

# Manufacturing Characteristics of Subcontractor SMME:s – an Empirical Study

Malin Löfving<sup>1,2</sup>, Christer Johansson<sup>1,2</sup> and Mats Winroth<sup>1</sup>

<sup>1</sup> Department of Industrial Engineering and Management, School of Engineering, Jönköping University, Sweden

<sup>2</sup> Departments of Product and Production Development, Division of Production Systems, Chalmers University of Technology, Sweden

## Abstract

This paper presents empirical findings on manufacturing characteristics at subcontractor small and medium sized manufacturing enterprises (SMME). The SMME:s play a significant role in today's economy, but they do not act to the same extent on the global market as the international larger companies. To remain competitive on the global market SMME:s should improve manufacturing.

The study has been accomplished in different industries and different sizes to identify their characteristics. The results indicate that SMME:s are focused on process technologies and not on the entire manufacturing system. The companies also have difficulties in locating and hiring skilled people.

## Keywords:

Small and medium sized enterprises, decision criteria, manufacturing characteristics

## 1 INTRODUCTION

Small and medium sized manufacturing companies (SMME) play a significant role in today's economy [1]. 99 % of the companies are SMME:s [2]. Many SMME:s are subcontractors to larger companies [3] and are therefore highly dependent on them. Historically, a subcontractor works for a limited number of larger customers [4]. Competitive advantages have been low price and whether the subcontractor is located near the customer [4]. This is however changing and more and more SMME:s are aware of this challenge and try to increase their customer base.

The challenges for the SMME:s have increased [4] during the last years. The challenges come from the increasing globalization and the increasing customer demands. The globalization increases the access to new technologies, to new knowledge, and to new markets, but the competition also becomes more severe [5]. For SMME:s, the globalization can be seen as a larger challenge than for larger international companies. The SMME:s are not acting to the same extent on the global market as the international larger companies. International larger companies can drive national SMME out of the market, since SMME:s do not have the same financial strengths or resources as the larger companies [6]. To remain competitive on the global market the SMME should improve productivity [1], management, and manufacturing.

Methods, tools, and philosophies used by large manufacturing companies, like Lean Production, have not yet been adopted by all SMME:s [7, 8]. To be able to adopt new manufacturing and managerial methods, financial resources, time, and skilled employees, both operators and management are needed [8, 9]. SMME:s suffer in general from financial constraints and lack of human resources [8, 9]. This makes it more difficult for smaller companies to implement methods that were developed by larger companies. Due to this, smaller manufacturing companies must have the ability to become more efficient. The first step to develop manufacturing in

SMME:s is to identify their manufacturing characteristics. The next step is to develop methods and tools that can support manufacturing in SMME:s.

Research into small and medium sized enterprises has increased the last years [10], especially in the business perspective. Studies about SMME have focused on growth and development of the company [10]. When manufacturing is mentioned in the SMME literature, it is often described as a part of the company that affects the market and the growth of the company [11] [12]. For the SMME:s the manufacturing is often a central part of the company. SMME:s concentrate largely on manufacturing and technical issues, rather than on management, organisation, or customer service [4]. Even if the SMME in general focuses on manufacturing, there is no general research about characteristics of manufacturing in SMME:s.

## 2 RESEARCH METHODOLOGY

The research presented here was performed as an empirical study. The purpose of the study was to identify manufacturing characteristics in subcontractor SMME:s. Data was collected through interviews and observations at 20 different subcontractor SMME:s in Southern Sweden. The companies participated in three different projects, depending on type of industry. Before visiting the companies, semi structured interview questions were designed. Semi structured interviews [13] were chosen as interview method to enable follow up questions. The first questions were about the company and ownership. The next questions were about the future, strategy, specific questions about the project, and manufacturing system. The interviews lasted not more than 2 hours. The observations were carried out in the manufacturing plant after the interviews and followed a structure that was developed prior to the study.

After the investigations of the companies were done, the interviews were transcribed.

The analysis of the data has followed Miles and Huberman [14] cross-case analysis. Cross-case analysis was chosen to enable a deeper understanding and to enhance the possibility to generalize.

