Features of location strategy planning

The location of a plant or facility is the geographical positioning of an operation relative to the input resources and other operations or customers with which it interacts. Andrew Greasly (2003) identified three main reasons why a location decision is required. The first reason is that a new company has been created and needs a facility to manufacture products or deliver a service to its customers. The second reason is that there is a decision to relocate an existing business due to a number of factors such as the need for larger premises or to be closer to a particular customer base. The third reason is relocate into new premises in order to be able to expand operations.

Decisions with regards to where an organisation can locate its plant or facility are not taken often, however they still tend to be very important for the firm's profitability and long-term survival. An organisation which chooses an inappropriate location for its premises could suffer from a number of factors, and would find it difficult and expensive to relocate. Location decisions tend to be taken more often for service operations than manufacturing facilities. Facilities for service related businesses are usually smaller in size, less costly, and are located in a location that is convenient and easily accessible to customers (Russell and Taylor, 2003). When deciding where to located a manufacturing facility different reasons apply, such as the cost of constructing a plant or factory. Although the most imporant factor for a service related business is access to customers, a set of different criteria is important for a manufacturing facility (Russell and Taylor, 2003). These include the nature of the labor force, proximity to suppliers and other markets, distribution and transportation costs, the availability of energy and its cost, community infrastructure, government regualtions and taxes, amongst others (Russell and Taylor, 2003).

Location Strategy

The facilities location problem is one of major importance in all types of business. It is important to notice the different problems that may arise whilst trying to choose a suitable location; which is the general area, and site; which is the place chosen within the location. Normally, the decision on siting proceeds in two stages: in the first, the general area is chosen; and then a detailed survey of that area is carried out to find suitable sites where the plant or facility could be located (Oakland and Lockyer, 1992). However, the final decision as to where to locate a facility is made by taking into consideration more detailed requirements. The following are a number of factors which might influence the choice of location (Oakland and Lockyer, 1992).

Proximity to market: organisations may wish to locate their facility close to their market, to be able to lower transportation costs, and most importantly, to be able to provide their customers with a better service. If the plant or facility is located close to the customer, the organisation would be in a better position to provide just-in-time delivery, to respond to fluctuations in demand and to react to field or service problems.

Availability of labour and skills: a number of geographical areas have traditional skills but it very rare that an organisation would be able to find a location which has the appropriate skilled and unskilled labour, both readily available and in the desired proportions and quantities. Even so, new skills can be tought, processes simplified and key personnel moved from one area to another.

Availability of amenities: organisations would prefer to locate their facilities in a location which provides good external amenities such as housing, shops, community services and communication systems.

Availability of inputs: a location which is near main suppliers will help to reduce cost and allow staff to meet suppliers easily to discuss quality, technical or delivery problems, amongst others. It is also important that certain supplies which are expensive or difficult to procure by transport should be readily available in the locality.

Availability of services: there are six main services which need to be considered whilst a location is being chosen namely; gas and electricity, water, drainage, disposal of waste and communications. An assessment must be made of the requirements for these, and a location which provides most or all of these services will be more attractive than another which does not.

Room for expansion: organisations should leave room for expansion within the chosen location unless long term forecast convey very accurately that the plant will never have to be altered or expanded. This is often not the case and thus adequate room for expansion should be allowed.

Safety requirements: certain production and manufacturing units may present potential hazards to the surrounding neighbourhood. For example certain plants such as nuclear power stations and chemical factories should be located in remote areas.

Site cost: the cost of the site is a very important factor, however it is necessary to prevent immediate benefit from jeopardising the long-term plans of an organisation.

Political, cultural and economic situation: it is also important to consider the political situation of potential locations. Even if other considerations demand a particular site, knowledge of the political, cultural and economic difficulties can assist in taking a number of decisions.

Special grants, regional taxes and import/export barriers: it is often advantegous for an organisation to build its plant or facility in a location where the government and local authorities often offer special grants, low-interest loans, low rental or taxes and other inducements.

Location Selection Techniques

The location selection process involves the identification of a suitable region/country, the indentification of an appropriate area within that region and finally comparing and selecting a site from that area which is suitable for an organisation. The following are a number of analytical techniques from the several that have been developed to assist firms in location analysis.

Weighted Score

The weithed scoring technique tries to take a range of considerations into account, including cost. This technique, which is also referred to as ‘ factor rating’ or ‘ point rating’, consists of determining a list of factors that are relevant to the location decision. Each factor is then given a weighting that conveys its relative importance compared with the other factors. Each location is then scored on each factor and this score is multiplied by the factor value. The alternative with the highest score is then chosen.

