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# **Manufacturing cost modelling and analysis for a Startup**

The case of 10MD

Master thesis in Production Engineering

Vishnu Manjunath  
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Department of Technology Management and Economics  
CHALMERS UNIVERSITY OF TECHNOLOGY  
Gothenburg, Sweden 2019  
Report number E2019:120

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# Abstract

The main purpose of this thesis was to identify the steps involved in decision making processes involved at 10MD and analyze the impact of Standard Costing on a SME such as 10MD. A standard costing model was created and used to analyze various costs involved in the value stream of 10MD HeadPeace product. The data was gathered by interviewing the founder and CEO of 10MD along with a few managers, shop floor personnel of 10MD subcontractors present at the various processes. The 'Stratego' tool developed at Chalmers University of Technology was used to analyze the current scenario of 10MD through which competitive priorities that had improvement potentials were identified. The results were analyzed and the main problem identified was the higher assembly costs down the value stream along with less satisfactory quality of fibre at the extrusion process. Recommendations were provided along with alternate cost calculations which include profitability analysis. These calculations show the profit margins for each one of the proposed recommendation and thus, would aid in decision making processes at 10MD.

Keywords : Decision making, Standard costing, Value stream, 10MD



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# Abbreviations

**TCM** - Traditional costing method

**ABC** - Activity based costing

**10MD** - Ten Medical Design AB

**SEK** - Swedish Krona

**HP** - HeadPeace



# Glossary

**Activity** - It is a specific task or action of work done. An activity can either be a single action or a collection of multiple actions. Activities are performed to accomplish a certain objective[1].

**Activity cost hierarchy** - According to Kaplan and Cooper[2], ABC uses a four part cost hierarchy to identify cost allocation bases. They are classified as unit level, batch level, product level and facility levels. These activities vary from one company to another.

**Activity dictionary** - It can be regarded as a database which contains all the activities that the company performs. It can include output measures, activity descriptions, names of suppliers and so on[3].

**Cost driver** - A cost driver can be described as the unit of an activity which causes a change in the activity's cost. It can be any factor which significantly changes the cost of an activity. An activity can have one or more cost drivers attached to it[1].

**Cost object** - Cost objects can be any products, services, activities or organizational units to which costs can be assigned[1].

**Direct cost** - They are costs which can be completely attributed to the production of certain goods or services. Material costs and labour costs can be regarded as direct costs[1].

**Variable costs and fixed costs** - A variable cost can be described as costs which vary in proportion to the production output while fixed costs remain constant irrespective of the output produced[1].

**Indirect costs or overheads** - Indirect costs are business expenses that are not directly related to specific product or service but are necessary for the general operation of the company. Marketing costs, administration costs are examples of indirect costs[1].

**Investments** - Purchasing of materials or making changes to the existing equipment to increase productivity and ergonomic quality of the workstation/task.

**Knowledge base** - Collection of a set of data or information essential for this thesis work from previous experiences and literature study.

**Resource** - It is an economic element needed or consumed in performing activities. Salaries, supplies and workers can be regarded as resources[1].

**Qualitative** - A type of analysis that focuses on collecting information that is not

numerical in nature. Mostly includes unstructured and semi-structured techniques.

**Quantitative** - A type of analysis that involves the conversion of available numerical data into usable statistics that supports the calculation model.

**Stakeholder** - People who can affect or get affected by the outcome of this work.

**Station** - Workplace where specific assembly operation or value adding work takes place.

**Outsourcing** - Outsourcing is defined as the act of obtaining semi finished products, finished products or services from an outside company[37].

**Offshore outsourcing** - It is a type of outsourcing where the vendor who provides the product or service is located in a different country[37].

**Core competency** - It can be defined as a harmonized combination of multiple resources and skills that distinguish a firm in the marketplace and therefore are the foundation of companies competitiveness[38].

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# 1

## Introduction

*This chapter describes the background to the thesis followed by the problem description and the objective. Delimitations and the research questions will conclude the chapter.*

### 1.1 Background

Making decisions is a part of our every day's lives and when it comes to organizational life, it is a fundamental task for the management. Indeed management and decision making are regarded as belonging together, as usually management makes the major decisions in the organization. Decision making involves selecting the best course of action[4]. In order to judge the best course of action, management has to judge the effectiveness of various alternatives. A guidance (Evaluation technique) is required during the process of decision making in order to cross check the effects of decisions that are undertaken. Without this guidance, the management will not be able to know if they are moving in the correct path. Majority of the organizations make use of financial statements and accounting during the process of decision making[5]. Accurate financial statements allows a business to sculpt well informed foresight to make future decisions[5]. Implementing wrong decisions will lead the company to bankruptcy. It is also very important for organizations to track costs carefully, so profits can be calculated against it in each period. This lets the organization know how well they are doing financially. Hence it becomes absolutely necessary for organizations to possess or maintain precise and accurate cost data. The point of this thesis is to show the importance of having proper cost data and how a particular costing method will help organizations in their decision making process.

### 1.2 Problem Description

In order to prevent financial disasters through ineffective decisions, there are lot of financial tools available to support decision making processes. Nevertheless, accounting tools applied vary from organization to organization. One tool that proved to be good in a particular organization may not prove beneficial in some other organization. Different information are required for these diverse purposes, therefore organizations have to focus on different accounting tools to support their decision making process. This thesis focuses mainly on addressing the financial decision

support problems of 10MD and how accounting tools will help the organization to overcome those problems and become financially stronger.

### 1.3 Objectives

The intention of the authors is to come up with a proper support tool to help the organization in decision making processes.

- To help the organization in the financial decision making process.
- To show the impact of accounting technique on the decision making process.

### 1.4 Scope and Delimitations

The focus of our study is to show the impact of accounting in the decision making process and how it can be used as an effective evaluation tool to select the best solution among various alternatives. This also serves as a decision support to match the expectations of the stakeholders involved in bringing about managerial changes at 10MD.

The study is specifically targeted towards production processes and activities that goes into the manufacture of 'Radiation Protective HeadPeace' in the value chain of 10MD. The various costs incurred by organization in the production processes are included in the study. However, cost details of few processes and the marketing costs that goes into advertising and marketing are not included due to unavailability of data.

### 1.5 Research questions

- What are the steps involved in an effective decision making process? Why is an evaluating tool required in this process?
- How does standard costing help organizations in decision making process?

These set of questions will serve the contents of the Methods and Results section and further discussed.

# 2

## Theory

*This section provides the theoretical background to the procedures and techniques used in this thesis work.*

### 2.1 Strategic planning process

Strategy can be defined as 'The direction and scope of an organization over the long term, which achieves advantage in a challenging environment through its configuration of resources and competences with the aim of fulfilling stakeholder expectations[42]. The whole process of planning strategies by organization is termed as strategic planning. Key aspects of strategic planning are a long time horizon, formalization, strategies in written form, use of strategic tools, and formal and planned meetings where strategic decisions are made in a logical and rational manner by the top management[43]. Strategies are developed from forecasts on what should happen and organizations should make sure to plan their strategies well in order for it to become successful. Strategy formulation should be based on the objective of the company and hence will be unique. The strategy formulation process also depends on the size of the company and the process will be different for large organizations and SMEs[42].

#### 2.1.1 Manufacturing strategy

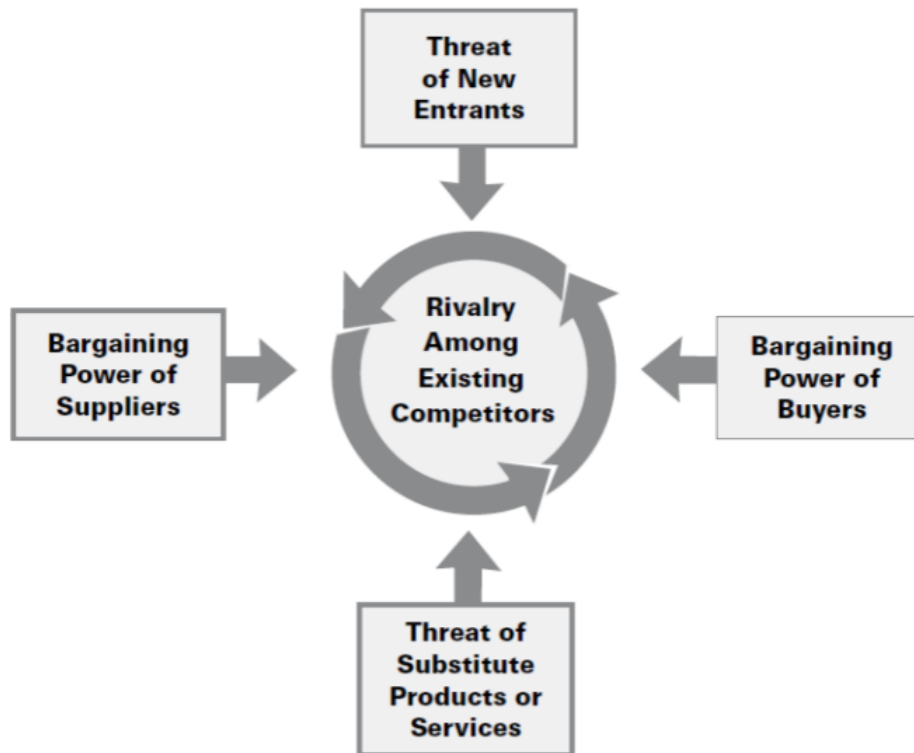
Strategies in an organization are divided into three levels[30]: corporate strategy, business unit strategy and functional strategy. Corporate strategy is concerned with the market sectors in which the whole company decides to compete. When a (large) company comprises different business units, its strategic direction, i.e. business unit strategy, concerns competition in one specific unit and it sets the competitive factors that should be fulfilled. A business comprises different functions, such as sales and marketing, research and development and operations. Functional strategies should be linked to and coordinated with the business strategies. If they are not linked together, decisions taken in each function might not correspond to each other or the business strategies. This can lead to misdirection and prevent the company from reaching its objectives[30]. Manufacturing strategy is also a functional strategy. Manufacturing strategy is defined as a series of decisions concerning process and infrastructure investment, which, over time, provide the necessary support for the relevant order-winners and qualifiers of the different market segments of a company[30].

### 2.1.2 Strategy formulation in startups

According to Cagliano et al[44], strategies in startups emerge through incremental learning processes and tactical decisions, which are aimed at acquiring critical resources and building distinctive capabilities that are valued by customers, rather than being crafted through formal long-term planning processes. It is also assumed that startup organizations have less formalized strategic planning process compared to large organizations[44]. This can be due to poor use of strategy framework and tools in startups and the lack of knowledge about framework and tools among managers[44]. Another problem that startups face is that their strategies usually won't be in line with the corporate strategy and hence leads to failure of the strategy over time[44]. In order for startups to have a clear vision about their strategies, they must first understand the importance of competitive priorities and decision categories. This will help the organizations to formulate a suitable strategy.

### 2.1.3 Importance of Competitive priorities

Any manufacturing strategy is a short or long term plan of action that is designed by an organization to achieve desired set of goals or objectives[45]. The Porter's five force analysis model can be pivotal for any organization in order to understand the forces that shape competition within an industry. Also, Porter's model could be beneficial in aiding the organization to set the competitive priorities in order to achieve the desired set of goals. It can also be used to adapt to the ever changing market conditions and improve potential profits[46]. The organizations choose their competitive priorities based on the business strategies in order to have an edge over the competitors [45].



**Figure 2.1:** Porter's five force analysis model

Due to the ever changing needs of the customer and dynamism in the market, any organization's competitive priorities are driven by and depends upon business competitive strategy.[47]. The competitive priorities can be grouped into 4 competitive capabilities dimensions:[45]

**A- Cost:** Cost as a competitive priority refers to a company's ability to produce and deliver to a low cost [49].

1- Low-cost operation

**B- Quality:** Quality is a competitive priority that is defined as the ability to satisfy needs and expectations of the customer.[49].

2- Top Quality(Customer perception)

3- Consistent Quality(Less faults)

**C- Deliverability:** It is a competitive priority which refers to the ability to deliver, both in terms of accuracy(reliability) and speed(time).[49].

4- Delivery Speed

5- On-Time Delivery

**D- Flexibility:** It is a competitive priority that is dealing with the ability to swiftly change and adapt production to necessary changes[49].

7- Customization

8- Variety

9- Volume Flexibility

### 2.1.4 Prioritization of Competitive priorities

Once the organization has established the competitive priorities, it becomes important to prioritize these competitive priorities so that the desired goals are reached under all circumstances. There are four basic competitive manufacturing capabilities - Quality, Dependability, Speed (Production flexibility) and Cost[48]. The Sand cone model states that even though short term trade offs are possible among the capabilities, there is actually a hierarchy between the four and thus the organization needs to focus on enhancing the quality first and then focus on dependability of the production systems. Once the efforts on these two capabilities are already enhanced, the production flexibility can be improved. Finally, the improved efforts in the previous three capabilities pave way to direct improvement in cost efficiency[48]. The application of this model is a long term approach and it requires patience as overnight changes cannot be obtained through this model.

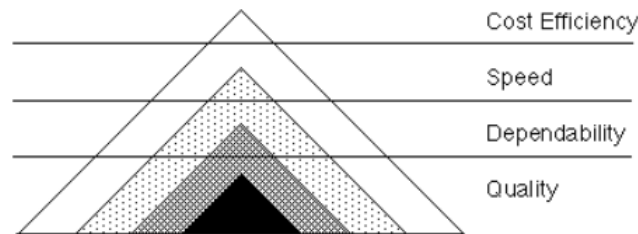


Figure 2.2: Sandcone Model

### 2.1.5 Decision categories and its importance

Decision categories are those areas in which company needs to make number of decisions. Each decision category has number of questions that need to be considered before making a decision. Since these decisions support the competitive priorities, it becomes very important to make accurate decisions [49]. The figure below shows some of the questions that are related to a particular decision category.

