
**HOW TO ARRANGE WORK AND PRODUCTION IN A
SMALL HIGH TECH COMPANY**



Bachelor's thesis

Mechanical engineering and production technology

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ABSTRACT

This thesis was commissioned by Elkome Installations, a small high tech company which exists under the Elkome group umbrella. It is a measuring and testing company which deals with electronic systems. The aim of this thesis was to find a solution to the problems that Elkome was facing in the organisation of work and production in their Hyvinkää installation unit. Using a qualitative research method, information on production planning and operation management for performance improvement and to emphasize the importance of planning in production is presented in this thesis.

The literature used was based on high technology manufacturing processes, production and operation management and primary data from questionnaire interviews. It also required an observation of how production is currently handled by the case company. The data was analyzed using the inductive reasoning approach.

The results found that the case company faces similar problems that most small high tech companies face. Therefore, in order to improve the organisation of work and production, Elkome should recognise that there is a need for specialization and proper work division. Therefore, a production process plan has been formulated to reinforce improvement in the case company's production system. With this in effect the production process will flow as smoothly as possible and hence quality in production work will be enhanced as well.

Keywords Organisation, Production, Planning, Control, Operation management

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1 INTRODUCTION

The main essence of this study is to help Elkome installation overcome the challenges the company is facing in the organisation of work and production in one of their installation units by improving the information flow, material handling processes, human resource planning and work planning of their production systems.

According to McMillan (2000) if an organisation is to encourage and support self-organisation and self-organising project teams, then it needs to provide the right kind of environment underpinned by supportive organisational ethos and set values. Therefore, this thesis will articulate a deeper understanding of how to arrange work and production in a small high tech company. It will also give an overview of how to formulate an elaborate workable organisational structure that will best suit the kind of production the case company is involved in. It is evident that many small manufacturing companies have been pushed to adopt more effective and efficient production strategies to meet the challenges of the short life cycles of high tech products. With the rapid growth of the service sector within the high tech society, the most rapid growth has occurred in manufacturing and production industries, including high tech and related services. Therefore the theoretical framework of this thesis is based on production planning, operation management and organisation theory with emphasis on small companies operating in the high tech industry. In order for Elkome's installation unit to be effective and successful there is a need to find a solution for the production handling processes and work flow of information including suitable software. It is important that the organisation structure and the production management process is flexible to cater for all kinds of projects as need arise. This will be of benefit especially now that it is looking into innovative ways to improve and grow the business. Importantly, it is crucial that the way work is organised is subjected to a systematic study, in order for the correct or suitable process for this company to be established.

1.1 Company Background

Elkome is a versatile measuring and testing Systems Company which is a specialized computer expert. This high technology company was established in 1986. Apart from measuring and testing Elkome's products, other services include manufacturing customized systems, production lines, electrification and automation of the manufacturing centers. It also offers electrical installation services in various industries, which cover the bus and probing solutions, installation and programming of motor drives i.e. electrical and logic centre installations and connections. Since 1986 Elkome has implemented hundreds of systems to suit the needs of the main industries around Finland and all over the world. It is the leading producer of electrification cabinets for so many companies. Elkome is divided into three operational organisations and these are, Elkome Group Oy, Elkome Installations Oy and Elkome Systems Oy. The main interest in this research is Elkome in-

stallations which is under the Elkome group umbrella. The figure below illustrates the operation structure in practice.

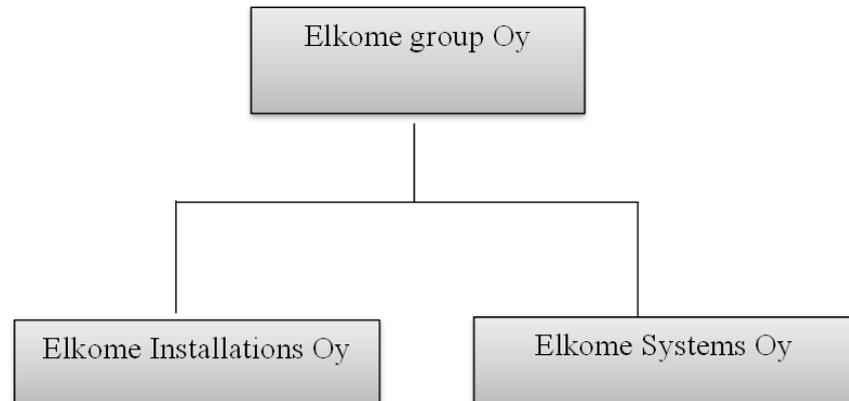


Figure 1 Elkome group operation structure.

Elkome installations has two operational units: One is located in Hyvinkää which is the main headquarters and the other is a branch office in Kauhajoki. It has 28 full time employees and the rest are sub-contracted. It provides global manufacturers of machinery and equipment with expertise which covers among other things: the centres of automation in various industrial applications; Mechanical design of the operations as part of special centres and Cabinets; instrument cabinets with application data collection devices with galvanic separators; and lastly specialty electrical connector Server and PC cabinets.

1.2 Definition Of Keywords

In order to fulfill the main purpose of this research the following definitions of the keywords below will be used interchangeably to enable easy understanding of the case study.

1. Arranging/Organise:

Organising in a general sense means systematic arrangement of activities i.e. to plan or put in a specific order. According to Jones (2004) “organisation is the process of identifying and grouping work to be performed defining and delegating responsibility and authority and establishing relationship for the purpose of enabling people to work most effectively together in accomplishing objectives”. Organising as a process of management essentially relates to sub-dividing and grouping of activities.

2. Production:

Kumar (2008) defines Production as “the step-by-step conversion of one form of material into another form through chemical or mechanical process to create or enhance the utility of the product to the user.” Thus production is a value addition process. At each stage of processing, there will be value addition. The business dictionary further describes Production as the processes and methods employed to transform tangible inputs (raw materials, semi-finished goods, or subassemblies) and intangible inputs (ideas, information, knowledge) into goods or services.

3. High technology:

The National Science Foundation (1998) asserts that there is no single definition for high technology industries. High technology industries have a great dependence on science and technology innovation that leads to new or improved products and services i.e. Today's cutting edge technology may be outdated tomorrow. The Merriam Webster dictionary however, defines high tech as a style of interior design featuring industrial products, materials, or design. Furthermore, it is a scientific technology involving the production or use of advanced or sophisticated devices especially in the fields of electronics and computer.

1.3 Research Problem And Objectives

The main objective of this research is to find a solution on how Elkome installations can organise work and production in their installation department. To identify the core competences of the company and to see how best that can be used to the company's advantage. Therefore the following goals have been outlined below in order to find a solution to Elkome's main problem:

1. To find a solution on how to arrange work and production in a small high tech company and also formulate an organisation structure that best fits it.
2. To compare the existing work arrangement with the anticipated solutions on the basis of efficiency and cost effectiveness.

In a nutshell, this research endeavours to identify both weaknesses and strengths in the way work is arranged. Why weaknesses: Because only then can they remedy what is wrong and strengthen the work process and vice versa for the strengths. i.e. to add on these corrective findings to the already existing work processes that the company has. Lastly to formulate steps for Elkome that will lead to a successful production unit and thus identify a suitable work process that will bring about satisfactory achievements in the company.

1.4 Limitations Of Study

The purpose of this thesis is to find a way to arrange work and production on the operational and organizational performance of Elkome installations. Based on this purpose, the main focus is mainly to help Elkome installations improve the information flow, material handling processes, human resource planning and work planning of their production systems. Therefore, for data collection, the research was limited to only interviewing the employees who are involved in the actual production process. Other data for this thesis was from books, academic journals, and the internet. However, since the research subject is wide, the research was limited to a single approach which is production and operation management. Without going into detail but only focusing on the factors that are relevant to the study which are production handling systems and production planning and control. Language barrier was another major limiting factor since the case company is a Finnish company, in which almost all of its employees are Finnish with minimal English skills except for the Managerial staff. This mostly had a bearing when carrying out interviews, translation help was needed for accurate results to be obtained. Another limiting factor was time, due to the demanding schedules of the company representative in charge of the thesis; it was rather difficult to follow the planned thesis schedule. The most challenging of all was obtaining accurate data, since all of the company's information was in Finnish and as such there was need to translate this information in the correct form.