Miltenburg's [15] six decision criteria for a manufacturing system were chosen for the cross-case analysis. The six decision criteria were chosen since they support the manufacturing system and provide the necessary conditions for successful manufacturing. After forming the characteristics of each decision criteria (see table 1), the entire manufacturing system can be described. The six decision criteria are:

- Human resource
- Organisation structure and controls
- Sourcing
- Production planning and control

- Process technology
- Facilities

Each decision criteria had certain characteristics that were listed in a table (see table 1). Each company was analysed in terms of the characteristics of the six decision criteria. The industries were then analysed and compared in terms of size, ownership, and manufacturing process.

### 2.1 Studied SMME:s

According to Cagliano [4], there are two main business models for SMME:s: original manufacturers and subcontractors. The manufacturers produce their own products, developed and engineered in house. The subcontractors provide manufacturing capacity and process technology skills, but are not endowed with design skills [9]. In this paper the subcontractors are studied.

The studied SMME:s are subcontractors from three different industries: foundry industry, polymer industry, and

Table 1: Table of the manufacturing characteristics

	<b>Small foundry</b>	<b>Medium sized foundry</b>	<b>Small polymer company</b>	<b>Medium sized polymer company</b>	<b>Small automotive part company</b>	<b>Medium sized automotive part company</b>
<b>Human Resources</b>						
Promotion opportunities	Easy	Medium	Easy	Easy	Easy	Medium
Level of education	Low	Low	Low	Low	Low	Low
Multi-skilled	Yes	No	Yes	No	Yes	No
Participation of employees in problem solving and improvement activities	Low	Low	Medium	Medium	Medium	Medium
<b>Organisation structure and controls</b>						
Organisational structure	Flat	Hierarchical	Flat	Hierarchical	Flat	Hierarchical
Centralised or decentralised organisation	Centralised	Centralised	Centralised	Centralised	Centralised	Centralised
Informal or formal	Informal	Formal	Informal	Formal	Informal	Formal
importance of line or staff	Staff	Line	Staff	Line	Staff	Line
<b>Sourcing</b>						
Relationship with supplier	Long-term	Dependent of the owner	Long-term	Long-term	Long-term	Long-term
Procedure of deciding whether a product will be produced internally or obtained from a supplier	CEO	Sales department	CEO	Sales department	CEO	Sales department
How supplier are chosen	Contacts	Price	Customer decide	Price	Contacts	Price
<b>Production planning and control</b>						
Whether the systems are centralised or decentralised	Centralised	Centralised	Centralised	Centralised	Centralised	Centralised
Push or pull	Push	Push	Push	Push	Push	Push

automotive parts industry. The definition of SMME used in this paper is made by the European Union [16]. According to this, companies under 49 employees are defined as small and companies, whilst companies between 50 to 250 employees are defined as medium sized [16]. The companies in this study have between 27 and 150 employees; 11 of the companies are small and 9 are medium sized. The visited companies are in the middle or southern part of Sweden, 88 % are located in the Gnosjö Region. The Gnosjö Region is famous for its strong entrepreneurial spirit, known as the Gnosjö spirit [17]. In Gislaved municipality in the Gnosjö region we can find 0,3 % of the Swedish population and 6,5 % of the Swedish polymer companies [18].

The studied SMME:s have different kinds of ownership: family business, venture capital, or a company group. Groups that own the studied SMME:s are often owned by families or private investors. When ownership was considered to affect the company characteristic, it is mentioned in the paper.

### 3 RESULT

The research analysis shows that four of Miltenburg's [15] six decision criteria of manufacturing system are dependent on size (see chapter 2 for the six criteria). The criteria discussed in this paper are:

- Human resource
- Organisation structure and controls
- Sourcing
- Production planning and control

The analysis indicates that these four criteria above focus on the organisation rather than the technology and facilities. The analysis also indicates that these four criteria are dependent on size and ownership, rather than what is manufactured. The other two criteria, process technology and facilities are dependent on what is manufactured rather than on size. The two criteria are not analysed further in this paper.

#### 3.1 Human resource

The study indicates that a qualified person can relatively easily be promoted within the small company, but for a person with higher education there are not many positions with challenging tasks within the small company.

The study shows that personnel are well-known to the CEO and management in the studied small company. The CEO or management knows who is skilled and experienced and who to promote. There is however a difficulty to be promoted in the studied smaller company since the organisational structure is flat and the promotion opportunities are scarce. Promotion opportunities are scarce because there are not many positions in the small company; another reason is that the turnover of staff is low. Manufacturing Management in the studied small companies often stay in a position for many years, before changing position.