Decision category	Issues to decide upon (examples)
Production process	Process type, layout, level of technology
Facilities	Amount, acquisition time
Capacity	Location, focus, lead or lag capacity
Vertical integration	Direction, amount, relation
Quality management and control	Approach, responsibility, control
Human Resources (HR)/personnel	Responsibility appointment, competence
Organisation	Organisation, structure
Production planning and control	Choice of system, size of warehouse

Figure 2.3: Decision categories and issues to decide upon

**Production process:** The production process transforms resources into products

and thus it becomes important to take decisions concerning process type, layout, level of technology and automation. The process decisions are mainly related to production volume and the number of variants based on which the flow of the process might be determined (single piece, continuous flow)[49]. The physical location of various equipment's in the layout will be based on the chosen process type. Finally, suitable level of technology or automation is chosen based on the degree of human involvement.

**Facilities:** Facility is regarding the physical location where the actual production will take place. It becomes important to locate the premises first and then prioritize on the production focus in those premises. The production focus denotes a multi-purpose workshop, which can be decided based on the desired specifications of the organization (large variety of products or single product) [49].

**Capacity:** Capacity is usually defined as the possibility to carry out certain activity over a period of time with respect to volume or quantity. In this category, decisions need to be made based on how much to produce (amount of capacity) and when to produce (when the capacity is requested). Based on the required specifications and market conditions, the organization can implement a lead or a lag strategy so that the organization can cope up with the actual demand throughout[49].

**Vertical integration:** Vertical integration mainly concerns how much control the company has over the supply chain. Decisions on what need to be bought from the external suppliers and what needs to be made internally must be decided in this category [49].

**Quality management and control:** Quality is both a competitive priority and a decision category as it is what the company wants to achieve and what methods does it choose to achieve them. Proper work procedures must be incorporated to ensure that quality standards are being followed throughout the value chain. The organization needs to decide whether to be proactive (process control and preventive actions) or reactive (more inspection, detect errors) in this approach[49].

**Human resources:** This decision category mainly deals with the questions such as sharing of responsibility and competence. The organization must decide on how to design the tasks in order to achieve best possible production along with the consideration of human aspects. Tasks distribution can be carried out either in vertical or horizontal distribution methods [49].

**Organization:** Deals mainly with the structure of organization, i.e how the company is divided into functions and departments. Main aim would be to allocate the work tasks to achieve maximum utilization of the resources and achieve the targets in the best possible way [49].

**Production planning and control:** Decisions regarding the production planning are about the choice of principles. At different levels, different solutions show the varying ability to support the desired targets. Planning needs to be carried out on different levels based on the specific needs of the organization [49].

## 2.2 Decision making

There are several different definitions and descriptions on understanding and presenting decision making. Mintzberg et al[6] defined decision making as 'a set of

action and dynamic factors that begins with the identification of a stimulus for actions and ends with a specific commitment to action'. Lawson et al[10] defined decision making as 'the process of choosing among alternatives and implementing it using the subsequent outcome data'. Stoner et al[7] defined decision making the process by which a course of action is selected as the solution to a particular problem. The definition involved in this study is 'that decision making involves selecting a course of action based on the nature of the problem with the aid of systematic and structured set of criteria'. In a sense, decision making can be considered as the heart of planning as decisions on certain course of action has to be taken for the plans to be formulated and implemented. Priem[8] argues that decision making is the most fundamental managerial activity of all. Decision making is discussed primarily within the context of planning; but despite the link with planning, decision making is a fundamental element of the entire management process[9].

### 2.2.1 Organizational decision making

Lewis et al[11] describes organizational decision making as the decision making processes that occur at all levels and units of an organization. Hatch[12] describes organizational decision making as decisions that are made throughout the organization.

In this study, organizational decision making refers to decision making process which takes place in the organization in order to achieve a common goal that involves all levels within an organization.

### 2.2.2 Decision making conditions

In general, the managers face three different decision making conditions:[9]

The first condition is certainty, which means that the available alternatives and their costs or benefits are certain. The managers will know the benefits of these alternatives and there will be no element of doubt. The market scenario today is quite turbulent and it is very difficult to make decisions with certainty. Only minor decisions within a company can be taken with a condition of complete certainty.

The second condition is risk. Under this condition, all available choices and their potential benefits are known but the outcomes are sometimes in doubt. The probability of certain events under these conditions can be found out by making use of statistical techniques[9].

The final condition is uncertainty, under which the available alternatives, their benefits and their outcomes are all unknown. Decisions made under this conditions are the most difficult to take because of their uncertain behavior. Such decisions tend to be ambiguous, intangible and highly unusual[13]. In the present turbulent market condition, more and more decisions have to be taken under such uncertain conditions.

Decisions taken under the conditions of certainty tend to be the easiest and most successful while there are chances that a decision might fail in the other two conditions. Any decision can become a failure if there is no proper procedure for the whole process. Given that most managers face lack of structure and information,

and uncertainty as they make decisions, it is not a surprise that managerial decision making has become more challenging, yet also very important in recent years.

### 2.2.3 Barriers to making good decisions

Research has shown that managers make better decisions when they follow a sequential procedure[14]. However, as managers tend to make good decisions they face lot of barriers. Decisions sometimes can be framed against a reference point or at time as gains or losses. All the alternatives are valued against these conditions to check whether the undertaken decision is successful or not. A manager normally applies a decision frame to a decision. A decision frame can be described as the perception held by the manager in terms of gains or losses associated with the outcome of a decision[15]. The nature of decision framing is important because managers usually tend to avoid risky options, though when faced with a choice between losses, managers will opt for a risky alternative. Decision framing may be responsible for many decision failures in that risky decisions that normally go wrong are the product of a choice between losses[16].

Decision making is also susceptible psychological biases. Managers often allow their subjective biases to interfere with objective decision making. It is a natural tendency for humans to allow their personal feelings and emotions to interfere in the decision making process and this at times will lead to bad decisions.

Managers can also be affected by the 'illusion of control'[16]. This means to say that managers develop a sense that they can affect outcomes even when they have no control over events. This can be viewed as overconfidence of the managers and such a mind set will lead to failure of decisions.

The final barrier for managers in making good decision is the issue of time[16]. Time pressure will usually cause decisions to be taken in a hurry and without proper examining of the problems. This will also hinder the quality of the undertaken decision.

### 2.2.4 Steps involved in decision making process

Decision making, as mentioned earlier is a process by which an alternative is selected among various alternatives. In order to carry out a decision making process effectively, a proper methodology has to be followed. There are various methodologies available today and in this particular thesis study, the 'Five step decision making model' is selected due to its proven benefits in SME's[26]. As the name indicates, there are five steps in the decision making process according to this model:[26]

**1. State the problem:** The first step in the decision making process is identifying problems. Until we have a clear understanding of the problem, it is meaningless to proceed in the decision making process. Care has to be taken to make sure that the problems are identified correctly failing to which the selected decision and alternatives chosen might prove fatal for the organization.

**2. Identify alternatives:** The next step in the process is to come up with alternative solutions depending upon the problem identified.

**3. Evaluate the alternatives:** The third step in the decision making process is to evaluate the identified alternatives by some means of guidance or logic. Usually

SWOT analysis and decision matrix tool are used by organizations to evaluate the identified alternatives. Finding proper methods of evaluation becomes a key in the whole process as it influences the decisions made. In the present study, standard costing technique has been chosen for evaluating alternatives.

**4. Make a decision:** The final step in the process of decision making involves selecting the best evaluated alternative among the rest.

**5. Implement the decision:** A decision will not have any value until it gets implemented and the final step in the whole process is implementing the selected alternative in reality. This should also be combined with a follow up process to check if the implemented decision is in line with the desired objective. If not, the whole process has to be repeated and a new decision has to be implemented.

### 2.3 Costing

Kulmala et al[17] describes cost as resources which are sacrificed or foregone to achieve a specific objective.

The present day market scenario is very competitive and organizations have to constantly improve their products or services to stand out in the market. Moreover, competition also increases demand for relevant cost information of a company's performance activities, products and services. Therefore companies need to be aware of their operating costs and share those information at the corporate level[17]. Companies have to work on their cost efficiency continuously and figure out ways to cut down unnecessary costs in order to gain competitive advantage in the market. This type of competitive strategy is referred to as 'cost leadership' and means that a company produces products or creates services at a lower cost compared to its competitors in the market[1]. This leads to higher profitability for the organization. Costs can be used for various purposes in an organization like financial accounting, budgeting, profitability analysis and so on. Costs can be classified as fixed, variable, direct and indirect costs[1]. Fixed costs are associated with investments such as machinery, infrastructure and human resources while variable costs refer to costs associated to varying factors such as number of products produced for a reference period.[1]. Direct costs are those which are directly attributed to the production of the product (Material costs) and indirect costs are those which are not directly allocated to products ( advertising, supervision costs). It becomes important to have a clear picture on these different costs in order to move towards cost reduction[1].

#### 2.3.1 Cost accounting

According to the terminology used Kaplan & Cooper[2], "cost accounting is the part of management accounting which establishes budgets and standard costs and actual costs of operations, processes, departments or products and the analysis of variances, profitability or social use of funds".

There are three main cost accounting systems which are used in organizations today[1]

- Direct costing
- Standard costing

- Activity based costing

Direct costing is associated to direct material and direct labour costs. Direct material costs refer to the cost of materials required to manufacture a specific product and direct labour costs refer to the cost of working hours required to produce a certain set of products[18]. This type of costing is very simple and may easy to implement. However, this costing system does not assign indirect costs and hence will not provide a holistic picture about the actual costs that are being incurred during the production of a product or creation of a service.

Standard costing is also recognized as 'Traditional costing system'. It assumes the cost of product or service under certain circumstances such as period of times the production process consumes and economic conditions[18]. Standard costing serves several purposes like decision making, budgeting, profitability analysis and so on.

### 2.3.2 Standard costing

Standard costing system is an approach which is often associated with a financial accounting focus and includes direct material costs, direct labour costs, and manufacturing overheads while determining the product cost [35]. The overhead is usually allocated based on the production volume or the number of labour or machine hours used during the production.

Consider an example of East India Company, a fictitious manufacturing company which produces bookshelves and has a diverse product line producing three bookshelf variants. The annual production volume ranges from 12000 to 20000. The total manufacturing overhead is 50,000,000 SEK. An assumption is made by allocating 50% of overhead to setup time and other batch level activities and 50% to facility level activities. The indirect cost considered in this case is just the setup cost.

	Std Bookshelf	Big Bookshelf	Wide Bookshelf
Annual Production Volume	12000	18000	20000
Batch Size	300	100	200
Direct material(SEK)	1300	700	1400
Direct labour per piece(SEK/h)	2	2	3
Labour rate(SEK/h)	400	400	400
Price(SEK)	3610	3018	4174

The profit and gross margin can be found out along with the cost per product using the standard approach. The calculated set of values for all the bookshelves can be found in the table below. The formulae used for the calculations are:

1. Direct costs = Direct material cost + Direct labour costs
2. Overhead per product = Total manufacturing overhead/ Production volume
3. Cost per product = Direct cost + Overhead per product
4. Profit margin = Selling price – Cost per product
5. Gross margin = Profit/Price \*100

	Std Bookshelf	Big Bookshelf	Wide Bookshelf
Direct cost(SEK)	2100	1500	2600
Overhead per product(SEK)	1000	1000	1000
Cost per product(SEK)	3100	2500	3600
Profit margin(SEK)	510	518	574
Gross margin	15%	17%	16%

### 2.3.3 Advantages and disadvantages of Standard costing

**Advantages:** Though most of the companies are moving towards a phase of transition from standard costing to activity based costing, the standard costing methods have been present since a long time and it is quite simple to implement it. Due to its simplistic nature, it creates cost reports that are easy to understand and eliminates employee irritation [29]. Even though standard costing has its inaccuracies, it can still identify all the direct costs and provide accurate cost data in cases of large production volumes.

**Disadvantages:** A standard accounting system assumes only volume-related bases such as labour hours, machine hours and material costs to allocate the overhead [29]. The allocation for production units in such a case assumes that the cost of production is proportional to number of items produced. This assumption is not true as there is a lot of variation in setup costs, inspection costs and purchasing costs that are not volume oriented. Since only volume related bases are considered, the accuracy of the cost figures will not be good. The simplistic nature of traditional costing might be too simplistic as it does not pinpoint to a particular location or activity from which the overhead costs arise.

### 2.3.4 Needs for accounting in decision making

From Yousif[19], some strong reasons for making use of accounting as an evaluating tool for alternatives while making decisions were obtained:

- 1. Relevant cost analysis:** Before a company takes any action, it needs to explore all possibilities and figure out the best tactic to increase profitability. Relevant accounting data provides accurate and precise information on the costs that are incurring and will help the management in choosing the right decisions.
- 2. Make or buy decisions:** Product production is often the most expensive segment of the business, so its very important to be sure which options suits your organization. generally there are two options- make products on your own or buy from a third party provider. With proper accounting information, it is possible to determine the real cost of each solution and decide whether to buy or produce.
- 3. Define budgets:** Budget related decisions must comply with sales history and marketing database of the organization. This is where management accountants step in to analyze former activities and define investments for the future actions. Relevant accounting information is used to make decisions on financial plans for each department, project and a new product.
- 4. Controlling:** Controlling is another important aspect of management accounting. Namely, it evaluates the work of all company units and makes conclusions

related to the financial performance. That way, you get to learn the reasons for both the loss and the profit generated by your departments. In such circumstances, it is much easier for senior executives to reduce operational costs. For instance, they can cut salaries in under performing departments or reduce the number of employees. On the other hand, they can also invest in branches that prove to be highly profitable, thus increasing the total profitability of the business.

**5. Planning:** The last benefit of management accounting comes from its potential to detect financial patterns and predict future developments. It enables you to stay up to date with the latest industry trends, which means you can react in a timely manner and implement strategies that allow you to stay head and shoulders above competitors. With the planning power of management accounting, you can also create long-term business policies. Doing so, you make sure that the whole team stays on the same track and works uniformly towards achieving your business objectives. Data precision and accuracy are critical to the success of each company. Without meaningful and actionable insights, you can hardly evaluate the current state of affairs or plan the future business moves. In such circumstances, management accounting becomes an anchor of modern business.