2 AN OVERVIEW OF A SMALL HIGH TECH COMPANY

Bernasconi et.al (2006) asserts that high tech companies are one of the most important driving forces behind innovative change in the world. Therefore, in order for them to succeed in the business world, those people managing the companies need to understand the special management skills required. They generally have a substantial economic impact, stimulated both by large research and development. New product development and capital investment often go hand in hand; making high technology companies an attractive addition to local tax bases. In addition, innovation demands a trained and talented workforce. The National Science Foundation (1998) add that the demand can serve the entire business community by drawing talent to the high tech companies, as well as by calling upon the resources of other companies and entrepreneurs in the region and beyond. Companies grow up around the high tech enterprises and supply raw materials, components, specialized technical expertise in design, marketing, and knowledge management, skilled subcontractors, specialty packaging, distribution, and transportation. How the definition of high technology will be used usually determines which of the major approaches to take. The basic methods use either the percentage of scientific and technical employment in a particular industry compared to all industries or R&D cost as a percentage of total sales, a measure of research intensity. Using workforce measures occupational employment and the percentage of particular occupations within industries changes over time, reflecting changes in employment growth as well as busi-

ness structure. The National Science Foundation (1998) goes on to say that a commonly used approach to identifying high technology industries focuses on whether developing or applying new technological knowledge which plays an integral role in the competitive strategy of the company. Using this approach, a company would be classified as high tech if one of its primary assets was the possession of advanced technological knowledge used to develop new products or processes. Therefore, there are a number of ways in which the production process can be organised, in terms of the manner in which the tasks are handled. According to Muhlemann et.al (1992), the main methods of production handling processes are job, batch, flow and group. He goes on to clarify that it is important to recognise that these approaches to organising the production process are not necessarily associated with any particular volume of tasks. This means that any organisation has to be careful when considering which method to use in their work organisation and Muhlemann .et. al (1992,p199) asserts that frequently, the decision reached depends on the development of the company concerned. Many organisations start on a job basis then proceed, as volume increases, to a batch method. It is rare to find any unit or company that only has one approach of organising work and production. There are several organisation and manufacturing systems that are used to arrange work in a company. For example in a manufacturing company there would be the decision maker who is the overseer of the whole production process. The figure below shows an illustration of a typical production process.

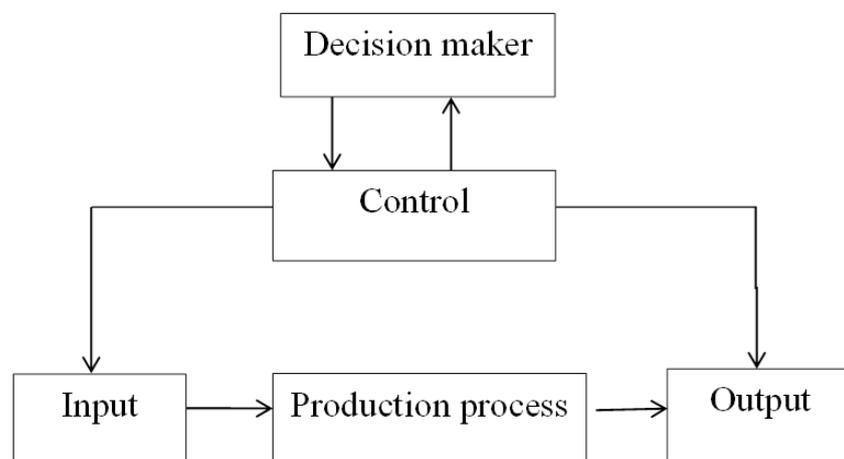


Figure 2 Production process structure. (Kumar 2008)

From the above schematic, it is very important for an organisation to look into production selection system in which the schedule structuring of any production operation is specified. There has to be a suitable system to follow for every production process. According to the MBA article knowledge base, (2012) “A production system may be looked upon as an independent group of sub-systems, each sub-system per-

forming a specific function. Different sub-systems may perform different functions, yet they are inter-related and require to be unified to achieve overall objectives of the organisation. Production systems need to interact with both internal and external environment. The internal environment is the combination of engineering, marketing personnel and accounts activities whereas external environment comprises of customers, competitors, suppliers, labour unions etc. The selection of the production system is a strategic decision for most organisations since changes at a later date are very expensive to make. The systems selected should be such that it can give the desired output, required quality and is cost-effective”.

3 THEORETICAL FRAMEWORK

In this chapter, the theoretical framework relevant to the study purpose and re-search questions will be presented. The chapter begins with an overview of a small high tech company which will lead to the Literature review; followed by the evolution of an organisational structure of a small high tech company and elaborating production handling processes.

3.1 Production Handling Processes

There are several types of Production manufacturing systems from which an organisation can choose to use in their production processes. According to Dilworth (1989), there is no single pattern of production system which is universally applicable to all types of production systems. He adds that they vary from one company to another. A production system is the framework within which the production activities of a company take place. Furthermore, a manufacturing production process is the conversion process through which inputs are converted into outputs. An appropriate design of a production system ensures the co-ordination of various production operations. These systems may include:

- Continuous production
- Job or unit production
- Intermittent production

However, the useful ones which might be suitable for a small high tech company would be the intermittent/batch production system and the job production system. (MBA article knowledge base, 2012)

3.1.1 The intermittent production system

According to Dilworth (1989), in this type of system goods are manufactured specifically to fulfill customers’ orders and also some for stock. For example, components are made for inventory but they are combined differently for different customers. Automobile plants, printing presses, and electrical goods plants are examples of this type

of manufacturing. Charantimath (2006 p.363) also asserts that the flow of material in intermittent production systems is a situation where the production facilities are flexible enough to handle a wide variety of products and sizes. These can be used to manufacture products whose basic nature of inputs changes with the change in the design of the product and the production process requires continuous adjustments. Hence, considerable storage between operations is required, so that individual operations can be carried out independently for further utilization of men and machines. Examples of intermittent system are: machine shops, manufacturing companies, hospitals, general office etc. (MBA article knowledge base, 2012)

Characteristics of intermittent system

- Most products are produced in small quantities.
- Machines and equipment are laid out by process.
- Workloads are generally unbalanced.
- Highly skilled operators are required for efficient use of machines and equipment.
- In-process inventory is large.
- Flexible to suit production varieties.

3.1.2 Job production system

The MBA article knowledge base (2012) points out that a job production system is characterized by the manufacture of one or a few numbers of a single product designed and manufactured strictly to a customer's specifications, within, the given period and within the price fixed according to the contract. Some typical examples of industries engaged in jobbing production are: general repair shops, special purpose machine tool manufacturers, workshops and fixtures for other units, building contractors, tailoring shops, manufacturers of ships, cranes, furnaces, turbo-generators, pressure vessels; and others manufacturing articles made to customers' orders. According to the MBA article knowledge base (2012) the characteristics of job production include;

- Disproportionate manufacturing cycle time: A considerable amount of pre-planning and organization is necessary in such a venture. Relatively long delays occur at the assembly as well as at the materials processing stages due to lack of materials or components, imbalanced work flow, design changes, design errors detected during manufacture, inaccurate work measurements, etc. which tend to lengthen the manufacturing cycle time. At times, the time needed to design the product exceeds its manufacturing time.
- Large work-in-progress: The work-in-progress inventory in a jobbing production is generally very large as detailed scheduling and progress control in this type of production is economically infeasible. For various reasons, jobs get delayed causing temporary work shortages. To overcome work shortages and keep men and ma-

chines busy, more work is released to the shops which in turn increase work-in-progress.

