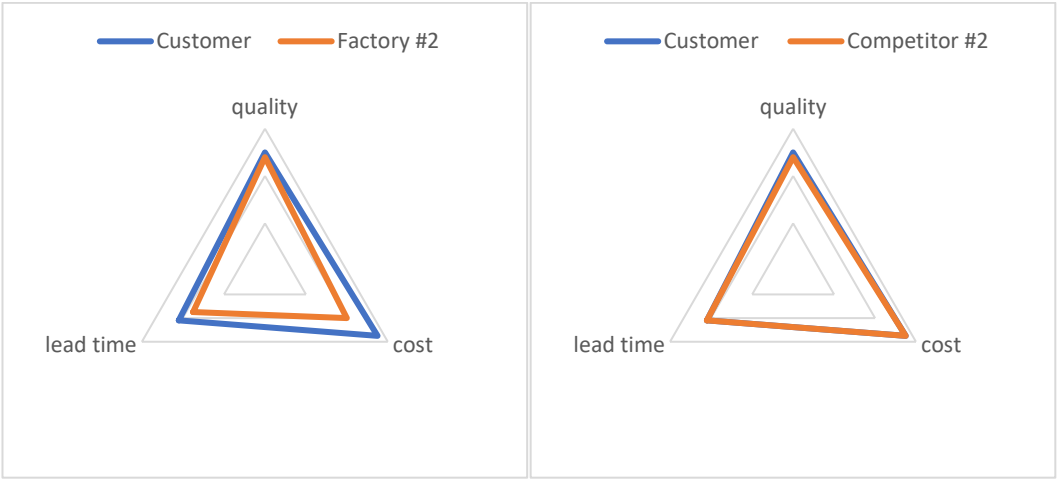

Figure 12. QCD of part type 3 for Factory 2 and Competitor 2.

Figure 12 shows that Factory 2 struggles to be successful in these parts due to the fact that a large share of this work is outsourced, and customers also tend to outsource these in a similar way to Asia. Customers accept the risk of quality fluctuation of Asian suppliers and prefer to put forth the extra effort of guidance and training or ultimately claiming the parts.

The customers clearly see a future of this kind of work in offshored plants. This shows in their commitment of giving constant feedback to those Asian's manufacturers of their quality performance. The continuous training and follow up by the customer leads to a high overspill of knowledge. Some customers have built an entire organization for monitoring suppliers locally in the Asian supply chain. This is a pricy solution and it requires this set up to function perfectly to compensate the costs created.

Certain companies already apply the same philosophy in their procurement that McDonalds uses in their restaurants with the touch screens. The touch screen receives the orders, but it also automatically forwards it within the system and places "internal orders" to the kitchen. This means that demand is directly transmitted to production and to the full value chain. Human participation is replaced by a process based, highly automized ICT system. The customer does the only work required in the process.

These companies also calculate a minimum amount of buffer in their own lead time, so the claim process can be carried out fully without missing the internal lead times. This is a trade off from the customer. Sometimes, this helps Factory 2 to score more orders when the customer's own Asian supply chain fails to deliver quality parts. Factory 2 manages to score a certain amount of these parts, but with a decreasing tendency. The future of these parts could be enhanced by creating an extra add-on service level before and after the manufacturing process. This could mean assisted design and a higher level of measuring and documentation. In some end-user industries, the full traceability of raw material and heat treatment can also help Factory 2 to score orders. The reliable source of raw material is more easily proven when the documents are in English.

5.4 Recommendations in light of GVC for manufacturing factory 2

The SWOT analysis shows Factory 2's position in the global value chain. It shows the niche market positions and how the factory can remain to serve in the global value chain.