## 2.4 Why outsource?

Outsourcing is the act of obtaining semi finished products, finished products or services from an outside company[37]. The decision to outsource is taken at a strategic level and requires the approval of the management board. The business case for outsourcing varies by situation, but reasons for outsourcing often include one or more of the following:[39]

- Lower costs (Due to economies of scale or lower labour rates).
- Variable capacity.
- The ability to focus on core competencies and getting rid of peripheral ones.
- Lack of in-house resources.
- Getting work done more effectively or efficiently.
- Increased flexibility to meet changing business and commercial conditions.
- Lower ongoing investment in internal infrastructure.
- Access to innovation and thought leadership.

### 2.4.1 Advantages of outsourcing

**Expertise:** Companies usually outsource products or services from specialized vendors who possess better equipment's and technical expertise than them. This results in better quality of products or services[40].

**Helps focus on core processes:** Outsourcing the supporting processes allows the organization more time to focus on company's core business process or job assignment.

**Save on infrastructure and technology:** Outsourcing eliminates the need for investment in infrastructure as the outsourcing partner takes the responsibility of the business processes and hence develops infrastructure for the same.

**Reduced cost:** Outsourcing reduces the need to hire individuals in-house; hence

recruitment and operational costs can be minimized to a great extent.

### 2.5 Disadvantages of outsourcing

**Organization loses some control:** When products or services are outsourced by an organization, it loses its ability to monitor and control the tasks that are being performed to produce the product or service[40].

**Security risks:** If organization is outsourcing processes which contain confidential information's, then the organization could be placing its business security at risk as the confidential information might leak from the vendor.

**Hidden costs:** Although outsourcing work is generally considered cheaper, companies must also beware of getting ripped off. Outsourcing companies or big agencies will typically ask small business owners to sign lengthy contractual agreements, and they'll include plenty of fine print. If organization's don't read the terms carefully, they could get hit with unexpected costs.

**Sharing financial burdens:** Although it can be nice to bring in expert agencies to share in risks, it can be pretty dangerous to tie a company's business to the financial well-being of another company. Again, the buyer company got to spell out any and all terms and conditions in contractual arrangements plainly – because you don't want to take a financial hit if they fail to deliver.

### 2.6 Hidden costs of outsourcing

The total amount of an outsourcing contract does not accurately represent the amount of money and other resources a company will spend when it sends its services out to a third party. According to Abdelzaher et al[41], an organization will end up spending 10 percent above the figure to setup the deal and manage it over the long haul. That figure goes up exponentially anywhere from 15 to 65 percent when the work is sent offshore and the costs of travel and difficulties of aligning different cultures are added to the mix[41].

Among the most significant additional expenses related to outsourcing are: the cost of benchmarking and analysis to determine if outsourcing is the right choice, the cost of investigating and selecting a vendor, the cost of transitioning work and knowledge to the vendor, the costs developing from possible layoffs and their associated HR issue, and ongoing staffing and management of the outsourcing relationship[41].

# 3

## Methods

*This chapter is about the methodology used and how the chosen techniques are implemented to improve the given case. This gives a clear idea of how each and every phase has been planned and executed to obtain the final results.*

### 3.1 The case study as a research approach

Case study research has been used extensively in the social sciences as a means of developing an understanding of social phenomena in their natural setting[23].

A case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident[22].

While performing a case study, multiple sources of evidence may be used depending on the requirement. Data collection techniques like interviews, observation, questionnaires are used during case studies[23]. A case study requires both qualitative and quantitative data, but research is most often concerned with qualitative data[23].

Case study research can be used for description of phenomena, development of theory and testing of theory[23]. The main purpose of our thesis work is to show the impact of standard costing and hence requires us to test a theory in a real life situation. A case study research methodology serves well for our purpose and hence has been chosen. Theory testing using case study research requires the specification of theoretical propositions derived from an existing theory or suggested by the results of prior research[23]. The case study findings resulting from analysis of the case data are compared with expected outcomes predicted by the propositions. The theory then is found to be validated or inadequate in some way, and may then be further refined[23].

### 3.2 Strengths and weaknesses of case study research

Case study research is particularly appropriate for situations in which the examination and understanding of context is important. Areas where there is little understanding of how and why processes or phenomena occur or where theory and research are at their early, formative stages can be usefully addressed using case study research[23]. There are situations, however, where case study research may

not be appropriate, such as areas where a phenomenon is well understood and mature, where understanding how and why the particular phenomenon occurs is not of interest, and where understanding of contexts of action and experiences of individuals in single settings is not relevant[23]. There are also some disadvantages associated with case study research methodology. The data collection and analysis processes in case study research are usually influenced by the researcher's background, and will rely heavily on the researcher's interpretation of events, documents and interview material[22]. Data analysis phase of case studies can be difficult as qualitative data analysis techniques are not well established as quantitative analysis techniques[22].

## 3.3 Single-case and multiple-case designs

According to Yin[22], a single-case design is appropriate where the case represents a critical case ( it meets all the necessary conditions for testing a theory), where it is an extreme or unique case, where it is a revelatory case, or where the research is explanatory. Single cases allow researchers to investigate the phenomena in depth to provide rich description and understanding[23]. Multiple cases may also be selected to predict similar results or to produce contrasting results for predictable reasons[22]. The focus on research question should determine the number of cases to be studied and in our case, the focus is mainly to help 10MD in their decision making process through activity based costing and hence the methodology followed will be for a single case study.

## 3.4 Designing case study research

According to Williamson[23], in order to design and scope a case study research project, it is necessary to undertake a comprehensive literature analysis. This will help the researcher to understand the existing body of research within the context of the area, to position the proposed research within the context of that literature, and to frame research questions accordingly[23]. In this thesis work, a set of research questions were formulated and relevant literature's were studied. Various literature's about decision making and costing techniques were studied during the start of our thesis work to get a clear picture about what has to be done. Williamson[23] also mentions that the design of case study research also requires selection of suitable data collection methods and data analysis strategies to ensure that the adequacy and validity of the evidence collected is established, that the process by which the research results are arrived at is made clear, and that the validity of the research findings can be demonstrated. These parts are explained in the coming pages.

## 3.5 Visualization an description of methodology

Figure shows a flowchart of how the thesis work is developed in different stages. The first and foremost step in this process is to strengthen the knowledge base through a

comprehensive literature study. With such a strong knowledge base, it becomes easy for the researchers to formulate research questions based on objectives put forward by stakeholders. The next process is to collect relevant data and figures from the organization and its suppliers. In addition, the data collection phase involves semi structured interviews with the firm's managers. With such a huge pile of data, the data analysis phase is initiated by processing and extracting some useful information from literature study, related documents at 10MD and the interviews conducted. In the next phase, conclusions are drawn by thorough analysis of data in accordance with the needs and wants of this work. The results are compiled and subjected to validation by testifying results through sensitivity analysis. Finally a few suggestions are made for carrying out future studies and sustaining the benefits of the current study. Each phase of this work has been explained in detail in the subsequent sections.

### **3.5.1 Structuring the knowledge base**

The fundamental knowledge base required for this thesis work commences with a brief understanding of the problem outline of the thesis with some prior knowledge acquired from Production Management course at Chalmers. This knowledge building process was intensified by studying various literature's regarding decision making and costing methodologies. Relevant literature pertaining to costing techniques like standard costing and its impact on organizational performance were reviewed which gave us a clear picture about what has to be done.

This sums up the knowledge gaining phase covering some important aspects of accounting and decision making with a time span of over 4 weeks and provides a framework to the next step of choosing the appropriate stakeholders. However, the literature study was also conducted during the data collection and data analysis phases to crosscheck certain aspects.

### **3.5.2 Stakeholder analysis**

According to Blocher[1], a stakeholder can be a group or an individual who can affect or be affected by the results of the project objectives. With a sound knowledge base set, the horizon of this topic is on a broader scale and indicates a sense of liability in narrowing down the scope and shaping the boundary. The stakeholders identified are classified as realization and result stakeholders. Realization stakeholders ( academic supervisor and authors) are more concerned with the approach or technique used to arrive at the results while the result stakeholders are more interested in the results of the study that emerge from the realization phase. This includes managers of 10MD, accountants of 10MD and managers of the supplier firms of 10MD.

The academic supervisor and the authors are considered to be both realization and result stakeholders.

## 3.6 Current state analysis

Current state analysis refers to scrutinizing a scenario comprehensively in order to understand the present state and identify the potential risks or challenges and improvement opportunities involved in it. This stage is crucial for organizations as they will get a clear picture about their performance in specific areas and also the risks which might come in their way in the future. This creates a base for all improvement activities as activities with improvement potential could be found out from current state analysis. There are many ways by which current state analysis can be carried out and the most common way is by conducting interviews with the concerned officials.

### 3.6.1 Data collection

Data collection is the systematic gathering of necessary information that can be carried out with two different approaches when involving humans, namely qualitative and quantitative approach[24]. The data collection phase is very important to strengthen the insights into the topic and structuring a framework for the findings. The qualitative approach involves gathering information from stakeholders through discussions, interviews or by observing the existing scenario. The quality of data derived from this approach is limited to a small group of people due to practical necessity to address the time consumption within our limited project time.

The quantitative approach involves measuring or quantifying the relationship of the described concepts on a numerical scale. The quantitative method is supposedly reliable only in circumstances where the sample size is large and the selection is representative[24]. The data collection for this work incorporates both qualitative and quantitative data. Qualitative data is obtained mainly through interviews and discussions with managers at 10MD. Quantitative data is collected from the organization's financial data base and some data was also collected from the financial database of supplier's for 10MD. The data derived from this approach is subjected to quantitative study where the credibility of factors are quantified and the results are analyzed before validating it.

### 3.6.2 Interviews

Interviews are conducted to see how different functions within the company perceive the selected case. According to Denscombe[25], semi-structured interviews are an effective way to collect information in most cases. Semi-structured interviews are those in which questions framed are open ended and follow up questions are based on the answers provided to the primary question. This kind of interview grants the author more flexibility in pursuing the right choice of questions since different interviews bring about different perspectives to the same topic leading to complexity[25]. The set of questions asked is documented in the appendix and the findings are described in the result section.

### **3.6.3 Stratego Tool**

In this step, the Stratego tool is designed for systematic manufacturing strategy work which caters to the specific needs of the production. It becomes extremely important to have a world class production system which has the ability to make right products, with right quality and on time in order to be successful, as the international market is dynamic in nature.[33]. The tool can facilitate number of decisions within various departments (decision categories) so that the production capabilities, order winning criteria and competitive priorities are analysed.

### **3.6.4 Discussion sessions**

Discussion sessions set up an opportunity to share information or documents via mail or hard copy, which was essential for the timely progress of the thesis work as the authors lacked access to 10 MD's financial database. At times, these discussion sessions are held as a consequence of doubts that arose from analysis of data retrieved from the interviews. These sessions turned out to be productive as lot of clarifications were made by the stakeholders or the supervisor on the current scenario and also how to tackle uncertainty conditions.

## **3.7 Summary**

Having understood the methodology for identifying stakeholders and collecting data, the authors introduce the actual case scenario at 10MD in a detailed manner in the next section.



# 4

## The Ten Medical Design AB Case

*This chapter is an introduction to the considered case at Ten Medical Design AB, Sweden. The contents of this chapter and the presented information is specific to 10MD only.*

### 4.1 Background

Ten Medical Design AB (10MD) is an organization that produces medical technology products within the area of X-ray radiation protection for medical staff in the operating room. The products are designed based on true customer needs and ergonomics. The 10MD product HeadPeace is the company's first product in a broader portfolio of products. The product is radiation protective and is unique in terms of fit and breathability when compared to competitor's products. HeadPeace has received CE mark and was recently clinically validated in a multinational study including Ireland and Sweden. Currently, 10MD has two products that are on the market: TeXray, which is the patented radiation protective textile and HeadPeace which is a head protection cap that is designed to protect the cranial area of the wearer. 10MD has full ownership of the value chain, from the making of the radiation protective filaments to the end product. The manufacturing processes involved in the value chain are outsourced to third parties.

1. **TeXray**- TeXray is a textile that is patented as a radiation protection material with a unique design by 10MD. TeXray was developed by 10MD to provide health care staff with functional and comfortable radiation protection that would not interfere with their main task of saving lives in the OR. Due to its textile design, TeXray has unique features compared to the metal composites used in traditional radiation protection clothings. Lab tests shows TeXray is significantly superior than its competitors concerning durability. The same textile is also being used as the core fabric for the production of HeadPeace

2. **HeadPeace** - Healthcare staff working in OR are not fully protected from harmful radiation. Only 75% of the body is protected from harmful radiation leaving arms, legs and cranium open for exposure. To mitigate the risk of radiation exposure, the use of leaded aprons, thyroid and glasses are mandatory. HeadPeace is designed to minimize radiation exposure in the front and on the sides of the head and is clinically proven for its reduction of scatter radiation and its usability in the OR.

10MD is a material production company with the goal to manufacture and sell a full assortment of radiation protection products as well as TeXray material on roll for other product manufacturers. The HeadPeace is available in Small, Medium and

Large sizes.



**Figure 4.1:** Use of HeadPeace in OR

## 4.2 Current Production Scenario

The product segment of HeadPeace was chosen for analysis in the master thesis. The current production scenario is on a pre-launch scale and the scale up of production is exponential, doubling the production on an annual base. The objective was to bring about cost efficiency within the product flow and analyze for bottlenecks in the value stream. Through interviews and plant visits, the value stream of the product was mapped and the process breakdowns are as shown in the Figure 4.2. The initial step is to calculate the costs at each juncture and look for potential improvements once the calculation model is completed. In this master thesis, the important processes are considered as workstations, so that the analysis can be carried out from the value stream perspective and bottlenecks can be determined. A brief description of these workstations are given below:

**1.Raw Material Procurement-** The raw material is purchased from a supplier located in the United States of America. The current purchase usually happens twice a year, with a batch size of around 200kg.

**2.Extrusion-** The raw material is directly shipped to the extrusion company based in Småland, Sweden, where filament production takes place. The raw material is extruded into filaments and sent to the next process.

**3.Coating and Winding-** In this stage the filament is coated with a PE based polymer material and the coated filament is wound on a paper spool. Both coating and winding processes are carried out in Molndal, Sweden.

**4.Weaving-** The coated fibre which is wound on paper spool is sent to a weaving industry based in Borås, Sweden. The TeXray fabric is woven based on the specifications provided by 10MD.