- Limited functions of production planning and control: The success of jobbing production mainly depends on the ability of the engineer in charge of the contract.
- Materials are indented and purchased on receipt of orders unlike in batch or mass production where material requirements are planned well in advance.
- Process planning activity is almost absent. Drawings and specifications are directly given to the supervisor who is expected to decide on work methods, select optimum process, fix up machine tools to be used and estimate time required completing an operation.(MBA article knowledge base ,2012)

Advantages and disadvantages of job production

The advantage of job production is that each item can be altered for the specific customer and this provides genuine marketing benefits. A business is likely to be able to ‘add value’ to the products and possibly create a unique selling point, both of which should enable it to sell at higher prices. However there are disadvantages to job production, depending on whether it is based on low or high technology, as it can be an expensive process as it is labour intensive (uses more workers compared to machines). This raises costs to firms as the payment of wages and salaries is more expensive than the costs of running machines. Apart from the stated advantages and disadvantages, the job type of production also has its own limitations. The following are the limitations of job production:

- Higher cost due to frequent set up changes.
- Higher level of inventory at all levels and hence higher inventory cost.
- Production planning is complicated.
- Larger space requirements. Kumar (2008)

Examples of job production systems

According to Muhlemann et.al (1992 p.119) a job production is a “one off” project or “make complete” these are descriptions given to the organisation whereby the complete task is handled by a single worker or group of workers. These jobs could be low technology or high technology jobs. It involves firms producing items that meet the specific requirements of the customer. Often these are one-off, unique items such as those made by an architect or a wedding dressmaker. For an architect, each building or structure that he designs will be different and tailored to the needs of each individual client. With job production, a single worker or group of workers handles the complete task. Jobs can be on a small-scale involving little or no technology. With low technology jobs, production is simple and it is relatively easy to get hold of the skills and equipment required. Good examples of the job method include: hairdressers, tailoring, painting and decorating, plumbing and heating repairs in the home. High technology

jobs are much more complex and difficult. These jobs need to be very well project-managed and require highly qualified and skilled workers. Examples of high technology / complex jobs include:

- Film production
- Large construction projects
- Installing new transport systems
- Installation of electrification cabinets
- Installation and programming of motor drives

3.2 Organisation Of Manufacturing Operations

It is probably fair to say that in most manufacturing production companies, more attention is likely to be paid to the organisation of the production system, than to the equivalent system in the service environment. Muhlemann (1992) points out the factors that influence the choice of organisation and these include the required skill level of the workforce and also dependency on specific equipment. He adds that, the customer can add a large element of uncertainty in specifying and changing requirements which can have an impact on the possibilities available in terms of organising work. Generally the customer is not present during the manufacturing operations even when 'job' methods are being used with high level of customization. Daft (2009, p225) asserts that, the system is more manageable and easier to plan once the specifications have been agreed. The methods of organising work and production can be more readily identified within a manufacturing environment, with the movement from job through batch to flow frequently being associated with the stages in the production cycle. Muhlemann (1992) also adds that the stated methods of organising production can be used in any particular environment. However, the appropriate method depends on a number of considerations, including some of the characteristics of the environment itself.

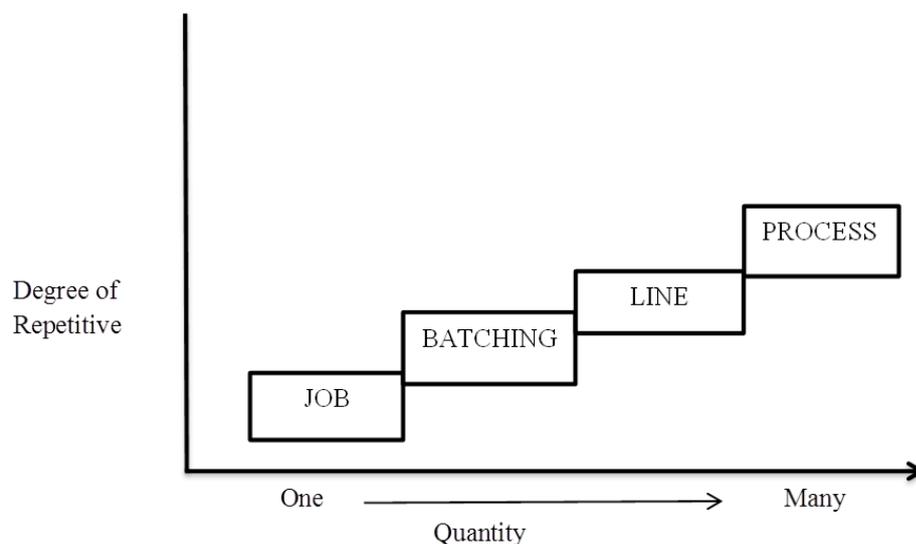


Figure 3 Types of Production (Kurma 2008)

According to Jones (2004) organisational structures and processes are influenced by the knowledge and tasks to be performed in the organisation as well as by its wider environment. Optimistic theories on information society support the idea of a non-hierarchical, flexible network form of organisation based on enabling technology and creative intelligence. Furthermore, Kumar (2008) adds that planned production is an important feature of small industry. Whether it is a service, high tech or manufacturing industry, production planning in the work organization is very important. The small entrepreneur should possess the ability to look ahead, organize, coordinate and have plenty of driving force and capacity to lead and ability to supervise and coordinate work. This helps to simulate its associates by means of a programme of human relation and organization of employees.

3.3 Production Planning

Kumar (2008) defines production planning as the technique of foreseeing every step in a long series of separate operations, each step to be taken at the right time and in the right place and each operation to be performed in maximum efficiency. It helps an entrepreneur to work out the quantity of material, manpower, machine and money required for producing a predetermined level of output in a given period of time. Production planning and control is needed to achieve:

- Effective utilization of firms' resources.
- To achieve the production objectives with respect to quality, quantity, cost and timeliness of delivery.
- To obtain the uninterrupted production flow in order to meet customers varied demand with respect to quality and committed delivery schedule. To help the company to supply good quality products to the customer on the continuous basis at competitive rates. According to Kumar (2008) there are certain steps to follow in the production planning process and these include: Routing, loading and scheduling.

3.3.1 Routing

This process ensures that the operations, process path and sequences are established. To perform these operations, the proper class of machines and personnel required are also worked out. The main aim of routing is to determine the best and cheapest production planning and control sequence of operations and to ensure that this sequence is strictly followed. In small enterprises, this job is usually done by the entrepreneur in a rather ad hoc manner. The routing procedure involves the following different activities:

- Analysis of the article to determine what to make and what to buy.
- Determination of the quality and type of material

- Determination of the manufacturing operations and their sequence.
- Determination of lot sizes
- Determination of scrap factors
- Analysis of cost of the article
- Organization of production control forms.

3.3.2 Scheduling

Scheduling is the allocating of time that is required to perform each operation and also the time necessary to perform the entire series as routed, making allowances for all factors concerned. It mainly concerns the time element and priorities of a job. Kumar (2008) asserts that the pattern of scheduling differs from one job to another. In the production schedule, the main aim is to schedule the amount of work which can easily be handled by plant and equipment without interference. It is not an independent decision as it takes into account the following factors:

- Physical plant facilities required to process the material being scheduled.
- Personnel who possess the desired skills and experience to operate the equipment and perform the type of work involved.
- Necessary materials and purchased parts.

Another factor to consider is master scheduling; this usually starts with the preparation of a master schedule which is a weekly or a monthly break-down of the production requirement for each product. It also describes a definite time or period of total production requirements and as such the entrepreneur is in a better position to shift the production from one product to another. This forms a base for all subsequent scheduling activities. A master schedule is followed by an operator schedule which fixes the total time required to do a piece of work with a given machine or which shows the time required to do each detailed operation of a given job with a given machine or process. Kumar (2008) further adds that another important step of scheduling is the manufacturing schedule. This is prepared on the basis of the type of manufacturing process involved. It is very useful where a single or a few products are manufactured repeatedly at regular intervals. Thus it shows the required quality of each product and sequence in which the same is to be operated. With this type of scheduling, comes the scheduling of Job order manufacturing and this acquires greater importance in job order manufacturing. This will enable the speedy execution of the job at each center point. As far as small scale industries are concerned, scheduling is very important as it brings out efficiency in the operations and reduces production costs. Therefore, the small entrepreneur should maintain four types of schedules to have a close scrutiny on the whole production process. These may include; enquiry schedule, a production schedule, a shop schedule and an arrears schedule. However, out of the above four, a shop schedule is the most important because it is most suited to the needs of a small scale industry as it enables the foreman to see at a glance, the total load on any section of the operational sequences.

3.3.3 Loading

The next step is the execution of the schedule plan as per the route marked out. It includes the assignment of the work to the operators at their machines or work places. Therefore, loading determines by whom and where the work will be done as routing and scheduling determines. (Kumar lesson 8) adds that Gantt Charts are most commonly used in small industries in order to determine the existing load and also to foresee how fast a job can be done. The usefulness of their technique lies in the fact that they compare what has been done and what ought to be done. Most small scale enterprises fail due to non-adherence to delivery schedules. However, they can be successful if they have the ability to meet delivery order in time.