In the studied medium size companies there are more positions in the organisation and there are more hierarchical levels. The CEO or Management does not know all personnel and relies on the manufacturing Management knowledge on skilled and experienced personnel that can be promoted.

A company representative stated that "when appointing a position, there are two alternatives: internal or external recruitment". Both of the studied small and medium sized

companies prefer to promote internally. The result of the analysis indicates that the personality and knowledge about the manufacturing processes are more important than education and management skills. Production managers or foremen should have deep knowledge in the manufacturing processes and technology. A skilled and experienced operator with knowledge in the technologies is often chosen to be manager. This is general for all of the companies, independent of size and industry. According to the studied companies, especially the foundries, it takes years of practice to learn the manufacturing processes. Management can be studied at the university or be taught by a consultant, but manufacturing processes must be learnt by experience. The analysis shows that the different companies have a lot in common, independent of the type of industry, but the companies often believe that they are unique, i.e. the manufacturing process are difficult to learn. The manufacturing processes are different in the studied companies, especially in the foundries were they often have specialised processes. We found in the study that it is often not necessary to have the deepest knowledge in manufacturing to become manager and sometimes it is better for the development of the company and the manufacturing to promote or appoint a person with new ideas and management skills, rather than the person with the deepest manufacturing knowledge.

In the studied companies, there are limited numbers of people with higher education, independent of the type of industry or size. The results of the analysis show that:

- The studied companies recruit thorough personal acquaintance.
- Difficulties in finding and employing people with higher education.
- The CEO or owner is not familiar in discussing with people with higher education.
- The company does not have the financial resources to employ people with higher education.

The study indicates that personnel, both operators and managers, are often recruited through personal acquaintances.

People with higher education often want to live in urban areas, where their friends and family live, or in larger cities with larger and well-known companies, many companies stated. If moving to a town without knowing anyone, it can be difficult to feel at home even if the work is interesting. The well-educated people want to have possibilities to be promoted, however there are limited opportunities in the studied companies.

The studies indicate that if the owner or CEO does not have any higher education, he or she does not know what the people with higher education can provide the company. The financial resources also affect when employing.

The study also indicates that it is difficult for the companies to find and employ skilled operators, who want to move to the town where the company is located. The studied companies are often located in smaller towns like Gnosjö. Gnosjö Region is known for its large number of manufacturing companies and the employment rate is high. The studied companies do not want to employ the unemployed people in the town, because they are not considered suitable for work in manufacturing. To be able to grow, many of the studied

companies have recruited skilled immigrants during the last years. The analysis shows that the trend is in employing immigrants, and to employ persons from Eastern Europe via unique agencies. The agencies act as an intermediary between the company and skilled persons in Eastern Europe. The immigrants and skilled people from Eastern Europe are also willing to move to the town where the company is located. In a studied foundry company, 50 % of the employees had an international background with different nationalities.

The study shows that the employees in the studied small companies are more multi-skilled than the medium sized companies. For example, in a foundry company the operators should survey the machine, remove excess material, and do maintenance. Some of them could also operate the CNC-machines. In a medium sized foundry company an operator only monitored the foundry machine, another did maintenance, and a third monitored the CNC-machine.

Participation of employees in problem solving is dependent of the ownership and size of the company. In general, in the studied companies the participations of employees in problem solving are quite low. In the studied small company the owner can have control of everything and decide everything by him- or herself, in the studied medium size company the decisions are often made by the foreman or the production manager.

### 3.2 Organisation structure and controls

The organizational structure is comparatively flat in most of the studied small companies. The study shows that between the operator and the CEO there is one level in the small companies, i.e. the production manager or the foreman. The studied small companies often had a foreman, or a number of foremen, instead of a production manager. The production manager's or foreman's role in the small company is mostly operational with a strong focus on daily and monthly activities. The study shows that the studied small companies have short term and operational focus in the manufacturing. Therefore the manufacturing processes are prioritized, not the long term development of the manufacturing system. Only a small number of the studied companies worked with systematic production development tools and methods. Many had however tried some methods, but due to the short term horizon and lack of resources that had time for implementing long term changes, the development tools and methods had not worked.

The foreman carries out many different work tasks in the studied companies, manager, planner, industrial engineer, and sometimes even operator. He or she has little time for each task and often does not have knowledge, experience, or interest in all tasks.