**5.Cutting-** The cutting process is also carried out in the weaving industry located in Borås, Sweden, by a personnel from 10MD. Products are patterned on the TeXray fabric based on the size of HeadPeace (Small, Medium or Large), and then the cut-

ting process is carried out. An ultrasonic knife is being used for this process.

**6.Assembly-** In this process, the HeadPeace product is assembled and sewn to its final design according to specifications provided by 10MD. This is carried out at an industrial sewing shop in Borås, Sweden.

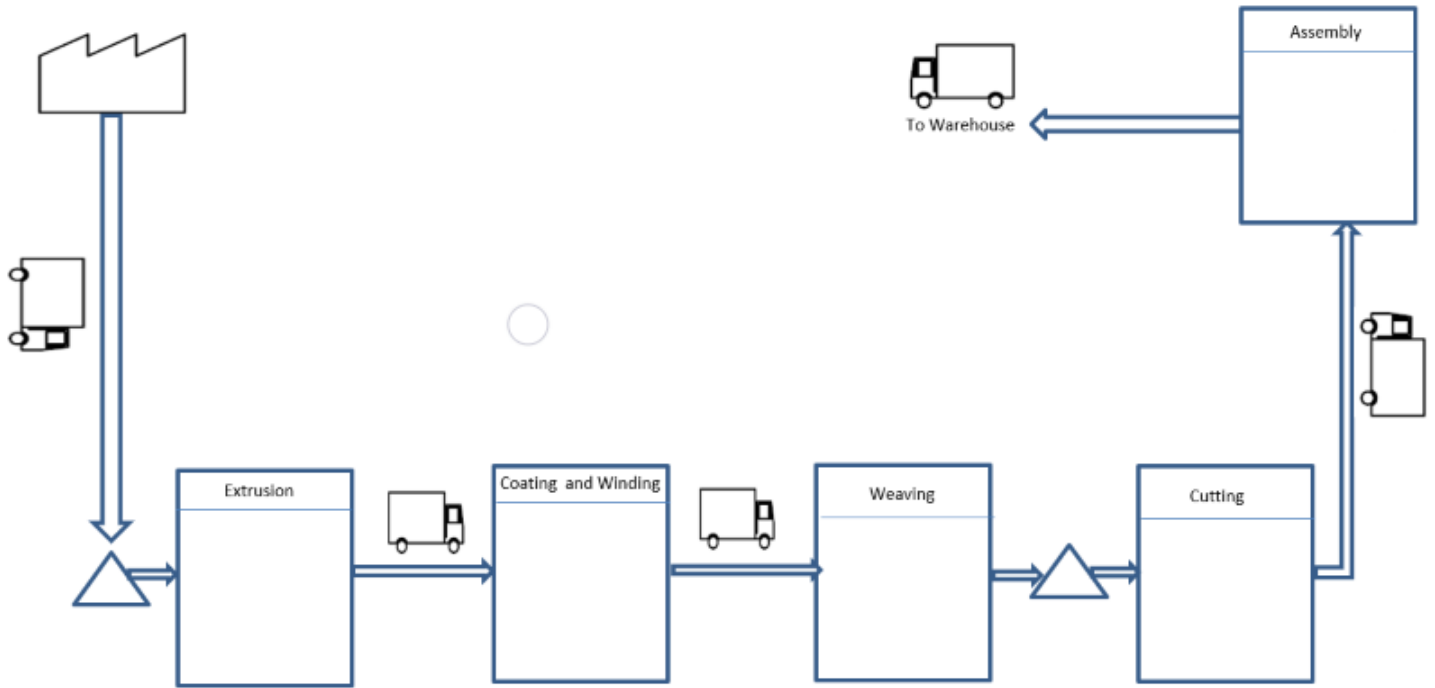


Figure 4.2: Value chain of 10MD

### 4.3 Issues in the value stream

There are a few quality issues that are being observed at the extrusion process, mainly due to the machine that is being used to carry out the extrusion of raw materials. This is affecting the quality at the weaving process at weaving industry as lower quality of fibre means lower quality of fabric. The labour costs at the assembly service supplier was found to be quite high mainly due to the working wages in Sweden. Also, since the fabrics are manually woven at the assembly industry, time consumption is high and 10MD needs to place an order at least two weeks prior to the requirement stating the exact quantities. Forecasting is carried out by estimating the sales volume (million SEK) at present and for the next 4 years. The current strategy employed by 10MD is Make to Stock. Given the dynamism of the current market, this approach might be considered risky given the long term perspective. Finally, 10MD does not have a performance measurement system to measure throughput time, cycle time and processing time of its subcontractors. This becomes a huge problem as it becomes very difficult to look for potential improvements when analyzing from the perspective of value stream.



# 5

## Results

*This chapter highlights the significant findings of this thesis work.*

### 5.1 Formulation of Manufacturing strategy through Stratego tool

#### 5.1.1 Step 1: Identify the competitive priorities

The product segment we have focused on is high end radiation protection HeadPeace products as it contributes a major chunk of total turnover sales in the company. The company has four competitive priorities which is as shown in the figure 5.1. In this step, the importance of competitive priorities is analysed by scoring for 1 to 5. (5=crucial/extremely important and 1= limited importance)

**1. Quality :** Quality is given the score of 5 as it is of utmost importance to the customer and plays a crucial role in the development of the organization. Since high level of quality is expected in surgical equipments, the company continuously aims to provide good quality products to its customer and thus, it is one of their main competitive priorities. The quality is measured in terms of complaints the company gets for the period of one year. The main aim is to reduce the quality defects and provide customer satisfaction.

**2. Annual Volume:** Annual volume is defined as the number of products that are being produced for one year. Since this is of low importance to the customer a score of 2 is allotted.

**3. Price:** Price is defined as SEK per HeadPeace. This is given the score of 4 as price is of significant importance to the customer.

Competitive priorities (1b)		Competitive priorities' importance to customer (1c)	Measure	← Comments (1b & 1c)
1	Quality	5	Complaints/year	
▶ 2	Annual Volume	2	Number of HP	
3	Price	4	SEK/HP	

**Figure 5.1:** Identify the competitive priorities

### 5.1.2 Step 2: Assessment of decision categories

The decision categories are the areas in which the company needs to make crucial decisions, so that the identified competitive priorities are improved. In this section, the 8 decision categories are analyzed to identify the improvement potentials in the identified competitive priorities. Two different scores are allocated in this step as seen in the figure 5.2. The allocation in 2a section is to state to what degree decision categories contribute in reaching the competitive priority. This is scored from 1 to 3 with 1 meaning limited contribution and 3 meaning considerable contribution. The second step of scoring (2b) determines the difficulties for making changes in the decision category with 1 being easy/cheap to achieve and 3 being difficult/costly to make changes.

The scoring was carried out based on the interview session which was held with CEO of 10MD. The motivation for the scores allocated in section 2a are as follows: **Quality:** The production processes play a prominent role in obtaining good quality of products and thus, a high score of 3 is allotted. Since the facility and capacity requirements for the HeadPeace products are very minimal, a score of 1 is allotted. 10MD is not vertically integrated and thus a score of 1 is given to it when assessing its contribution to all the competitive priorities. Quality management and control systems play a huge role in maintaining in the quality standards set and identify room for potential improvements due to which a high score of 3 is allotted. Human resources is given a score of 2 as it is involved in creating training programs, ensure that the workers have sufficient knowledge about the product and the process thereby maintaining a good quality. The organization is allotted a high score of 3 as it is the upper management that creates strict measures and a structure to ensure that the quality standards are followed throughout the value chain. The production planning and control are given a score of 2 as the decisions regarding production planning and control are about choice of principles for planning and control, both material

and production. The organization must plan comprehensively in order to get higher quality, and make organisation as productive as possible.

**Annual Volume:** The production processes have a prominent role on the number of HeadPeace products produced. Since the production volume of HeadPeace products is not high, a score of 2 is allotted. Due to nominal production volume, the facility requirements is minimal and score of 1 is allotted. The capacity is allotted a score of 2 keeping in mind the potential to increase the productivity considerably based on the market requirements. Due to the dynamism of production market, the capacity needs to be a bit high in this case to accommodate increase in the production volume as and when needed. 10MD is not vertically integrated and thus a score of 1 is given to it when assessing its contribution to all the competitive priorities. Quality management and control, human resources and organization are given a high score of 3 as it is critical to maintain quality standards, ensure skilled labour and strict measures so that the quality of produced products are meeting the standard requirements, thereby reducing the total amount of scrap which directly contributes to increase in productivity. It becomes increasingly important to have production planning in place while assessing the production volumes and thus, a high score of 3 is allotted.

**Price:** The production processes and facilities have a significant impact on the price due to which a score of 2 is allotted. 10MD is not vertically integrated and thus a score of 1 is given to it when assessing its contribution to all the competitive priorities. The customers of 10MD pay a premium price mainly due to the quality of the product and thus, a high score of 3 is given to quality management and control. Human resources, organization and production planning are given a score of 2 as the price of the product is dependant on these decision categories and may vary based on the market requirements.

The next step is to determine the level of difficulty in carrying out changes with these decision categories. Since 10MD uses sub-contractors, it does not own the facilities or the production processes and thus, it becomes really difficult to make changes in those decision categories. Thus, a score of 3 is given for facilities, capacity and production planning as shown in the figure 5.2. However, the company can makes changes easily in quality management and control due to which a score of 1 is allocated.

[illegible]

**Figure 5.2:** Assessment of decision categories

### 5.1.3 Step 3: Assess the present production

In this step, the performance of the company is estimated based on how well it is performing with respect to the different competitive priorities that are established. The scoring is carried out from 1 to 5 in this step. (1=less well and 5=very well). It can be seen from the figure 5.3 that the company is doing well at present as good scores have been allocated to all the competitive priorities that are established. Quality is given a high score as the company is very strict in adhering to the quality standards due to which a minimal scrap rate of 1% is obtained. Even though the current production volumes meet the customer demands, productivity is given a score of 3 as the production is quite low at present with respect to the market potential. Price is given a score of 3 as 10MD is currently charging less amount of money for their products when compared to its competitors.

Competitive priorities (1b)		Present production (3a&3b)	← Comments (3a)
1	Quality		
▶ 2	Annual Volume	3	
3	Price	3	

**Figure 5.3:** Assess the present production

#### 5.1.4 Step 4: Competitive analysis

Mavig, RadPad and Lite Tech are the competitors of 10MD. These companies are also involved in the production of radiation protection garments that are used in operating rooms. The analysis in this section could not be carried out due to the lack of data available regarding the competitors of 10MD. However, we strongly believe that, the analysis using the stratego tool would be much accurate if examination of this section was carried out.

[illegible]

**Figure 5.4:** Competitive analysis

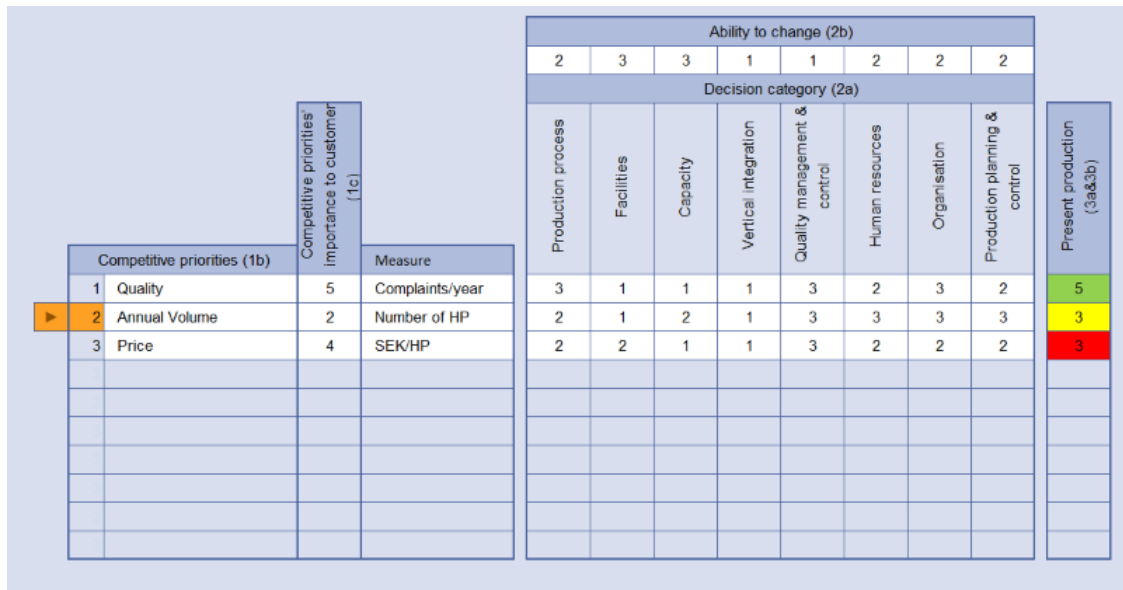
### 5.1.5 Step 5: Prioritize focus areas

This step is carried out to identify the competitive priorities which has the highest potential for improvement. As shown in the figure 5.5, the tool automatically indicates with colour(green/red/yellow), where red means highest potential and green means least potential for improvement.

From the below analysis, it was found that pricing was marked in red and had the highest potential for improvement. As mentioned earlier, 10MD is charging less amount of money for its products when compared to its competitors. From the interview, it was clear that the quality of 10MD products were much better than its competitors and thus, gradual increase in price would be beneficial as there is good market potential for radiation protection garments at present. Since yellow indicates that the changes might be considered, there is room for improvement in productivity as there could be increase in the production.

Now that the competitive priorities that have most potential for improvement are analysed, it becomes critical to identify the decision categories that can be changed to accommodate these improvements. The decision categories that have the highest impact on pricing are Quality control and management, Human resources, Organization, Production planning and control. All these decision categories are moderately easy to change as a score of 3 is allocated to quality control and a score of 2 has been allocated to the other decision categories mentioned above thus, it can be concluded that the objective of achieving better pricing can be carried out in the upcoming

years if these changes are implemented. In order to get a good picture about pricing, the cost data has to be studied as costing and pricing are directly related. Pricing can be controlled or improvised by controlling the cost aspect in the value chain. Thus in further sections, cost aspects are focused with an intention to become more price competitive.