3.4 Production Control

According to Kumar (2008) production control is a process of planning production in advance of operations, establishing the exact route of each individual item part or assembly, setting, starting and finishing for each important item, assembly or the finishing production and releasing the necessary orders as well as initiating the necessary follow-up to have the smooth function of the enterprise. The production control is of a complicated nature in small industries. Sawik (1999) asserts that the production control department can function at its best in a small scale unit only when the work manager, the purchase manager, the personnel manager and the financial controller assist in planning production activities. The production controller directly reports to the works manager but in a small scale unit, all the three functions that is, material control, planning and control are often performed solely by the entrepreneur.

3.4.1 Dispatching

Dispatching involves the issues of production orders for starting the operations. Necessary authority and conformation is given for:

- Movement of materials to different workstations.
- Movement of tools and fixtures necessary for each operation.
- Beginning of work on each operation.
- Recording of time and costs involved in each operation.
- Movement of work from one operation to another in accordance with the route sheet.
- Inspecting or supervision of work

Dispatching is an important step because it translates production plans into production. (Kumar, 2008)

3.4.2 Expediting

The next step is expediting which is the control tool that keeps a close observation on the progress of the work. It is a logical step after dis-

patching which is also called 'follow-up'. It helps to coordinate extensively the execution of the production plan. Therefore, progressing functions can be divided into three parts, i.e., follow up of materials, follow up of work-in-process and follow up of assembly. The duties include:

- Identification of bottlenecks and delays and interruptions because of which the production schedule may be disrupted.
- To devise action plans (remedies) for correcting the errors.
- To see that the production rate is in line with schedule.

3.4.3 Inspection

Inspection is a major control tool. It is important in production control in such a way that it is used both for the execution of the current plans and its scope for future planning. Although the aspects of quality control are separate functions, inspection is very important because it forms the basis for knowing the limitations with respects to methods, processes, etc., which is very useful in the evaluation phase.

3.4.4 Evaluation

This stage neglected by many manufacturing companies, is very useful in the improvement of productive efficiency. This is a factor that is used in the analysis of all the other factors influencing the production planning and control. It helps to identify the weak spots and the corrective action with respect to pre-planning and planning. The success of this step depends on the communication, data and information gathering and analysis. (Kumar, 2008)

4 PRODUCTION PLANNING IN RELATION TO ERP SYSTEMS

The Aware business system (2012), defines enterprise resource planning (ERP) systems as integrating internal and external management information across the entire organization, embracing finance/accounting, manufacturing, sales and service, customer relationship management, etc. ERP systems automate this activity with an integrated software application. Their purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. The Aware business system (2012), asserts that the ERP system can be simplified as a means of holding most of the information that can be used in a business on a day to day basis. It enables the organisation to plan what has to be done, when it has to be done, and provides information on any issues that need to be addressed. It is added in that article that ERP systems encompass quoting and estimating, sales orders, product costing, production planning, shop floor documents, recording of production, advanced stock control, purchasing of materials used in manufacturing, purchasing of all other product including

spares. It may offer forecasting of demand, inventory planning, and a production planning board. All this is integrated with financials. The terms MRP and ERP mean Materials Requirements Planning and Enterprise Resource Planning respectively and refer to the fact that the systems offer, as a minimum, planning of materials based on your finished product requirements. ERP systems typically offer additional functions such as scheduling, advanced inventory planning, customer relationship management and supplier relationship management. The purpose of these functions is to enhance the flow of materials and information between suppliers, the business and customers. (Aware business system, 2012)

Benefits of implementing an ERP system in a small company

Hossein (2004) further adds that, many companies fail to realize the full benefit of ERP systems because they are not organised in such a way that they could benefit from the new information tools provided by the ERP systems. It is true that these benefits are all intangible but they have been achieved time and time again by companies both large and small. For any small company prepared to make the effort it will pay for itself many times over. According to the Encyclopedia of Business (2012) when the idea was first introduced, ERP was an attractive solution for many large companies because it offered so many potential uses. For example, the same system could be used to forecast demand for a product, order the necessary raw materials, establish production schedules, track inventory, allocate costs, and project key financial measures. According to Forger (2000) ERP acts as a planning backbone for a company's core business processes, he further adds that the system also ties together the varied processes using data from across the company. ERP is also able to share the data from these processes with other corporate software systems. Another important benefit of ERP systems is that it allows companies to replace a number of complex computer applications with a single, integrated system. This system may be categorized under data, inventory etc.

Data: One of the primary benefits is that information is available to everyone in the organisation who has the right to see it. The information is also up-to-date up to the last keystroke. Stock levels, or when items arrive into the stock, are instantly available. The status of production orders, and the current cost to manufacture, can be viewed and changed where authorised.

Inventory: Stock is only ordered when required and for the time it is needed. Stock levels are set to improve availability as well as keep the investment low. Emergency expediting is normally reduced by 50-80%. It also gives the company the ability to negotiate with suppliers to further lower material costs. It also provides the tools to manage consignment stock effectively. (Encyclopedia of Business, 2012)

Factors in a successful ERP implementation

Furthermore, it was noted in the Encyclopedia of Business (2012) that once a small business has decided to install an ERP system and selected a vendor, there are a number of steps the company can take to ensure a successful implementation. In his article, Forger (2000) noted that the ERP implementation is more likely to succeed if the company positions it as a strategic business issue and integrates it with a process redesign effort. Of course, the ERP system should fit the company's overall strategy and help it serve its customers. It may also be helpful to find a passionate leader for the project and select a dedicated, cross-functional project team. The small business owner should make certain that these individuals have the power to make decisions about the ERP implementation process. Forger (2000) recommends that companies attack the implementation project in short, focused stages, working backward from targeted deadlines to create a sense of urgency. It may be helpful to begin with the most basic systems and then expand to other functional areas. He also suggests using change management techniques to manage the human dimension of the project, since ERP requires a great deal of support from affected areas of the company. Finally, he emphasizes that once the ERP system is in place, companies need to interpret the data collected carefully and accurately if the system is to contribute to business planning. According to Morrison (2000) although ERP systems may seem complex and costly, even small businesses are increasingly finding it necessary to invest in such technology in order to remain competitive. ERP systems are being implemented today to provide a stable foundation for a growing number of businesses across all segments, from dot-coms to major automotive manufacturers. Morrison (2000) also wrote in CMA Management that the number of implementations down the supply chain and into small and medium-sized companies is steadily growing as the initial costs are reduced along with the overall cost of ownership.

4.1 Organizational Structure

Organizational structure is defined as the framework, typically hierarchical, within which an organization arranges its lines of authority and communications, and allocates rights and duties. Abramowicz (2009, p263) also defines organisational structure as a hierarchy of an organisation showing how its elements work together in order to achieve organisational goals. Therefore it determines the manner and extent to which roles, power, and responsibilities are delegated, controlled, and coordinated, and how information flows between levels of management. When setting up a new business unit it is important to pay careful attention to the design of the company's organizational structure. This can be decided upon according to the company's size, industry and aims. Jones (2004) characterized a company's organizational structure by the design of the structural and process organizations that mutually determine each other. It should be thought of as communication flowcharts. It is noted that poorly conceived organizational structures will result in inefficient communication in which managers at various levels are required to deliver information to too many people

for too many levels of approval. Therefore, in order to manage a complex social structure, as represented by companies with their many employees, it is necessary to subdivide these structures into manageable units. This helps to consider the association of basic task-sharing, functional, and organizational elements such as the job/project (Hatch, 2006). Therefore, it is possible to derive different structural types that express the ranking ratio with the formal information flow and communication flow within the organization and, also the development of organizational forms as a reaction to changing market conditions. These forms include line organization, functional organization, team organization, object-oriented models, and matrix organization. Well-designed organizational structures will produce efficient communication channels and encourage fast, clean decisions. Hatch (2006) further adds that, there are three main types of organizational structure: functional, divisional and matrix structure. Among the above mentioned types of organisation structures, functional organisation is the most commonly used by a lot of businesses. It is a top down flowchart with a high ranking executive at the top, with multiple middle managers such as human resources, marketing, accounting and engineering department heads all directly reporting to the top executive. These departments are managed separately from each other by the department heads, and they only answer to the top level manager. The strength of this system is that it is easy to understand, and keeps businesses neatly classified. However, if a weak or poorly organized executive is at the top, then cases where the right hand fails to talk to the left will occur, causing frustrating problems (Sun , 2011). It is typical that this occurs in high tech companies. It is rather difficult for them to have a proper organisation structure because of different types of organisation approach. The production management is not properly observed and manufacturers have no control over priorities. This has been the major weakness when it comes to high tech companies. The figure below shows a typical example of a functional organisation chart.