In the studied medium sized companies, the organization has more hierarchical levels than the small companies. The study shows that between the operator and CEO there are often two levels, both foreman and production manager. In the studied small company the owner is often the CEO. The CEO in the studied small companies often takes a major part of the decisions. Neither the studied small nor medium sized companies are decentralized. In the studied medium sized companies the CEO, production manager, and quality manager make the decisions that affect manufacturing. The study indicates that the decisions that are made are tactical or operational decisions, not strategic and long-term. The operational focus means that the companies have process

focus. None of the studied companies has a system focus, probably because of the short time perspective and the lack of competence.

The studied companies do not have a production development department, but they have multi skilled and experienced employees that can carry out a large number of different work tasks in manufacturing when necessary. The operators can come up with a request to the CEO and the CEO listens to them. Decisions can be made immediately. The small companies, independent of industry, are more informal than the medium sized companies because of the size; everybody knows the owners and the owners do not hesitate to visit the manufacturing premises, discussing with personnel study what is going on. In the medium sized company, the owner or CEO does not have the same contact with the operators and rely more on secondary information from the planning department, quality, and production manager.

The line consists of a team of operators that works with a machine or machine group. The line is more important in the medium sized companies than in the small company, where staffs are important. In the small company the relations are closer and each employee is important in order to be able to fulfil the daily orders. The result of the analysis seems to be that medium sized company is too large to have a close relationship with every employee, i.e. the line is more important.

### 3.3 Sourcing

The studied companies, independent of size and type, purchase raw material from a limited number of suppliers. The studied companies manufacture components from raw material. The components are sent to an assembly company or to the customer's manufacturing plant to be assembled to a final product.

The study indicates that the relationship between the studied companies and their raw material supplier is long-term and based on existing acquaintance. A company representative, from a medium sized company, said "we are more professional today because we rely on performance when choosing suppliers rather than on existing acquaintance". This company has grown from small to medium size during the last years and the market share has increased. The studied company can affect the price because of the larger size of quantities of material that are being purchased. This is general for the studied medium sized automotive part companies and foundry companies that are owned by a company group.

In the polymer industry, the studied companies' customers choose and own the injection moulding tool as well as the raw material. The customers also choose the raw material supplier as well as the tool supplier. This result is unique for the polymer industry in this study, see table 1. The customer often chooses the cheapest supplier, independent of the quality of the material. This affects the studied companies; they can not influence what material is chosen and must manufacture the products in the time the customer wants, independent of material quality and how the material works in the machines. The customers also own the tools, so the studied companies only own the injection moulding machines and the facilities. The result of the analysis indicates that this is a somewhat problematic situation for the companies; they can not influence the development of the products they

manufacture or the choice of material. The study shows that the single competitive advantage often is the price and the customer often chooses the injection moulding company with the lowest price. The studied companies get decreased profitability when offering the customer a low price, and cannot afford to purchase new machines or develop organisation and manufacturing. One medium sized polymer company lost their largest customer this way; they could not offer the lowest price. To survive they changed their business plans and goals, from relying on the old customer to offering complete solutions in injection moulding. They are also developing a new department which specialty is plastic material component development.

The studied polymer companies do not have own competence about material, the material supplier or machine supplier is the expert of plastic material. The studied polymer companies take advices from the suppliers when they need information about material or what machine they should purchase. In the studied foundry companies the operators and purchasers have knowledge about the raw materials that are used in the products, in this case iron, steel, or non-ferrous metal. The studied foundries are proud of having their own experts in material, both within the companies and at their own material research centre which educates personnel in both foundry technology and casting materials. In the studied automotive part companies, the customer decides material but the companies own and purchase the material.

The study shows that the CEO and/or production manager decides whether a component should be manufactured internally or purchased externally. The studied companies can purchase the components if the component is cheaper to purchase from 3<sup>rd</sup> party in a low wage countries, or if there is a lack of capacity. The study also shows that a new order from a customer can trigger the purchase of a new machine. In the studied foundries, new machines are often purchased to replace old ones. Polymer companies can decide to produce a product at a competitor in the Gnosjö region, instead of buying their own machines, this because of the Gnosjö spirit and near relationship between the competitors in the region.