**Figure 5.5:** Prioritize focus areas

## 5.2 Role of standard costing in 10MD's decision making process

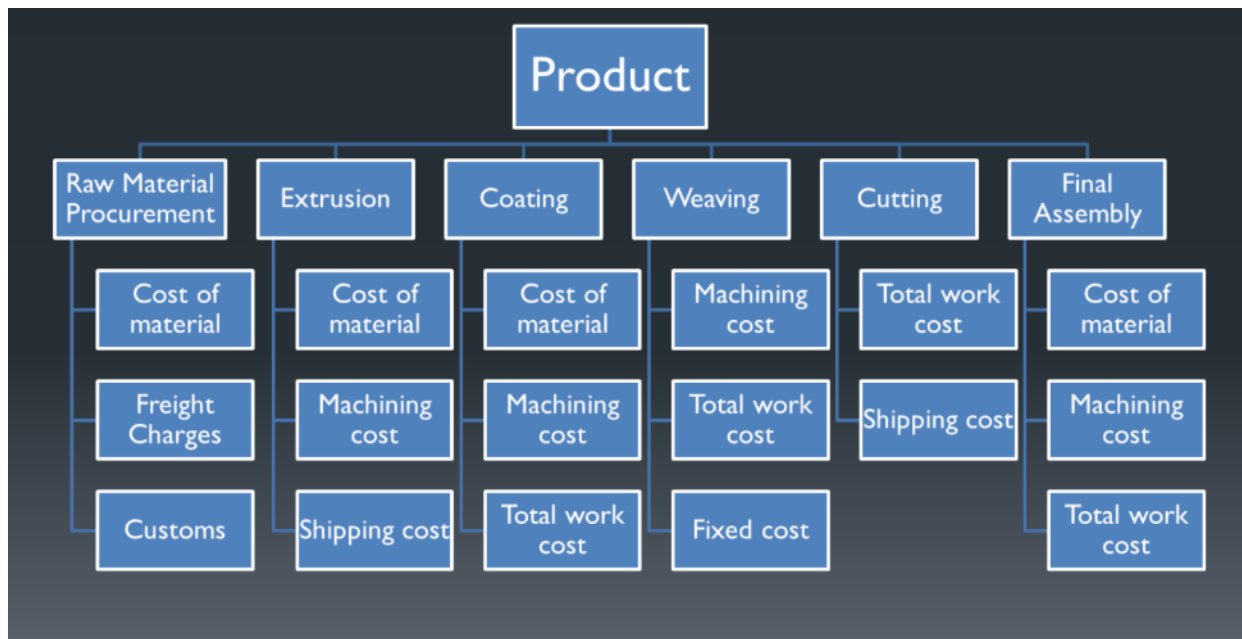
### 5.2.1 Initial data gathering and accounting process

10 MD did not have an organized accounting information and as a result, data regarding costs had to be gathered before starting the costing process. The data was gathered with the help of Fredrik Gellerstedt, CEO of 10MD by contacting the supplier firms and various other concerned officials. Since standard costing technique was selected, information regarding the processes and what activities goes into the production of a product had to be collected. The whole activity analysis and data gathering process was done in a span of three weeks and the gathered data was being documented in 'MS Excel' and 'MS Word' tools.

The coming section shows the costing information for all the processes involved in the value chain.

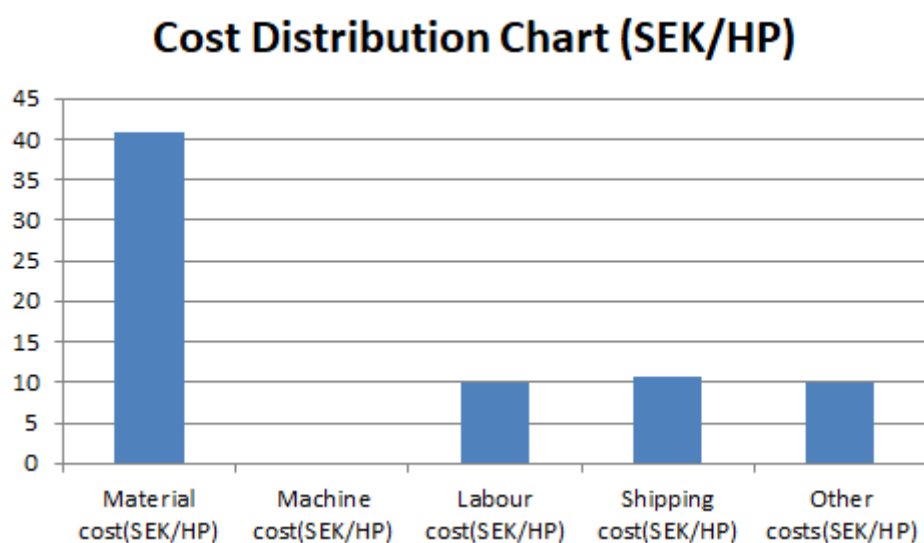
### 5.2.2 Standard costing information of the value chain

As explained in the case description, the value chain of 10MD's product has 6 different processes and the costing information for each of the processes are as follows: The costs of different processes are classified into five categories for the sake of easy comparison. The costs are classified as material costs, machining costs, labour costs, shipping costs and other costs.



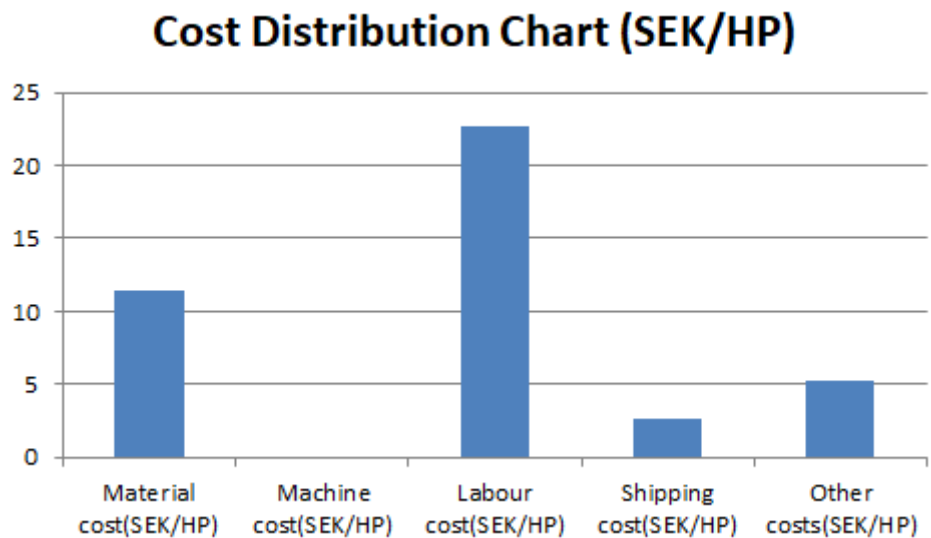
**Figure 5.6:** Processes and the cost factors involved in the value chain

**1. Raw material procurement process:** The costs incurring from this process can be divided among four different factors, the raw material cost, the customs cost (as the material is imported from USA), the freight charges and overheads. It was seen that 57% of the total process cost can be attributed to material cost which is a direct cost. The handling charges accounted to about 14% of the total process cost and was categorized under labour cost. The shipping cost which includes the freight charges and customs cost accounted for 15% of the total process cost and administrative overheads which includes the salary of managers and storage costs accounts to 14% of the total process cost.



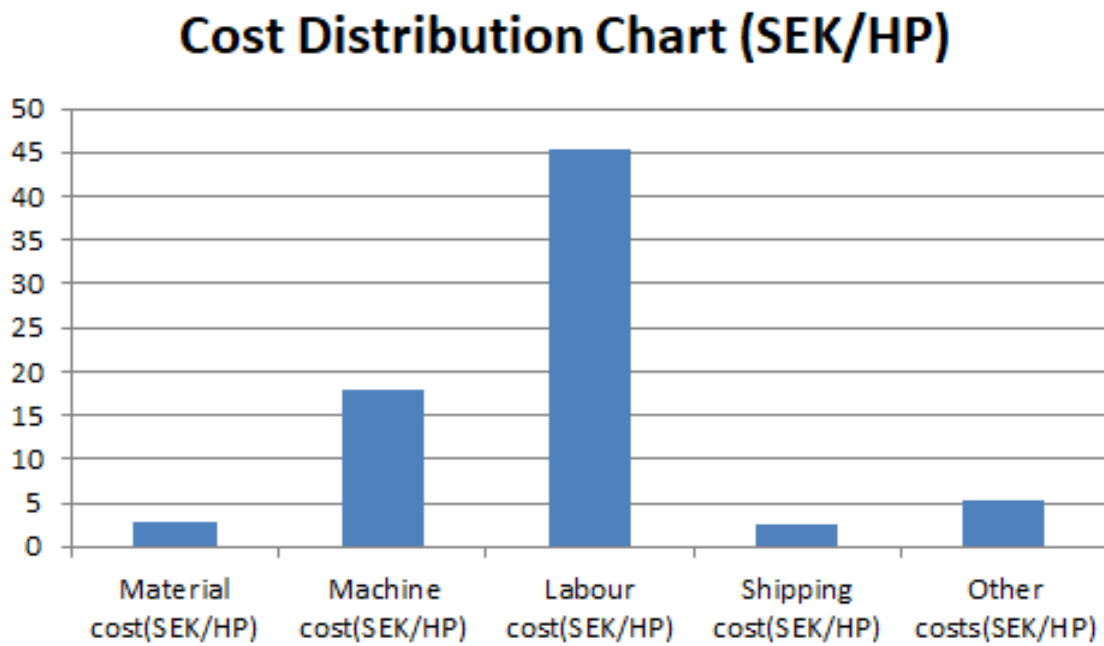
**Figure 5.7:** Cost distribution for raw material procurement process

**2. Extrusion process:** The costs incurring from this process can be divided among four factors, the PC filament cost which is the cost of material that is required for the extrusion process, the labour cost, the shipping costs and the administrative overheads. 27% of the total extrusion activity cost can be attributed to the PC filament cost, labour cost accounts for about 54% of the total process cost, 6% of the total activity cost is due to shipping and the remaining 13% of the total process cost is attributed to administrative overheads which includes cost for storage and salaries of managers. Costs for electricity and machining has been included in the filament cost and data for those factors could not be gathered separately due to unavailability of information at the supplier's end. Data regarding those factors would have provided us with a better picture about how costs are distributed in the extrusion activity.



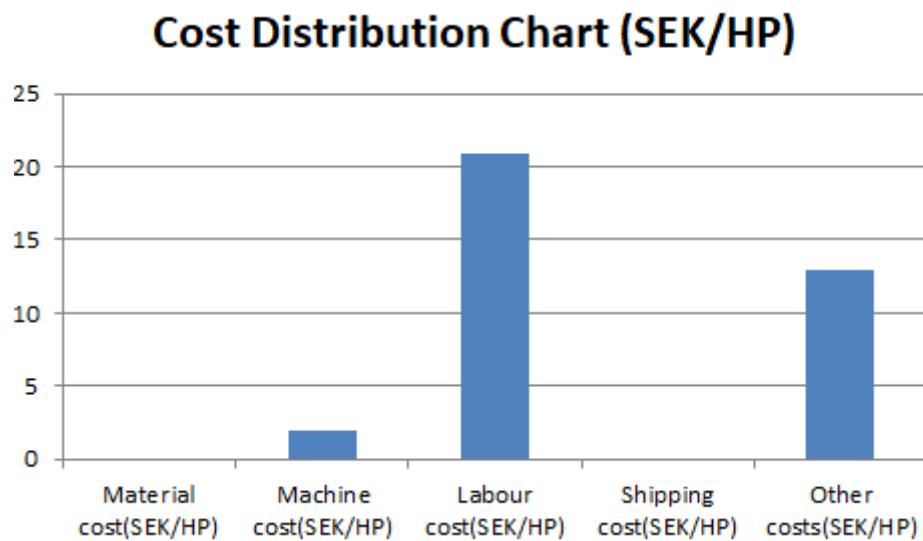
**Figure 5.8:** Cost distribution for extrusion process

**3. Coating process:** The costs incurring from this activity can be divided among six different factors, the coating material cost, the reinforcement material cost, the machining cost, the total work cost, shipping charges and administrative overheads. The total material cost adds up to only 4% of the activity cost as the cost of materials required for the coating process is very less. The machining cost adds up to 24% of the activity cost and it is the labour cost which contributes maximum to the coating activity cost. The labour cost attributes to about 61 percent of the total coating cost. This is due to the fact that coating activity is manual in nature and requires supervision continuously. The administrative overheads which include storage costs accounts for 7% of the total process cost and the shipping charges accounts to 4% of the process cost.



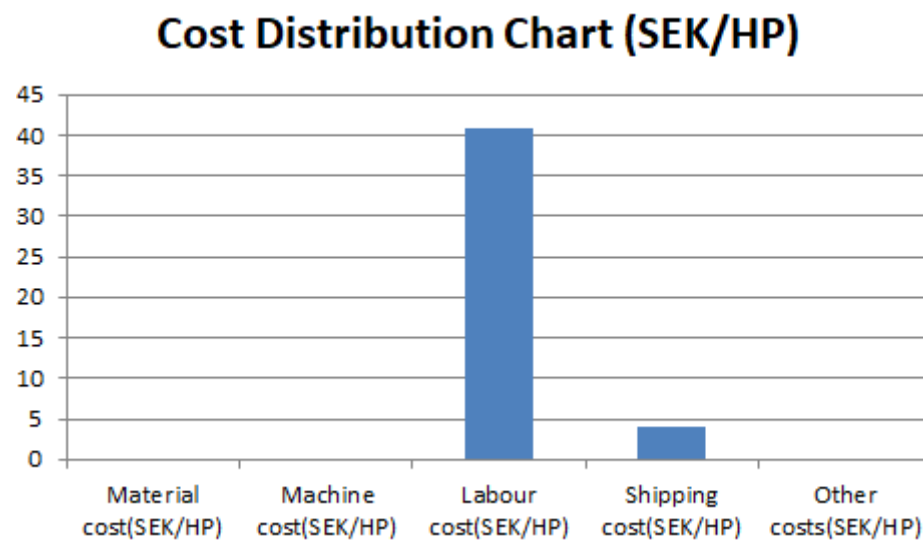
**Figure 5.9:** Cost distribution for coating process

**4. Weaving process:** The weaving activity is a semi automated process and requires the operator to start and stop the machine to load the coated material. The manager at the weaving company told that occasional supervision is required to make sure that the woven products match to the quality requirements. Three factors contribute to the overall process cost in this case which are the start and stop cost, the labour cost and the machining cost. The start and stop cost includes administrative overheads along with set up costs. The administrative overheads includes cost for storing product and salaries of managers. Labour cost accounts for 54% of the process cost. 6% of the total process cost can be attributed to machining costs and 36% of the total process cost is due to administrative overheads. The large setup cost is due to low volumes being produced at the supplier's end in order to compensate for idle times. Since the cutting process is done in the same facility, no shipping charges are included in this activity.