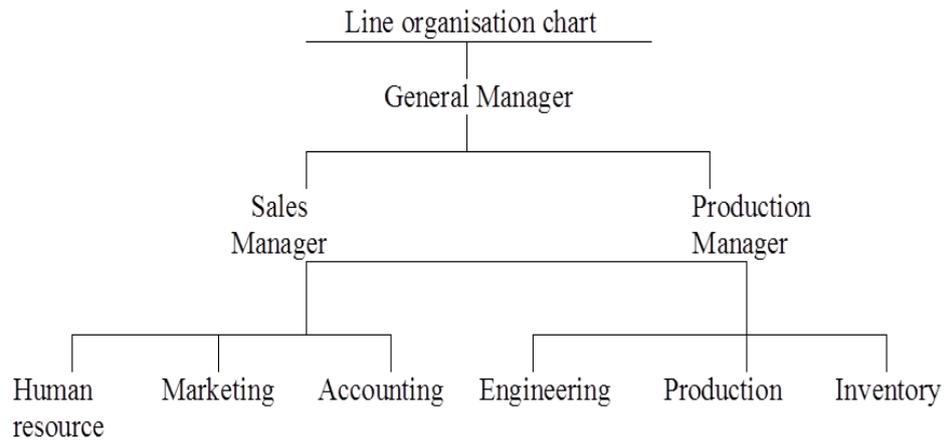


Figure 4 Organisation chart, (Jones 2004).

The figure above is a schematic figure of the functional type of organisational structure. The other two types mentioned are divisional and matrix. Divisional organisational structure is one that is used in larger companies that operate in a wide geographic area or that have separate smaller organizations within the umbrella group to cover different types of products or market areas. The matrix organisational structure on the other hand is a hybrid of divisional and functional structure. Typically used in large multinational companies, the matrix structure allows for the benefits of functional and divisional structures to exist in one organization. This can create power struggles because most areas of the company will have a dual management a functional manager and a product or divisional manager working at the same level and covering some of the same managerial territory (Writings 2012).

5 METHODOLOGY

In order to effectively answer the research problem “How to arrange work and production in a small high tech company”, it will require relying mostly on emerging literature on high technology manufacturing processes, production and operation management. It will also require an observation of how production is currently handled by the case company. This Chapter will discuss and motivate the methodological issues connected to this study. The procedure of the research and the technique approach will be provided. The study will undertake the inductive reasoning approach and the type of research to be conducted will be qualitative. This means that the research to a larger extent will make use of both secondary data from various books, journals and primary data from interviews. According to Saunders et.al (2003) research can be categorized into either a qualitative or quantitative approach. For qualitative research, information is gathered to gain a deep and thorough understanding, and to describe a holistic view Saunders et.al (2003). Qualitative research, broadly defined, means "any kind of research that produces findings not arrived at by means

of statistical procedures or other means of quantification" Strauss and Corbin, (1990, p. 17) and instead, the kind of research that produces findings arrived from real-world settings where the "phenomenon of interest unfold naturally" (Patton, 2002, p. 39). The research questions to be tackled in this study are as follows:

- What is a high tech industry and what kind of organisation structure best suits a high tech firm?
- What are the characteristics of a small high tech firm?
- What are the steps to follow when arranging work and production in a small high tech company?
- What are the factors to consider when arranging a small high tech company?

6 CASE COMPANY: ELKOME INSTALLATION

Elkome installation is under the Elkome group umbrella. It is a new company which is trying to find its niche business area. Elkome Installation manufactures electronic systems and its customers are global manufacturers of machinery and equipment manufacturers. Its products include; Switchgears for various industrial applications, control panels, PLC centers and motor centers, pulpit and enclosures, mechanical design of the operations centers and cabinets. With it being a small high tech company, it has experienced a rapid growth in a small period of time, for this reason, it is very tough and difficult to penetrate the competitive market in the standard cabinet business. Recently, the case company opened a new unit and it has been facing problems in coordinating the production processes of the organisation. The company is doing the same business as the old unit, but according to the company manager, there is a need to put in place proper guidelines on how to arrange work and production for both their units. This problem was noticed because the company is growing and it is attracting more customers with different demands other than the ones they are offering; as such before it could venture into supplying more customers. There is a need for proper guidelines to help and improve their way of arranging work in the production unit. There is also a need to help improve the information flow, material handling processes, human resource planning and work planning of their production systems.

6.1 The Case Company Working Principle

A questionnaire for interviews was carried out from the two units. Hyvinkää and Kauhajoki and the data obtained from those interviews is used to describe the current working principle of Elkome Installations. Hence, Elkome Installations jobs vary from one type of job to the other. The actual installation process depends on whether the job is small or big. When it is a big project, it might require two or three individuals to work on it. All projects are handled by the unit leader and the electrical designer who ensure that work schedules and work arrangements are in place, and also ensure that electricians have understood the work plans. It is also their responsibility to see to it that all

components are delivered on time and all the necessary information is available before planning for the works. At the moment Elkome Installation has acquired software which is being used for making quotations but it is not yet in use. Given that making quotations is time consuming, Elkome Installation is working in collaboration with Elkome Systems which handles all quotations, book-keeping and invoicing because it has the ERP system. The secretaries and salesmen in Elkome installations pile up all their orders documents and send it to Elkome systems for invoicing and quotations. Elkome organizes weekly meetings for all its employees and this method of communication has proven not to be effective. In addition, the company uses Excel sheets for scheduling its production processes. This is another contributing factor to the problem it is incurring. This hampers the work break down structure, feedback and dissemination of information. As for the practical side i.e. the actual production process, the unit leader/foreman receives orders from the customer, analyses the data and specifications, then makes orders for the needed materials and then sends a quotation to the customer. The next stage depends on whether the customer agrees to the terms and conditions. If agreed, then the unit leader appoints an electrician who is helped by any one he selects or anyone who is basically free to handle the project. After the project has begun, the second quotation is sent to the customer. If the customer is satisfied then the project continues as shown in the production process plan below. The electrician reports to the unit leader on the progress of the project and the unit leader gives feedback during the weekly meetings. The figure below shows Elkome's production process plan as per project. (i.e for a big project)

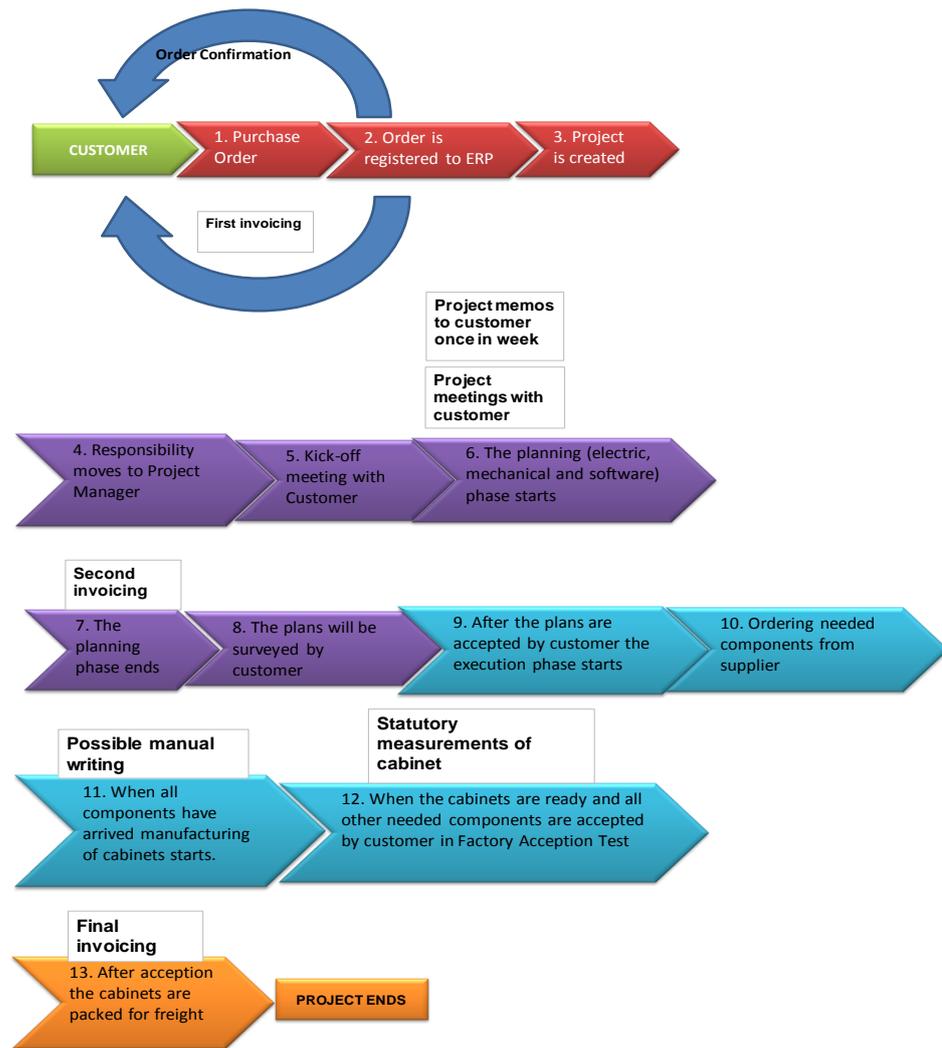


Figure 5 Elkome production process plan. (Elkome 2012)