### 3.4 Production planning and control

The study shows that all the studied companies, independent of size or type of industry, use the manufacturing forecasts. The studied companies use forecast planning because they have long delivery times, 1 week to 16 weeks. Normally the customer puts the order 3 to 4 weeks before delivery. To be able to handle the delivery time the studied companies trust the forecast. The result of the analysis shows that the components are sometimes manufactured before the customer lays the orders, i.e. the component is pushed through the manufacturing system.

In the studied polymer and automotive part companies, one batch can take one month to produce. The customer often wants to receive the entire order at a certain time, which leads to increased inventory for the company. The studied companies accept this manufacturing situation to get the order.

The study shows that none of the studied companies knows the lead time in manufacturing, but all of them are aware of the machine time, i.e. the time for a component to be manufactured in a machine. The time before and after the manufacturing of a component has not been important in the

studied companies due to the importance of the pay-back time. The empirical study indicates that the studied companies therefore focus on manufacturing processes, not the whole manufacturing system.

In the studied foundries and automotive part companies, the delivery time of raw material sometimes take several months, depending on the demand of the material. The studied polymer companies have shorter delivery times of plastic material.

In this time of economic boom, the studied companies have problems in delivering the components to the customer on time, because the companies cannot process the volume of incoming orders. The study indicates that prioritized customers get their products on time, whilst others must wait. Prioritized customers are often the largest and most important customers that the studied companies cannot afford to lose. The studied companies, however, try to decrease the largest customers' share and increase the number of customers, to be able to survive if the largest company cancels the contract. In the studied foundry companies the delivery precision is 90 %, the other two industrial sectors have higher. The analysis of the study shows that many companies have capacity problems, and have started or are going to start a new shift. This is done instead of working with manufacturing improvement methods.

The studied medium sized companies have their own production planner, but in the smaller companies it is the foreman who plans the manufacturing. The foreman is often promoted from manufacturing and does not have any knowledge in production planning and production planning systems. The planning of the production can be seen as a time consuming task rather than as a help for the foreman.

## 4 CONCLUSION

The result of the study shows that there are more differences between small and medium sized companies, independent of the type of industry (see table 1).

Today, in the economic boom, companies get customers' orders due to the lack of manufacturing capacity in Swedish companies. Today, the polymer industry is affected by the competition from low wages countries and the customer chooses in most of the cases subcontractors on price. The Swedish polymer SMME:s can compete up to a certain level with prices, when they will start losing money. To break this trend, in the polymer industry and the other studied industries, the companies must take action and develop the company in the long-term to survive. There are a limited number of people with higher education in the studied companies. To be able to develop the manufacturing in the companies, persons with higher education should be employed in manufacturing. The companies have difficulties to employ people with higher education because of the location of the company, and because the lack of financial resources. The companies also have difficulties employing skilled operators from the town the company is located in; often they employ immigrants or people from Eastern Europe through agencies. If they had not employed skilled immigrants, the companies would have problems to grow and to survive.

Another reason for the insecure situation of the studied companies is the fact that they do not develop and sell their own products. In the studied polymer companies, as well as

other companies, the customer chooses and owns the plastic material. The studied companies provide manufacturing processes and technology without being able to affect the situation. Some of the studied companies are aware of this and have taken different actions to be more than a provider of manufacturing processes, however, with various successes. Today the studied companies have operational and/or tactical perspective in the manufacturing. To survive in the long term perspective the studied companies should have a long term focus in the manufacturing to be able to develop the manufacturing system further.

The studied companies, independent of size and type of industry, mostly focus on the different manufacturing processes; they do not have a holistic view on manufacturing system. The studied companies know the machine times, but not the lead time. To be able to rise the delivery time the studied companies also should measure the lead time. Today the prioritized customer gets the components on time; other customers must often wait for the delivery. To survive and be able of keeping their customers, the companies must focus on the whole manufacturing flow, not only the different machines. The companies are not aware of the lead time and do not have the competence to measure and analyse the lead time. Often, when more capacity is needed, a new shift is started to gain more capacity. The time for a component in the machine is often reduced, but nothing is done to the manufacturing system, due to lack of competence.

Only a limited number of the studied companies are working with manufacturing system development. Today, when the low cost countries are getting better and better at manufacturing quality products, there are many challenges for the studied companies. To survive in this time of globalization the companies must focus on manufacturing system development. Today, the lack of resources of employees with higher education and lack of financial resources makes it more difficult to compete on the global arena.

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