**Figure 5.10:** Cost distribution for weaving process

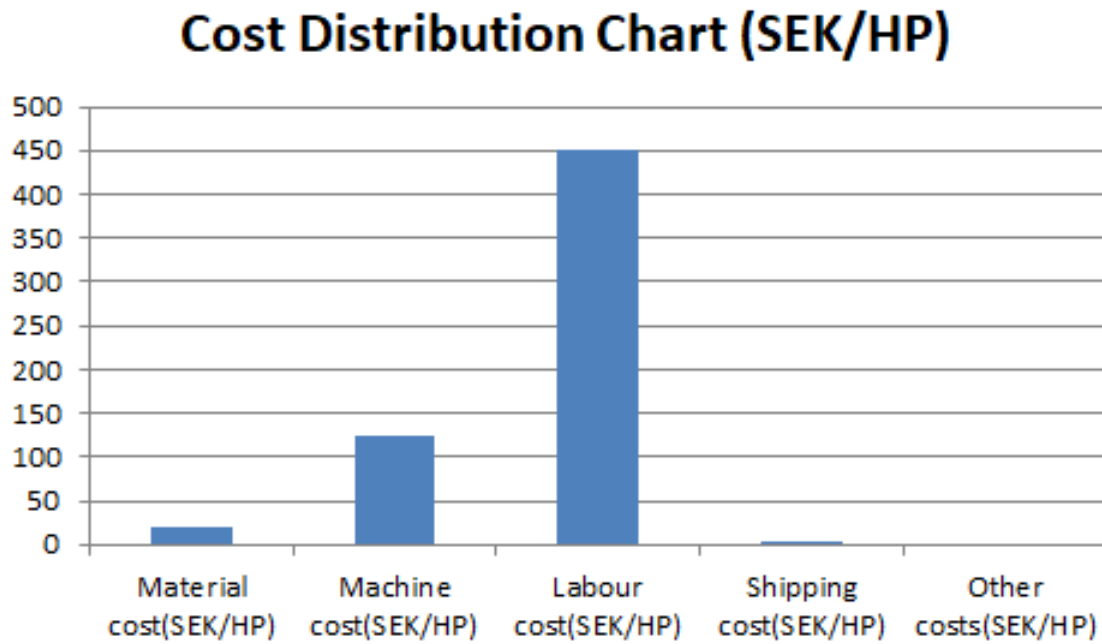
**5. Cutting process:** The total cost of this activity can be attributed to two factors which are the work cost and the shipping cost. The cutting operation is completely manual in nature and as a result requires manual supervision throughout the process. 82 percent of the total cost was found to be due to work cost and only 18 percent was due to shipping.



**Figure 5.11:** Cost distribution for cutting process

**6. Assembly process:** The assembly process is the final activity of the value chain and is labour intensive. It requires manual supervision and manual skills due to which a large part of the total activity cost goes into work cost. The working and handling cost which can be categorized as labour costs accounts to 76 percent of the total activity cost, the machining cost accounts to 21 percent of the process

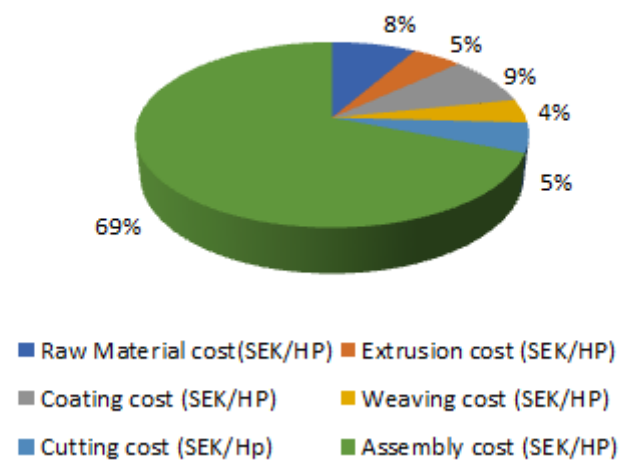
cost and raw material costs account to about 3 percent. Shipping charge is very negligible when compared to the other costs.



**Figure 5.12:** Cost distribution for assembly process

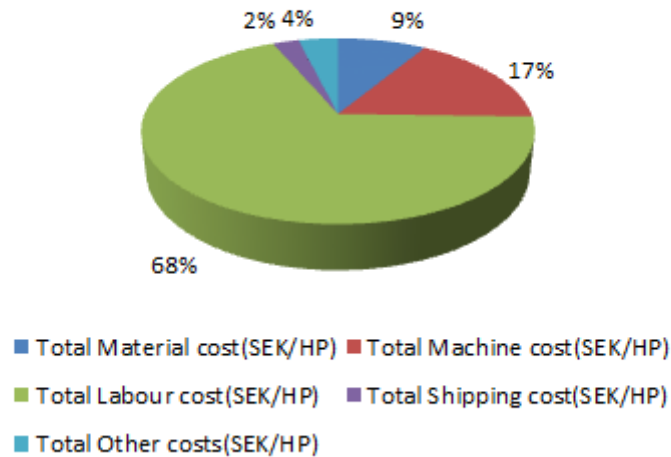
**Summary of cost distribution for the value chain:** By assigning costs to each activities and their corresponding factors, a clear picture about the cost distribution for the value chain was obtained. It can be seen that 69 percent of the total production cost was due to assembly operation and the reason for this is that the assembly operation is labour intensive and requires lot of skill sets. In a country like Sweden, where the working costs are quite high when compared to other nations, the overall work cost is certainly going to be high for a process like assembly. All the other activities are almost distributed equally in small amounts. Raw material cost adds up to 8 percent, the extrusion activity adds up to 5 percent, coating accounts for 9 percent, weaving accounts for 4 percent and cutting activity attributes to 5 percent of the overall production cost. This information is useful to recognize the cost consuming operations and differentiate necessary and unnecessary processes. The organization can keep this as a reference during their decision making process to evaluate alternatives and predict the financial outcomes of making those decisions.

**Cost Distribution Chart(SEK/HP)**



**Figure 5.13:** Cost distribution for the value chain

### Cost Distribution Chart (SEK/HP)



**Figure 5.14:** Cost distribution for the value chain

## 5.3 Proposed Strategies to reduce the assembly costs

It can be seen that about 69% of the total production cost is due to assembly process and this has to be reduced initially in order to achieve cost efficiency in the value chain. Three alternative scenarios were shortlisted by brainstorming and an attempt has been made to analyze the alternatives and predict its financial outcomes through accounting.

Calculations are made by considering the current annual production volume of 2080 HeadPeace. Details of cost figures and calculation pertaining to this section is shown in Appendix A.

### 5.3.1 Alternative one: Invest on Automated sewing machine and hiring one contract worker for manual supervision

A large portion of assembly cost is due to working and handling costs. The reason for this is that the assembly process is labour intensive and requires a lot of manual work and supervision. In order to eliminate these costs, an automated sewing machine could be purchased by 10MD and kept in Syverket. Automated sewing machines will reduce the assembly time and the need for manual work. However, manual supervision is still required for setup and changeover operations. Hence a worker has to be hired on a contract basis to carry out this task and he/she will be completely responsible for the assembly work of the HeadPeace.

Cost figures used in analysing the feasibility of the investment:

**Current assembly cost figures:**

Production volume = 2080 HeadPeace

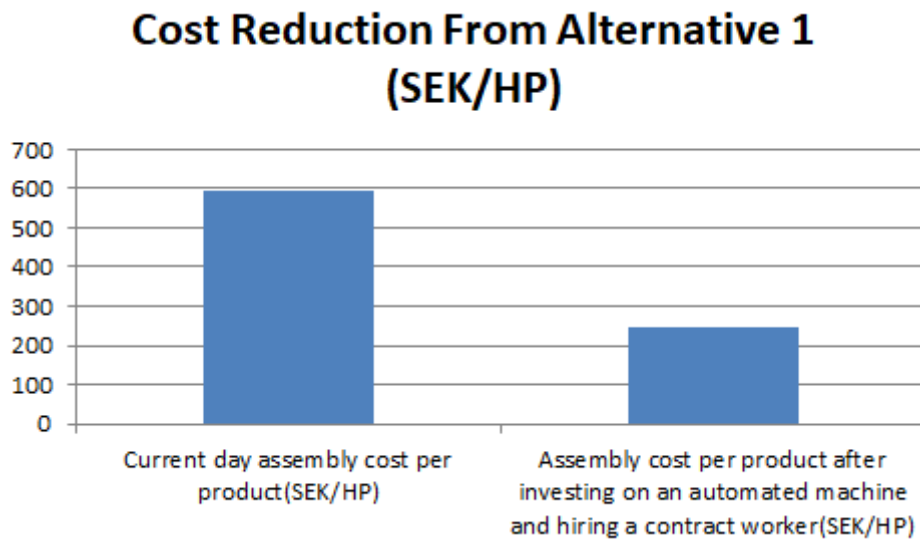
Assembly costs for 2080 HeadPeace (initial) = 1241760 SEK

Assembly cost per product (initial) = 597 SEK

**Proposed investments and other fixed costs :**

<b>Investment:</b> Automated Sewing Machine(SEK)	105051
<b>Fixed costs:</b> Labour cost for 2080 products(SEK)	340080
Rent cost for the entire year(SEK)	100000
Maintenance cost(SEK)	25000
Shipping cost(SEK)	4160
Raw material cost(SEK)	41600
Total assembly cost for 2080 products(SEK)	510840
Total assembly cost per product(SEK)	245.59

It is seen that the annual assembly cost can be reduced by 58% if alternative 1 is implemented. The payback period for the investment made will be less than a year by considering the cost saved in the assembly process.



**Figure 5.15:** Assembly cost reduction due to alternative 1

### 5.3.2 Alternative two: Invest on two Manual sewing machines and hiring one contract worker

If the organization does not want to invest on a costly automated sewing machine, it can invest on two manual sewing machines and hire a contract worker to work completely on the product. Manual work requires two machines to complete the assembly work in order to reduce changeovers. Manual sewing machines cost less when compared to automated machines but the overall work takes a long time in a manual machine. Currently, the assembly work is being done by 4 workers and as a result, the working wages are quite high. However, for the present production volume, 4 workers are not required and in this case, the costs are analyzed by considering only one assembly worker.

Cost figures used in analysing the feasibility of the investment:

**Current assembly cost figures:**

Production volume = 2080 HeadPeace

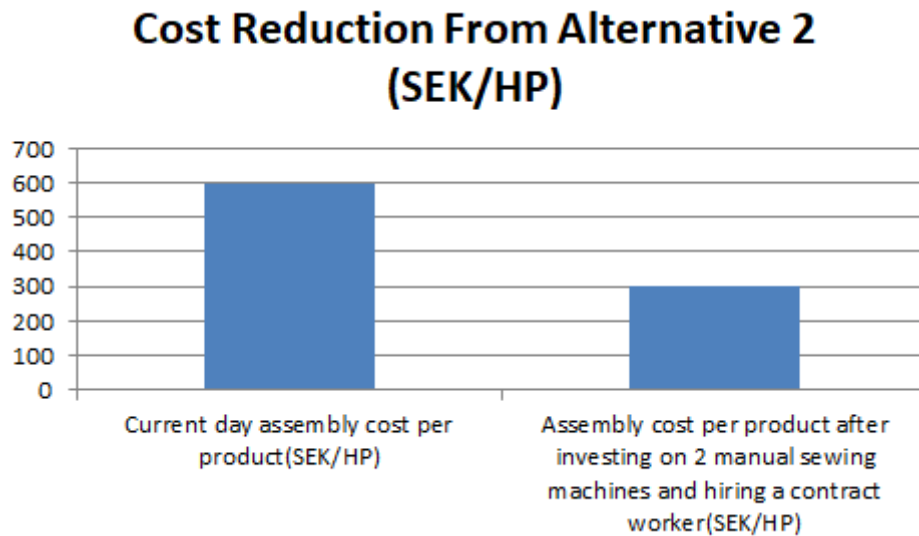
Assembly costs for 2080 HeadPeace (initial) = 1241760 SEK

Assembly cost per product (initial) = 597 SEK

**Proposed investments and other fixed costs :**

<b>Investment:</b> Two manual Sewing Machines(SEK)	10000
<b>Fixed costs:</b> Labour cost for 2080 products(SEK)	510120
Rent cost for the entire year(SEK)	66000
Maintenance cost(SEK)	5000
Shipping cost(SEK)	4160
Raw material cost(SEK)	41600
Total assembly cost for 2080 products(SEK)	626880
Total assembly cost per product(SEK)	301.384

It is seen that the annual assembly cost can be reduced by 49% if alternative 2 is implemented. The payback period for the investment made will be less than a year by considering the cost saved in the assembly process. However, the payback period is less than the payback period of alternative 1 as the investment made in this case is a lot less.



**Figure 5.16:** Assembly cost reduction due to alternative 2

### 5.3.3 Alternative three: Outsource to Latvia

The reason for high working costs as mentioned before is due to the fact that the process is labour intensive and that the average working wages in Sweden is quite high when compared to other countries. In order to reduce this cost, the working and handling costs had to be reduced which is possible by outsourcing the assembly work from a different country. Quotations from various organizations were obtained and details regarding the subsequent shipping and other handling charges were collected

from shipping service providers.

In this alternative, quotations of 'Gefa' which is a Sweden based textile industry situated in Latvia are considered for calculations.