Internal Environment

Each organisation has its own weakness and strengths and as such there are factors or situations that occur that affect the way a business operates, either in a positive or negative way. These situations or events are called driving forces or environmental factors. There are two kinds of driving forces: Internal driving forces, and external driving forces. Internal driving forces are situations, or events that occur inside the business, and are generally under the control of the company. According to the data obtained from the interviews, the internal environment of Elkome installation is as follows. Organisation of machinery and equipment is done by the unit supervisors and when looking at the technological capacity, the case company has made use of information technology for a long time, but the level of information technology capacity varies from one project to the other. Furthermore, it has managed to create a positive organisational culture which is the method used to achieve the company goals. i.e. collective attitudes, beliefs, common experiences, procedures, and values.

Inner capabilities

When looking at the internal environment of the company, it is important to talk about the inner capabilities of the company. This may include the aspect of core competence of the employees and their level of skills and of course ensuring the issue of quality. According to the employees, one of their major strengths of the case company is the fact that each individual is able to do almost everything and all kinds of projects that are handled in the company. Therefore, the job can be done faster and as such they are able to meet most of their deadlines. They also possess leadership qualities that help them to work together and take charge of their individual projects. They are also an innovative team which is eager to learn new things. On the other hand, in terms of responsibility and quality, employees are unable to meet these demands and this is the reason why the company would like to have a structured system to guide each employee on how to handle their work.

7 DATA ANALYSIS

The findings show that Elkome Installations' productivity has been affected by the lack of proper guidelines for production handling processes and as such this has been interfering with the production operation management of the company. The findings also show that there is a lack of a clear communication policy between the employees and management, to ensure that there is a smooth flow of information concerning a particular project. This has to do with everyone having the same information at the right time in readiness for the production process. The case company has its own flow plan process of handling work and production which guides them in the organisation of work. This process has been working for them but it has proven to be difficult in terms of handling certain projects because of the rise in the

technology sophistication in the global market. From the findings it can also be noted that the organisation structure in terms of arranging work and production processes is not laid out in a proper way and as such there is no proper follow up of protocol especially when it comes to individual responsibilities.

7.1 How To Arrange Work And Production In A Small High Tech Company

Kumar (2008) points out that production and operations management is the process, which combines and transforms various resources used in the production/operations subsystem of the organization into value added product/services in a controlled manner. Therefore, production is a part of an organization, which is concerned with the transformation of a range of inputs into the required products and services having the required quality level. The most important things in the production strategy are the long term investments for the production which are the technological aspects and quality. Another factor to consider in the organisation of production is to look at how to organise workers' activities and production management. In the same way McMillan (2000) asserts that if an organisation is to encourage and support self-organisation and self-organising project teams, then it needs to provide the right kind of environment underpinned by supportive organisational ethos and set values. Therefore, the case company needs set values and guidelines on how to run the company.

The first step in developing a workable organisation strategy is to set up an organisation structure which will include the main activities of the company. That is, the specific levels of hierarchy which may include: Administration, Sales and marketing, Production, Product development and design. Figure 6 below shows the new simplified organisation structure for a small high tech company.

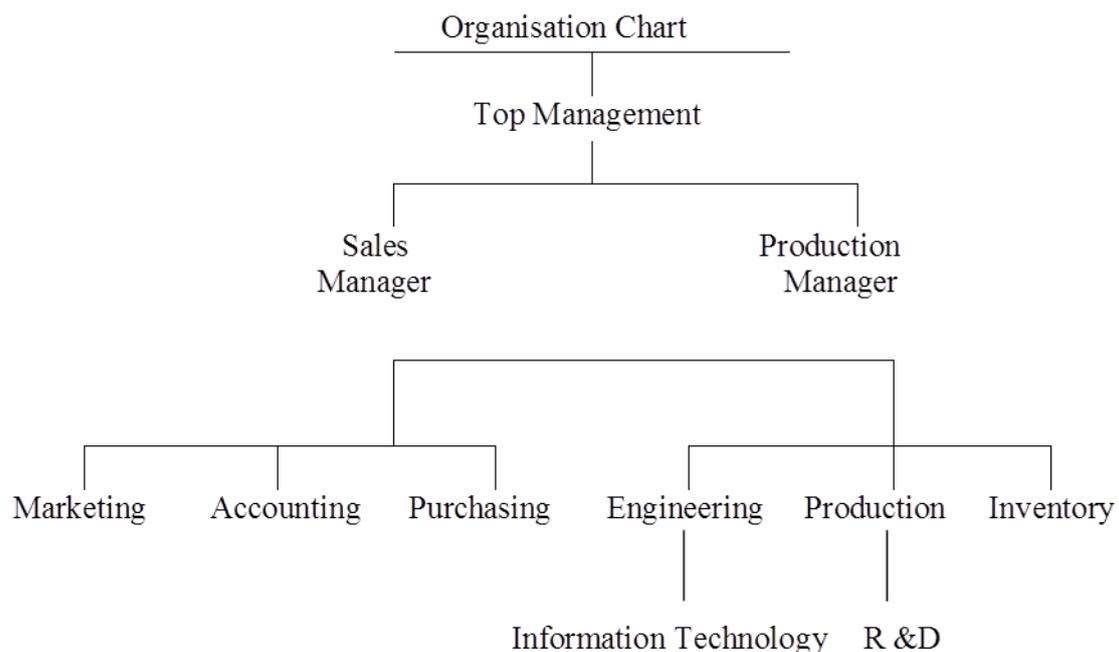


Figure 6 New simplified organisation chart.

Dale (1999) asserts that organizations are totally reliant on communication, which is defined as the exchange of ideas, messages, or information by speech, signals, or writing. Therefore, from the above chart it is important for the case company to note that when communication is thorough, accurate, and timely, the organization tends to be vibrant and effective. All available information, from the marketing team, engineering team e.t.c adds to various forms of teamwork which must be considered for achieving positive employee interests, participation and contribution in the improvement process. For example in production operations, management must share information and some of their powers and responsibilities. Figure.7 below explains further the flow of information in terms of up and down and across the organization. Another factor to note is the use of informal communication with individual managers because according to research, this form of communication has a great impact on ensuring that quality is maintained. It is direct, face-to-face, communication which employees most value.

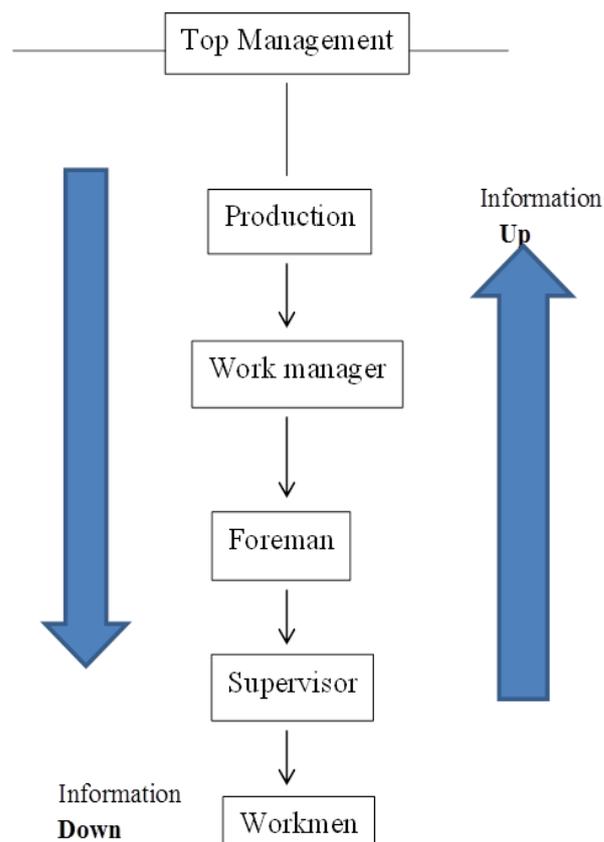


Figure 7 Production team organisation structure.