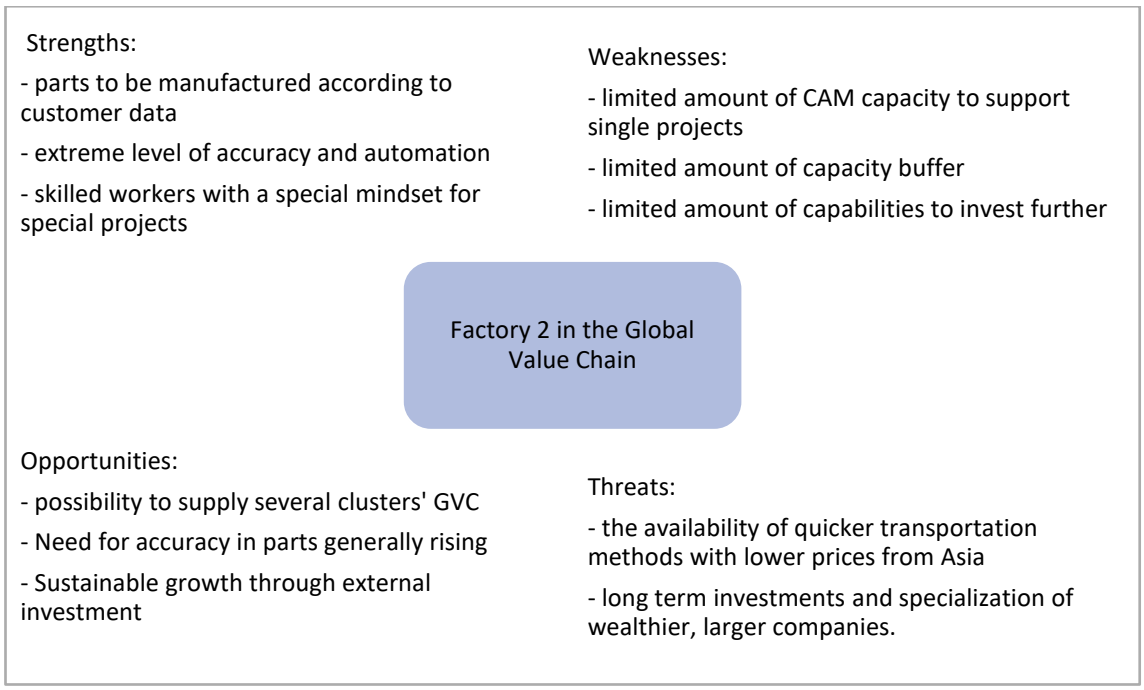

Figure 13. SWOT analysis of Factory 2.

Factory 2 is a rising star on the global market. As customers realize the total cost saving prospects due to interchangeability of parts, they will demand higher accuracy in the tooling of their parts. Demands for higher accuracy means more projects to cope with. The factory has the possibility to increase the market share to a quite sizeable one. However, this requires development in CAM programming resources and eventually machine resources. Growth in this case is dependent on investments, and manufacturing with this accuracy is truly dependent on investment capital.

The future also involves a lot of advancement in technology and materials. Customers expect that their parts can be manufactured less expensively or they can last longer due to material toughness and other characteristics. In both cases the

factory must focus on continuous improvement of their machining efficiency. Being the forerunner in any of this development will mean the victory in a market that can be easily dominated by Asian low-labor-cost countries.

6 DISCUSSION/CONCLUSION

The research shows that being competitive in the global value chain requires a diverse view of comparative advantage. Customers split up project into fractions to get better prices from better manufacturers. This split may be even according to machine types. In some types of parts, the winning supplier is chosen on the basis of the machine park. Customers possess procurement systems that have information on all the manufacturing capabilities of suppliers. This means that even requests for quotations are only sent out to those clearly specialized in that type of work.

Earlier, the market also had a trading niche. As the research shows, simply trading with these manufactured components has become very difficult because the customers are able to go to the sources, reach manufacturers in Asia directly. With their more complex procurement systems and fractionalized parts, it no longer requires a strict technical support for procurement to make purchasing decisions. Competence is decided based on performance.

The research was not able to offer any solution for the constantly decreasing business area of trading with outsourced parts. Both companies seem to be going through a clear structural change, because losing deals means lower turnover. Both factories are forced to find other alternatives to trading. Trading in this business requires large stocks to be able to compete in lead time. Competition is dominated by large companies that possess large stocks. They are able to deliver parts with a really short lead time and keep price level low due to their procurement power.

The correct mindset for continuous improvement has proven to be one of the strengths a company must have when seeking to be competitive in the global

value chain. Rapid changes are constant and less predictable than before. Both interviews point out that in order to adopt to new situations, these factories learn to continuously evolve to provide a competitive offering. Their values include openness, honesty and being pro-active towards customers about development. At the same time, the analysis shows that the European manufacturers make sure that they are always one step ahead in their development through investments in new technologies.

From the manufacturers' sales points of view, it is very critical for both factories to familiarize themselves with the information technology being incorporated in procurement processes. Communication with customers does not depend on the chatting skills of the salespeople. The interviews clearly show that procurement decisions are made based on the performance of price, quality and lead time. It is systematically measured and continuously monitored by teams of people.

Will this mean that human to human contact no longer be required in business to business relationships? To a certain extent, for sure. On the other hand, salespeople will now need to be even more on the edge of knowing the business of their customers, so they get a chance to get on board just on time. Getting this knowledge is only possible through personal contacts and very good communication skills. One will also need to be able to find the correct way of communication that is swift, easily accessible, yet accurate enough, so the message is not lost in the technology.

The research had its limitations in reporting about investigation of customer-specific case studies and studies of profitability per customer. The report focused on the more general picture of today's position in the global value chain, instead of deep diving into more specific quantifiable analysis. The reason for this is that both factories considered it a serious risk to expose actual figures to a research that will be generally available to any parties and might give precious insight to competitors. The request of limitation and non-disclosure is hence honored. This can be considered also the weakness of the research.

While there are no quantifiable results disclosed in this report, many of the findings, conclusions and suggestions made here are, in fact being used for the strategical planning and risk mitigations of both factories. Both factories found it necessary to expand the research and illustrate the findings of this reports with calculations that will be used for decision making process of their strategy. Further research, planning and budgeting is underway as a separate confidential project.

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