Cost figures used in analysing the feasibility of the investment:

**Current assembly cost figures:**

Production volume = 2080 HeadPeace

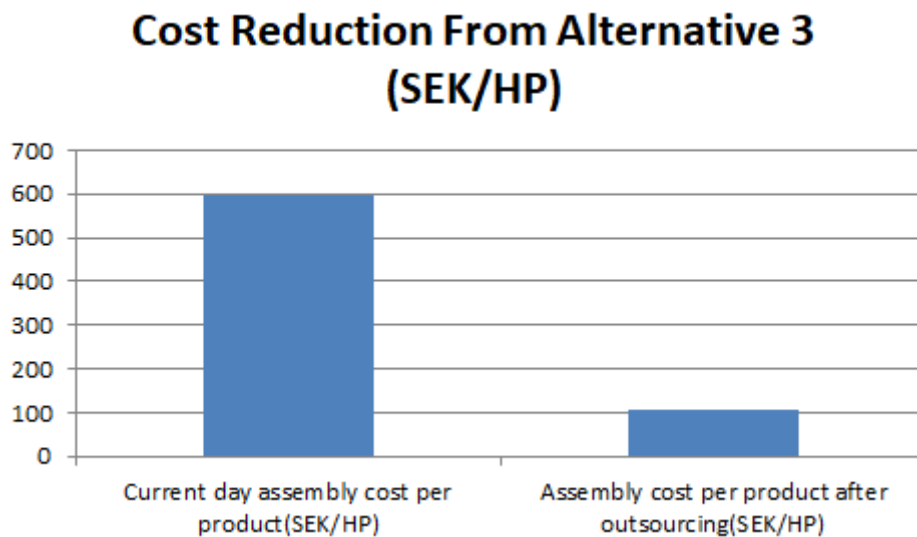
Assembly costs for 2080 HeadPeace (initial) = 1241760 SEK

Assembly cost per product (initial) = 597 SEK

**Proposed investments and other fixed costs :**

<b>Investment:NIL</b>	
<b>Fixed costs:</b> Work and handling charges(SEK)	168007.84
Raw material(SEK)	41600
Shipping cost(SEK)	4160
Raw material cost(SEK)	41600
Total assembly cost for 2080 products(SEK)	220007.84
Total assembly cost per product(SEK)	105.773

It is seen that the annual assembly cost can be reduced by 82% if alternative 3 is implemented.



**Figure 5.17:** Assembly cost reduction due to alternative 3

### 5.4 Proposed solution to increase fibre quality

Since 10MD produces medical garments like radiation protective headpieces, extra care has to be taken regarding the quality of products and a lot of quality standards have to be met for the product to enter into the market. The quality of the coated materials was satisfactory and the organization had plans on improving it by investing on a new machinery. The new machine had the capability of performing both extrusion and coating operations in a much faster rate and produce better quality

coated materials. The new machine would also make the coating and extrusion process automated and would eliminate/reduce manual supervision. The management were quite sure that the new investment would help them achieve better quality products and improve their production rate but were not sure about how it would help them financially. Financial returns is equally important for organizations and while deciding upon investing on a new resource, care has to be taken to analyze returns.

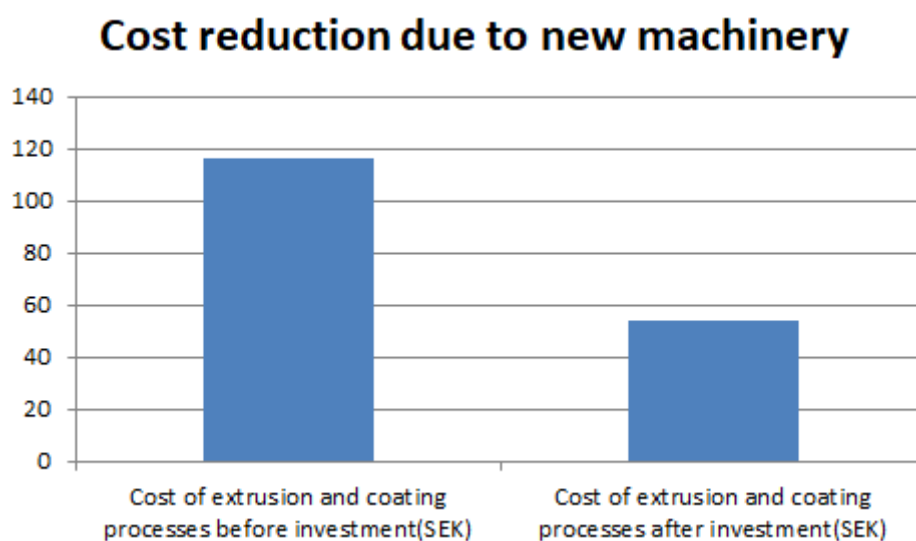
Since we now had all the cost information pertaining to activities, it was easy for us to predict the financial outcome of investing on a new machinery. The new machinery has the capability of performing extrusion and coating operations at a single facility. This will result in the elimination of some costs associated to certain factors which are mentioned in the previous section and addition of certain other costs. A detail of what factors change has been showed in the appendix. By making those changes, the total cost of extrusion and coating stations combined were obtained. It was seen that the activity cost of extrusion and coating stations almost reduced by 53 percent and the overall production cost dropped by 7.15 percent.

It is important to determine the salvage value for investments as it gives the organization a clear picture about the size of their depreciation expense. The salvage value for the investment made was calculated by using the standard formula:

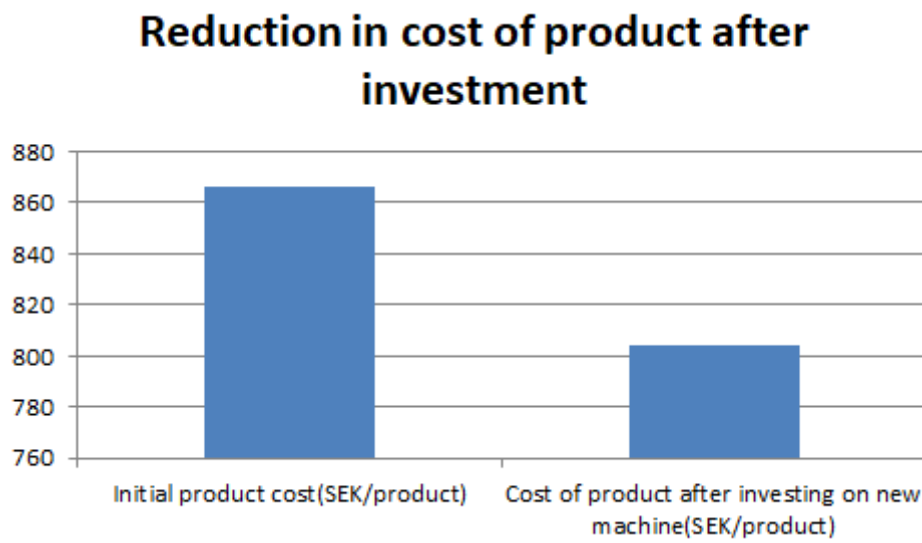
$$\text{Salvage value} = P(1 - i)^y$$

Here, P = Original cost of the asset, i = depreciation rate, y = number of years the machine will work efficiently

The investment made on the machinery is 1.5 Million SEK, The depreciation value for machinery in Sweden is around 40%. The purchased machinery will work efficiently approximately for about 7 years. Using this data, it was seen that the salvage value for the machinery was found to be 41,990 SEK which results in a depreciation of about 1.4 Million SEK.



**Figure 5.18:** Reduction in extrusion and coating activity costs due to new investment

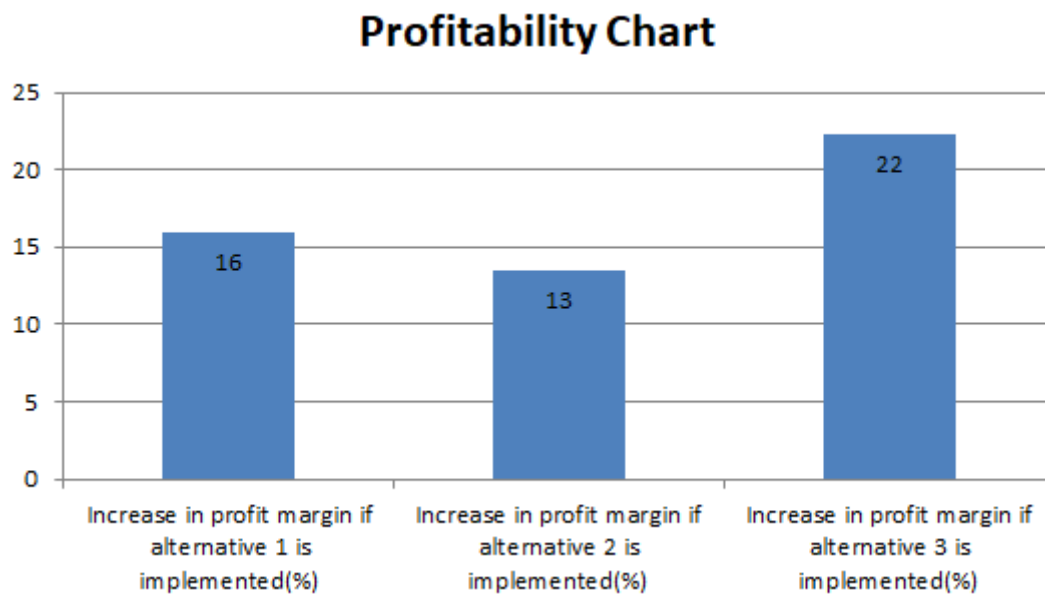


**Figure 5.19:** Reduction in overall production cost due to new investment

These findings have helped the organization to take a bold step regarding investing on a new machinery. The finding has shown the organization that they will also be benefited financially by investing on the new machinery.

### 5.4.1 How the costing approach helped 10MD in their profitability analysis

The cost information obtained helped us in determining the profitability of the organization. Since the costing information provided us with accurate production costs, it was easy for to determine the profit margin by collecting information about the selling cost and additional marketing costs. Information about profits becomes important for organizations to know how well they are doing financially. In our case, the the impact of decisions on profitability was determined and this in turn will be a supporting factor while implementing those decisions. It is seen that all the alternatives, if implemented will have a positive impact on the profitability of the organization. However, the increase in profitability will be maximum if the assembly process is outsourced to Latvia.



**Figure 5.20:** Increase in profitability if alternative solutions are implemented



# 6

## Discussions

*This section consists of discussions with regard to methods, findings and analysis.*

### 6.1 Discussion of Methods

The method adopted in the completion of this thesis was in line with the formal procedures that need to be followed in implementing the process of standard costing as discussed in the literature work[36]. Since the selected accounting technique is vast, information regarding cost data and processes became an integral part of the process. The implemented technique also demanded management support as a lot of management information was also required during the study. This calls for a combination of top-down and bottom-up approach for the process of activity based costing and decision making.

The data gathering step revealed on the in-existence of proper accounting techniques and cost information in the organization. This provides us with justification as for the basis of a costing technique like standard costing, which turns out to be the most important step, providing a strong backing for the used methods.

Since all the qualitative data was collected through interviews with concerned officials and valid literature works, it can be rated as satisfactory on validity. Quantitative data which was collected from the management's database and from supplier firms can be rated high on both validity and reliability as costing techniques were implemented by making use of the collected quantitative data and results which were trustworthy to the management were obtained. The selected method of costing gave an accurate financial prediction to the organization regarding some important decisions. This prediction will help the organization in implementing their decisions in the future as they know that it will have a positive impact on the company's financial turnovers. The used technique can be used as an evaluating tool during decision making processes to evaluate and predict the financial outcomes of implementing various decisions. However it must be noted that this method will only help the quantitative evaluation part of decision making and must not be solely relied upon. A combination of financial predictions along with qualitative judgments must be considered before implementing any decision.

The collection of qualitative data from interviews and the data collection techniques used in the collection of quantitative data has also proven effective in fulfilling the purpose of this thesis.

## 6.2 Discussion of Findings

The purpose of this thesis work was to show the effect of a costing technique like standard costing method during decision making process in organizations. The numerical findings show that it is easy to predict the financial outcomes of decisions by making use of an accounting technique like standard costing. Knowing such outcomes will help organizations to select a particular solution among alternatives and move on with the implementation phase. The predicted financial data can also be used to check the undertaken decision by comparing it with the actual financial outcomes. This will ensure if the undertaken decision is working as planned. Remedial measures can be taken if the action is not in line with the predicted outcomes.

Having cost data for each process also helped in analyzing the cost drivers and identifying the cost distribution among processes in the value chain. This helped us to target a particular process and take suitable action in order to reach a particular objective. For example, the total cost of production was reduced by targeting the assembly process as it accounted for a lot of production cost share in the value chain. Suitable remedies were identified by looking at cost factors which contributed to the overall assembly cost. It was seen that all the three proposed alternatives had a positive impact on cost reduction and the alternative to outsource assembly process to Latvia had the maximum impact on reducing the assembly cost. Since the organization is a startup, investing on an automated machinery is a difficult thing at the present as several other investments have been made in the recent past. Since the production volume is quite low at present, it will be difficult to hire a skilled contract worker who agrees to be paid on an hourly basis as he will only have few days of work every month. This could be a very good option in the future when production volumes increase. A similar problem arises while implementing alternative two. The company can invest on two manual machines as they are cheap but will have a difficult time to hire a skilled worker who agrees to be paid on an hourly basis. If the company finds a suitable worker, alternative two will fetch them good results and can totally avoid all the complexities involved in the outsourcing process. Outsourcing will have the highest positive impact on cost reduction as the labour cost in Latvia is very less when compared to the labour cost in Sweden. Since the 10MD do not have any plans of setting up their own production line in the near future, manufacturing processes involved in production of the product is not their core competence. Hence outsourcing one of the manufacturing process will definitely have a positive impact on the cost without the company losing their competency[31]. However, finding a suitable vendor and making proper agreements with them becomes important if the company decides to outsource. Having more alternatives which have positive impact will help organizations as they can be used as backup plans if any one of the alternatives fail. A clear picture about the profitability of the organization was also determined which was unknown to the organization before this study. This helped the company to know how well they are doing financially and also make future decisions and plans to improve the overall profitability of the organization. All this was possible only due to analyzing processes and what factors contributed to the cost of processes. This is the sole idea of a costing technique like standard

costing and the results obtained helped us in reaching the desired objective.