By adopting such an organisation structure for the production handling process, the case company will become effective in their production because such a structure brings about important factors like sim-

plicity: where the structure is easy to understand and follow by superiors and subordinates. It is simple and clear in regards to authority and accountability. It also brings about individual decision making (i.e., workers have the right to be innovative in the way they handle work), discipline and attracts skilled personnel which in turn brings out talented workers and develops in them the quality of leadership. This works well as a way to motivate employees because it offers opportunities of self-development to employees. In addition, it offers quick communication, high efficiency and flexibility in the way work and production is arranged.

Production Planning and control

It is evident from the findings that the case company is facing a big problem with the production processes used in the organisation. The principle of production planning and control lies in what is known as 'First Plan Your Work and then Work on Your Plan'. The main functions of production planning and control include planning, routing, scheduling, dispatching and follow-up. Please refer to the theory in Chapter 2.1 for detailed notes. There is the need for the case company to revise the way the work flow chart is planned.

The first step is in developing a new production process chart that will include new investments and other process phases needed; this will start by tabulating the type of production done at Elkome Installations. According to the product type, there are two basic types of products. Standard Products that are already made and are stocked and order-specific products were the customer makes a specific order for a particular product. Therefore, the case company is a type of company that deals in a job type of production. In this type of production, production is handled in such a way that products are made according to the customer's needs. With the make-to-order type of production, the case company needs to include the following phases in the production process during the planning phase, since planning is deciding in advance what to do, how to do it, when to do it and who is going to do it. This should include, material needed, labour needed, labour scheduling, inventory need and financing needed.

Then when it comes to the control phase, which is equally important when arranging work and production in any company, the main aim should be to give detailed information concerning the whole production process from beginning to end. The first step is routing which determines the best and cheapest production planning and control sequence of operations. This will elaborate the process to be used, the path each part will follow while being manufactured and how much time each process will take. Please refer to detailed notes in the theory chapter.

Secondly, scheduling is concerned with preparation of machine loads and fixation of starting and completion dates for each of the operations. The main objective for detailed scheduling is for the purpose of short lead time, constant loads and small inventories. As far as small scale industries are concerned, scheduling is of importance as it brings out efficiency in the operations and reduces cost price. If the case

company maintains four types of schedules to have close scrutiny on all the stages namely an enquiry schedule, a production schedule, a shop schedule and an arrears schedule will be able to be effective because this will enable a foreman to see at a glance the total load on any section. This includes the operational sequence and the stage at which any job has reached. The next step is loading which is the actual execution of the scheduled plan. It determines by whom and where the work will be done as routing and scheduling determines. Last but not least, comes dispatching and follow-up; dispatching is a transition from planning phase to action phase. This is where the workers are ordered to start the production process and there are a number of documented pieces of information that are required. This is a very important factor for the case company to adopt in its production handling process because it will enable a smooth flow of information between management, employees and customers. The documentation information will provide important information like, the basic product information, materials, operation sequence with time and also work order number, customer order, quantity and delivery dates. This will bring about efficiency and all the employees will have access to the same information at the right time. Finally, the follow up stage will enable the company to follow through with inspections and evaluations and as for Elkome, it is the testing phase. Figure 8. below shows the new and revised version or the production planning process chart showing the planning stages of the whole production process because it is the most important factor in arranging work and production in any organisation and business. Therefore, for the old one refer to Figure.5 and then the figure below is a new and more appropriate modified production planning process chart which if adopted will help the case company improve their production work process. Thereafter, more detailed diagrams are given below to help break down the production process plan.

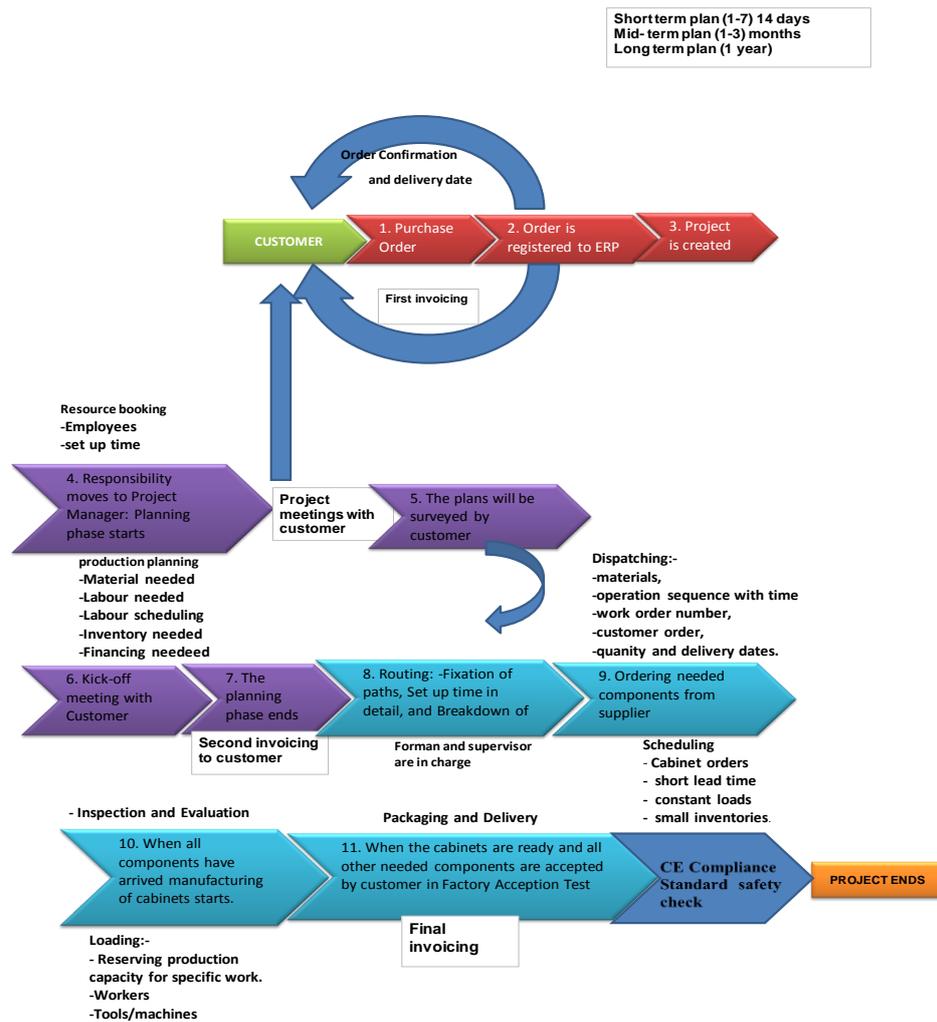


Figure 8 New and revised production planning process chart.

The figure below is a summary of the production planning process chart showing only the details on the planning stage and how the control phase and the action phase are interdependent on each other.

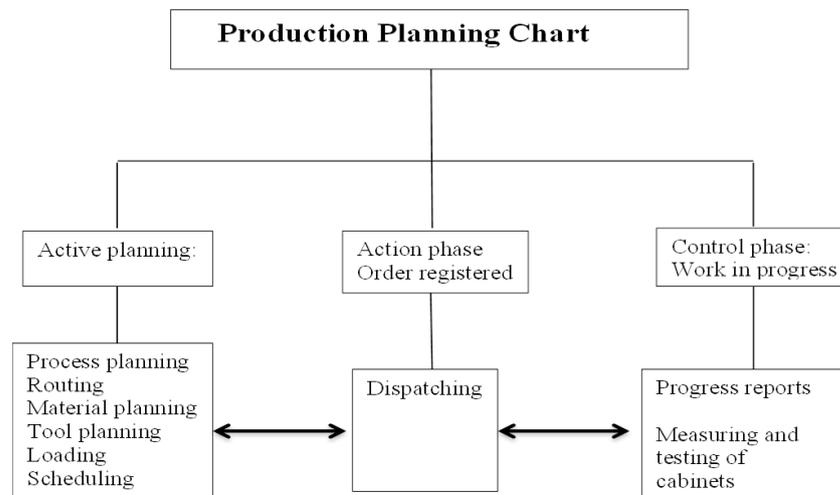


Figure 9 detailed revised production planning chart.

The figure above is the new and revised production process chart/plan that will help the case company remain on track with the production that goes on in the company. This flow plan gives immediate visual information on how to work through the production process. The action phase in which the customer is the main focus, is the point where the case company will be able to know what type of project and the way to go about delivering the finished product. Then the process will go on to the next stages which are active planning and control phase. As it is shown in Figure 9, active planning occurs at every level of production planning and control and as such that is why dispatching and progress reporting are dependent on the process planning of the whole production process. This could be a standard approach to any operation or any project and it is subject to change depending on the innovation processes in the company. In addition, this will help the case company to focus on the customers' needs because every development step is related to the customers' voice. Therefore, Since the case company is a high tech organisation, it has more concern on the dynamic changes in the global market in terms of new innovative technology that is being adopted by other competitors and hence the concern for the for the case company is to improve on the arrangement of work and production so that it is able to respond to the market demand. The main idea is to develop a stable and standard production process which will help to bring efficiency in the production work process and increase profits. Furthermore, the case company can divide the work plan process in two ways. The Figure below shows a detailed addition to the production plan from the action phase and dispatching shown in Figure 8.

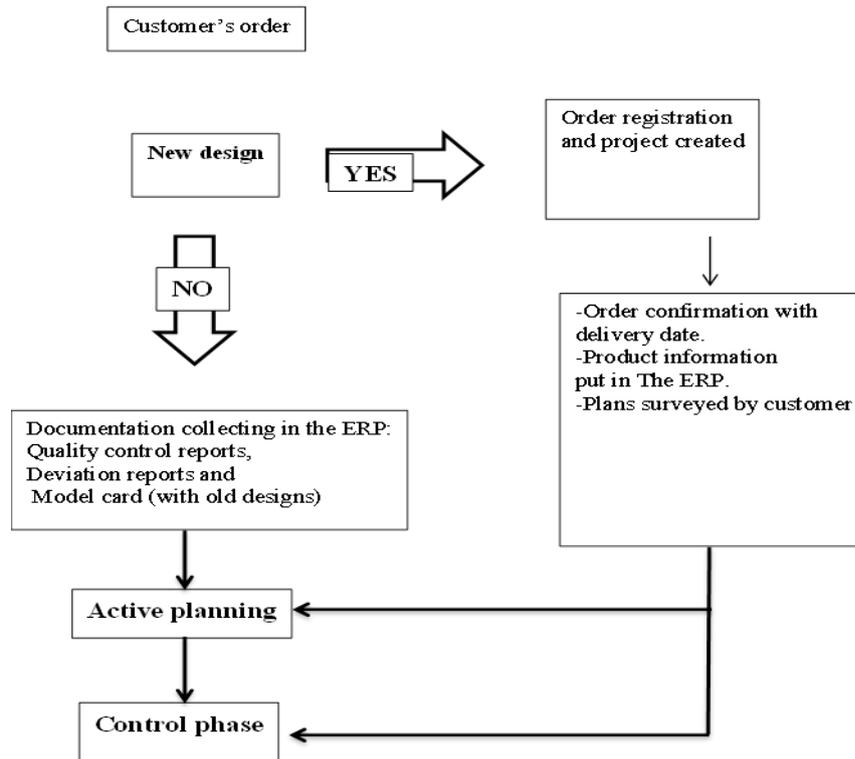


Figure 10 detailed part of the action phase production plan.

Figure 10 shows the new and improved production planning process which will help the case company to be able to meet all customer demands. That is, whether the project is new or something that they have done before. This part of the flow plan is divided into two separate parts and the part where they have to deal with a new design/product, will be handled by the production manager who will create the project. Then the other part will follow the standard procedure as shown in Figure 7 and Appendix 1. This part of the plan will be handled by the project manager and will be updated once a year by the production manager. It is also evident from the findings that the case company has the same problem that most high tech companies face. It was mentioned that the major inner capabilities of the case company, which is also their strength is that each individual is able to do almost everything and all kinds of projects that are handled in the company. The company recognizes this as strength but in all actual sense it is a huge weakness. Refer to Chapter 2.1 in the theory which for reasons why small high tech companies fail because of a lack of assigned roles. This is because they take on too much and a lack a definite structure. The famous saying Jack of all trades and yet masters of none is what is happening here. There is the need for specialisation and this will yield results and it will also enhance quality and productivity.

8 CONCLUSION

The aim for this thesis was to find a solution to how Elkome installations Oy can organise its production processes in order to meet its desired market demands. Although there are so many ways to arrange work and production in small high tech companies there must be a standard way that is effective and provides the right kind of environment underpinned by supportive organisational ethics and set values of the company. The production process structure that the case company has been using is one way of arranging work and production in a company. It has proven not to be very effective and, as such, the key factor for Elkome Installations to overcome the challenges it is facing in the organisation of work and production is centered on the improvement and implementation of the production planning and control process plan articulated in the research findings. Therefore, it is important that there is top management involvement in making strategic choices when it comes to the exploitation of best skills amongst the employees. This will help the company to have skilled man power with knowledge on production handling processes. In addition, an elaborate workable organisational structure has been formulated to suit the type of production. The results found that the case company faces similar problems that most small high tech companies face. According to research most small high tech companies experience failure because of a lack of a proper organisation structure and they also lack experienced labour i.e. professional skill. On top of this it has also been found that small high tech companies become myopic forgetting that the environment they operate in has a lot of un-certainty. Therefore it calls for a company like Elkome to be on their toes, constantly re-inventing themselves and applying the best methods possible in the way they arrange work. Therefore, in order to improve the organisation of work and production, Elkome should recognise that there is a need for specialization and proper work division. With this in effect the production process will flow as smooth as possible and hence forth quality will be enhanced as well.

With this conclusion I would recommend that it would be a good idea for the case company to make both specific standards and other standard cabinets for various customers for them to widen their market segmentation. It is a high tech company and as such there is room to be more innovative even in the way work and production is handled. Furthermore, for better results and improvements the case company can begin with the most basic systems and then expand to other functional areas. If it installs its own ERP system instead of relying on Elkome systems to do their invoices and quotations, it will be cheaper and easier to organise work and production in the company because there is a need to change management techniques to manage the human dimensions of the project. Since ERP requires a great deal of support from the affected areas of the company, it will therefore contribute to the production planning process. Furthermore, the company could still be using the excel sheet as they have been but now it has to be used by all the employees for their daily accountability/reporting of work progress. This will ensure a higher level of control on quality in-

specifications and also allow the project manager to keep track of the work progress on individual projects.

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ELKOME INSTALLATIONS PRODUCTS



Big cabinet



Components



Small cabinet



QUESTIONNAIRE

Appendix 2

Name of company: Elkome Installations

Name of Respondent:

Gender:

Position:

Brief Company Profile of Respondent (i.e. company facts)

1. Briefly describe your business
2. How do you organise work for your production process
3. How do you prepare the production line?
4. How is the actual installation process done?
5. Who is in-charge of the production schedules?
6. Who handles the paper work when it comes to orders, production time and deliveries?
7. What type of machines and tools do you use in your production line?
8. Do you use automated or manual machines?
9. How often do you service the machines and if any part of the tools or machine is damaged during the production process. How long does it take to change the tools?
10. What type of testing machines do you use?
11. What software do you use for the production process?
12. Are you required to change the data every time there is a new project?
13. How many products do you make in a day/month/year?
14. How long does it take make one standard cabinet?
15. How much does it cost?
16. How long is your daily schedule at work?
17. Do you service the cabinets when a customer has requested and how long does it take to do the work?
18. What strategies do you use to ensure that the production process is done effectively and efficiently?
19. What measure have you put in place to ensure that your production is cost-effective?
20. What are your potential strengths and weakness in your production?
21. What skills do you have that help you to achieve your work goals