### 6.3 Discussion of Analysis

**RQ1: What are the steps involved in an effective decision making process? Why is an evaluating tool required in this process?** The process used for decision making becomes very important for organizations as it shows a systematic path to make better decisions. Various methodologies for making decisions are available in literature's and in this particular study, the 'Five step decision making model' suggested by Madiwal[26] is prioritized. This model requires the management to evaluate the alternatives by making use of some guidance tool and selecting the alternative which topped the evaluation process. Selecting a particular alternative becomes crucial for organizations as a lot of money and other factors are tied to it. Deciding upon wrong solutions will prove disastrous for organizations and will lead to financial downfall. It is usually seen that managers make use of qualitative assessments based on their instincts and experience but this alone will not lead to making the right choices as a lot of times, it can be misleading[15]. Hence it becomes important for organization to make use of some king of quantitative factor along with the instincts of managers to make effective decisions[15]. In this thesis work, standard costing has been used as an evaluating tool to help the management in the decision making process. This method helps the managers to predict the financial outcomes of various alternatives and such measures can be used to evaluate alternatives quantitatively.

**RQ2: How does 'Standard costing method' help organizations in decision making process?** Standard costing system is an approach which is often associated with a financial accounting focus and includes direct material costs, direct labour costs, and manufacturing overheads while determining the product cost [35]. A costing technique like standard costing becomes useful in organizations like 10MD as complex cost data required for ABC are unavailable. Since 10MD is a startup, standard costing was quite simple to implement as the cost reports present were not complex and were easy to analyze. An accurate analysis was possible as standard costing considers all the direct costs due to which cost distribution in the entire value chain could be known and the processes that contributed the most to the entire product cost was identified. Based on this, few alternatives were shortlisted and a financial evaluation was performed in order to select the best alternative. The cost data collected for standard costing helped in the process of evaluation and the financial outcomes of the alternatives were calculated. It was seen that all the proposed alternatives had a good financial impact on the organization and all the proposed alternatives reduced the costs significantly. This will help the organization to take a firm step and make a suitable decision.

## 6.4 Sustainability aspects

This master thesis addresses the aspects of sustainability with the help of manufacturing cost model. The aspects of environmental and economic sustainability are considered in this master thesis. Since 10MD is involved in radiation protection equipments, it becomes extremely important to be aware of the potential impact of every material that are being used. The impact of the materials used can be identified through Life Cycle Assessment (LCA) approach. Through this approach, a material can be tracked throughout its life cycle and its impact can be analysed by identifying factors such as Global warming potential (GWP) and Acidic potential (AP).

While considering the outsourcing alternative from an economic perspective, there are two conclusions that can be drawn. As stated in the above sections, outsourcing does have a lot of advantages, with the primary advantage being reduction in costs. The major drawback of outsourcing is the layover of employees and this becomes a huge setback for any country as there is significant loss of jobs if outsourcing is implemented. Thus, outsourcing is a trade off that has to be made by analysing various alternatives in order to make a well informed decision. Since 10MD is a startup and is not vertically integrated, it would be ideal to outsource as a lot of unwanted costs can be reduced and aid them in being economically sustainable.

## 6.5 Ethical aspects

The aim of including ethical aspects is to create an awareness of it while considering research and testing. This also brings out the difference between understanding and the use of ethics by the management. The authors have considered few ethical aspects while designing the new costing model.

In cost accounting, the lack of understanding of the accounting and finance process by the business manager is an incentive for the unethical employee to manipulate the system. Since the cost model created provides a clear picture about all the costs incurring in the value chain, the managers can be well informed which retards chances for any unethical acts by employees. It is ethical for an organization to provide accurate cost pictures to investors and other stakeholders rather than showing incomplete cost figures. The cost model created will help the organization to present accurate and complete cost figures to the investors and stakeholders which will definitely create a sense of trust between the management and stakeholders. This will also help the management to maintain a good professional relationship with the stakeholders.

# 7

## Future Work Recommendations

*This chapter describes the recommendations in different areas that 10MD should consider exploring. Investigating and implementing these suggestions can further validate the model in order to improve its understanding.*

### 7.1 General recommendations for Ten Medical Designs AB

It would be a great step forward if the theory that is developed here can be tested further and a realistic evaluation could be made. Some of our findings show that there can be improvement potentials in certain areas and thus, recommendations are suggested below to achieve those improvement potentials:

- **Reduce Assembly costs:** It was observed in the Standard costing model that assembly costs contributed the most among all the processes involved in the value stream. The main reason for the high costs is the higher working wages present in Sweden and thus, 10MD must consider switching to one among the three alternatives proposed.
- **Improve fibre quality:** The main quality issue that is hindering the yield rates of every process down the value stream is found at the extrusion process. When the quality of fibre extruded is not satisfactory, it affects the yield rates of other processes considerably. Thus, investment must be made in a new machine that can produce better quality of extruded products. It would be beneficial if this machine is placed along with coating and winging processes as considerable amount of time and cost can be saved from the logistics perspective.
- **Improve productivity:** It was found in the Stratego analysis that productivity also had an improvement even though the potential was not high. It would be beneficial for the company to take in more orders and increase the batch size at each process in the value stream. Current batch size is around 520 products and thus, it would be advantageous to 10MD as larger batch sizes would reduce considerable amount of indirect costs and productivity can also be increased.
- **Implement performance measurement systems:** Currently, 10MD does not have any measurement systems and thus, performance measurements sys-

tems need to be implemented. This can be highly beneficial as throughput times, cycle times and other critical information can be measured throughout the value chain. This will further help in analyzing the bottlenecks and bring about improvements continuously.

- **Switch to Activity Based Costing:** The main purpose of ABC is to remove the distortions present in standard costing systems. Some of the standard costing approaches were valid when the direct labour cost formed a large percentage of the product cost. By looking at the dynamism of the current market, it becomes very important to adopt to a new costing system which would consider the best attributes of standard costing system and apply all the indirect costs to the products that actually produce that particular cost. [29] The idea to treat the all costs as if they were variables bodes well as it facilitates the manager in making better decisions and provides an overall picture of the current scenario.

# 8

## Conclusions

*The master thesis study focuses on studying the impact of 'Traditional costing method' as an evaluating tool in the decision making process of 10MD. This chapter illustrates the main features of the master thesis study.*

From the discussions on how and why the achieved results are deduced, it can be said that the authors have satisfied the purpose of this thesis and helped 10MD to better understand the importance of costing technique in their decision making process and business in general. The suggested accounting technique which is derived through established methodology is ready to use by the managers at 10MD or at least can be used as a base model for further improvement. In conclusion here are the highlights of this master thesis study.

- The relationship between decision making and a costing technique like Standard costing as an evaluation tool has been strengthened
- Though this accounting technique is used to predict financial outcomes of alternatives in decision making, it can also be made use of to determine necessary and unnecessary processes, determine profitability and made use as an effective tool to identify processes which have cost reduction potentials.
- If the solutions discussed are implemented by 10MD, the assembly cost and the company's overall production cost will go down drastically. If the future work recommendations are implemented, 10MD can have an optimized value chain which leads to better quality products.
- The economical aspects of sustainability will be addressed by these solutions as a lot of cost is saved and unnecessary wastage of costs will be prevented in the future.



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# A

## Appendix A: Cost figures for alternatives

Case 1	Cost(SEK)
Investing on automated sewing machine and hiring a contract worker	
Cost of automated sewing machine(Investment)	105051
Time required to complete assembly of one product(Min)	30
Time required to complete assembly of one product(Hour)	0.5
Number of products produced in a year( 2019)	2080
Time required to produce 2080 products(Hour)	1040
Hourly working wage for a blue collar worker(SEK/h)	327
Yearly wage for a blue collar worker to produce 2080 products	340080
rent for an year (includes all facilities)	1,00,000
maintenance	25,000
Shipping cost for 1 product	2
Shipping cost for 2080 products	4160
raw material cost for one product	20
Raw material cost for 2080 products	41600
Total assembly cost	5,10,840
price per product	245.5961538
Initial assembly cost(for 2080 products)	1241760
cost after investing on a new automated machine and hiring a contract worker	5,10,840
difference	7,30,920
payback period for investment	0.143724347

**Figure A.1:** Cost figures for alternatives

## A. Appendix A: Cost figures for alternatives

Case 2	
Hiring a contract worker and appointing him to do manual work	
Investment on 2 manual sewing machines	10,000
Time required to complete assembly of one product(Min)	45
Time required to complete assembly of one product(Hour)	0.75
Number of products produced in a year( 2019)	2080
Time required to produce 2080 products(Hour)	1560
Hourly working wage for a blue collar worker(SEK/h)	327
Yearly wage for a blue collar worker to produce 2080 products	510120
rent for an year (includes all facilities)	66000
maintenance	5000
Shipping cost for 1 product	2
Shipping cost for 2080 products	4160
raw material cost for one product	20
Raw material cost for 2080 products	41600
Total assembly cost	626880
price per product	301.3846154
Initial cost	1241760
cost after alternative 2	626880
difference	614880
payback period for investment	0.016263336

Figure A.2: Cost figures for alternatives

Case 3	
Outsourcing	
Working and handling charges per product	80.773
Working and handling charges for 2080 products	168007.84
Raw material cost for one product	20
Raw material cost for 2080 products	41600
Shipping charges for one product	5
Shipping charges for 2080 products	10400
Total assembly cost in a year	220007.84
price per product	105.773
Initial cost	1241760
cost after alternative 3	220007.84
difference	1021752.16

Figure A.3: Cost figures for alternatives

# B

## Appendix B: Interview questions for Stratego tool

### **QUESTIONS FOR CEO:**

#### **Step 1: Identify competitive factors (select a segment), KPI, importance for customers**

1. Do you have a manufacturing strategy today?
2. How is the strategy connected to the overall company strategy?
3. What are your competitive priorities for your strategy? What are your goals? (Like quality, cost etc)

#### **Step 2 & 3: Assessment of decision categories and current production**

1. What is the level of technology? (manual, semi-automatic or fully automated) Do you want to invest more in automation?
2. Do you see in any connection between the level of automation and quality?
3. What are the reasons behind your production process as it is today?
4. Process type?
5. Layout?
6. Level of technology?
7. Are there a lot of variants in your production process (i.e. how often the product reoccurs in the production)?
8. What type of process layout is followed in the plant? Is it fixed position layout, functional layout, batch flow system.
9. What type of a production system is used? Push or pull?
10. Do operators systematically identify sources of variability?
11. No: Do operators know which variables to monitor? (Variables: excessive scrap and product and process variability- signs of poor process management)  
Yes: Are the reasons behind the variability communicated upwards?
12. How have you developed the production process based on those findings?
13. What tools are used for continuous improvement? Have you thought of using SPC, TQM?
14. Your company was started with main focus on quality, how has that initial focus formed you as company today?
15. Have you added new competitive advantages aside of quality?
16. How were those achieved?
17. Any radical changes? What was the trade off?
18. What areas of operation are currently the primary focus of improvement effort?
19. How do you reduce scraps?

20. Are there any consultants involved in the improvement projects? If so, what are their tasks? Do you have a goal with them being there?
21. Are there a large variety of products? If so, how do you handle them meaning is there a multi purpose workshop for that?
22. Are you planning to change the facilities or expand your facility? (Will you expand this plant or build another one?)
23. An important issue is how tasks can be designed in the best way, both regarding human aspects as well as how to achieve best possible production effectiveness.
24. How do you design tasks to be beneficial for the human aspects of the work?
25. How to then relate that back to effectiveness?
26. How do you work with competence and flexibility? Do you have incentives to generate motivation to extend the work force competence?
27. Do you work in any special way to educate your own personnel?
28. Are there any internal education/training programs?
29. Do you provide courses for internal recruits?
30. How does the material handling take place within the plant?
31. How much of a priority is given for resource utilization?
32. Are there any issues regarding resource utilization ?
33. How many days of work-in-process inventory are there?
34. What is the ratio of the time the product is actually being processed to the total throughput time?
35. How many man-hours per unit are required?
36. Are all bottlenecks known? Is it possible to use free capacity in another machine when a bottleneck is being taken care of?
37. Do you have a lead or lag capacity?
38. How do you work with the organization to utilize the resources at hand?
39. Internal programs for quality improvements?
40. Do you recruit to fill the gaps or is the organization flexible in that sense?
41. Since you are producing radiation protection garments do you have a lot of regulations that you need to take into your strategy?
42. How many employees are currently working in this plant?
43. Who are your customers?
44. How often does the customer-requested date match the actual delivery date?
45. What is the degree of vertical integration you have?
46. How is collaboration with suppliers organized?
47. How is the supply-chain? Do you have different suppliers or the same supplier for all the materials?
48. Where are the resources coming from?
49. Are fast changeovers a possibility with your current machines?
50. What is your current level of automation and what level do you plan on reaching further?
51. How often do you change the strategy?
52. Do you use any software for better decision making?
53. How well is it being managed on a day-to-day basis?
54. What are the key performance indicators used at your company?
55. Is the typical response to breakdowns fire-fighting heroics or proactive problem solving?

56. Is auditing being done?

57. Is there something that you are struggling with right now that keeps you from achieving your goal?

58. Are there standard procedures to follow when the process fails?

**Step 4. Competitor analysis** 1. Who's your competition?

2. What changes do you plan to make due to the current competitiveness inherent in the market?

**Step 5. Prioritized focus areas** 1. What areas are you planning to change/develop in the future to become more competitive or match competition?

**Additional Questions:**

1. Does each individual understand his or her role in executing the company's strategy?

2. Do the operators focus on performance measures that are clearly tied to the company's mission?

3. Are there characteristics of the hardware that would make it particularly easy or difficult to perform the job expected of the company?

4. Does one machine frequently fail to produce to specification, and what causes it to do so?

5. How does the current product mix affect performance?

6. How did the last few investments in capital equipment turn out?

7. Over what horizon does the production occur? Do you produce for seasonally or does production occur throughout the year?

8. What is the current defect rate that occurs?

9. Is the process standardized?

10. Do you implement lean in the layout?

11. What is your function within the company, and how long have you had this function?