Locational Break-Even Analysis

This technique makes use of cost-volume analysis to make an economic comparison of location alternatives. An organisation would have to identify the fixed and variable costs and graphing them for each location, thus determining which one provides the lowest cost. Locational break-even analysis may be carried out mathematically or graphically. The procedure for graphical cost-volume analysis is as follows:

Determine the fixed and variable costs for each location.

Plot the total cost (i. e. the fixed + the variable) lines for the location alternatives on the graph.

Choose the location with the lowest total cost line at the expected production volume level.

Plant Layout

According to Andrew Greasly (2007), the layout of a plant or facility is concerned with the physical placement of resources such as equipment and storage facilities, which should be designed to facilitate the efficient flow of customers or materials through the manufacturing or service system. He also noted that the layout design is very important and should be taken very seriously as it can have a significant impact on the cost and efficiency of an operation and can involve substantial investment in time and money. The decisions taken with regards to the facility layout will have a direct influence on how efficiently workers will be able to carry out their jobs, how much and how fast goods can be produced, how difficult it is to automate a system, and how the system in place would be able to respond to any changes with regards to product or service design, product mix, or demand volume (Russell and Taylor, 2003).

In many operations the installation of a new layout, or redesign of an existing layout, can be difficult to change once they are implemented due to the significant investment required on items such as equipment. Therefore, it is imperative to make sure that the policy decisions relating to the organisation, method and work flow are made before the facilities are laid out rather than trying to fit these three into the layout. This is an important area of production and operations management since it is dealing with the capital equipment of the organisation which, in general, is difficult to relocate once it has been put into position.

Keith Lockyer (1992), in his book Production and Operations Management, explained that the plant layout process is rather complex, " which cannot be set down with any finality, and one in which experience plays a great part". The author also explained that it is impossible for an organisation to design the perfect layout, however he discussed a number of criteria which should be followed to design a good layout. These criteria are discussed in brief below.

Maximum Flexibility

A good layout should be designed in such a way that modifications could rapidly take place to meet changing circumstances, and thus should be devised with the possible future needs of the operation in mind.

Maximum Co-ordination

The layout should be designed in such a way that entry into, and disposal from, any department or functional area should be carried out in the most convenient way to the issuing and recieving departments.

Maximum use of volume

The facility should be considered as cubic devises and maximum use is to be made of the volume available. This principle is useful in stores, where goods can be stored at considerable heights without causing any inconvenience, especially if certain mordern lifting machinery is available.

Maximum visibility

Locker further insists that all the workers and materials should be readily observable at all times and that there should be no hidden places into which goods or information might get misplaced and forgotten. Organisations should be careful when they make use of partitioning or screening as these may introduce undesirable segregation which reduces the effective use of floor space.

Maximum accessibility

The machinery, equipment and other installations should not in any way obstruct the servicing and maintenance points, which should be readily accessible at all times. Obstructing certain service points such as electricity and water mains could hinder the production process in place.

Minimum distance and Material handling

All movements taking place within the plant should be both necessary and direct. Handling work does add the cost but does not increase the value, thus any unecessary movement should be avoided and if present, eliminated. It is best not to handle the material and information, however if this is necessary it should be reduced to a minimum by making use of appropriate devices.

Inherent Safety

All processes which might constitute a danger to either the staff or customers should not be accessible to the unauthorised. Fire exists should be clearly marked with uninhibited access and pathways should be clearly defined and uncluttered.

Unidirectional Flow

All materials which are being used in the production process should always flow in one direction, starting from the storage, passing through all processes and facilities, and finally resulting in the finished product which is later dispatched for storage or sold directly to the customer.

Management Coordination

Supervision and communication should be assisted by the location of staff and communication equipment in place within the chosen layout.

The Basic Layout Designs

After choosing the process type which will be used within the plant, it would be necessary to select the layout of the operation. Presently, there are four basic types of production layouts, each with their own set of characterisitcs which are briefly discussed below.

Fixed Position Layout

A fixed position layout design is used when the product being produced is either too fragile, bulky, or heavy to move and so the conversion process would have to take place at the location where the product is created. Figure 2. 7 conveys an example of a fixed position layout within a full service restaurant.

In this particular type of layout, all resources and factors of production used to produce a particular product must be moved to the location where the product is to be produced. Scheduling and coordination of the required resources are important characterisitics of this layout, since these resources have to be available on the site where the product is to be produced in the required amounts at the required time (Andrew Greasley, 2007). For example, certain activities that are carried out in construction sites are only able to take place after the completion of other activities. The utilization of equipment in such a layout is often low, since it is cheaper to leave equipment idle at a location where it will be used during subsequent days than to move it back and forth (Russell and Taylor, 2003).

Process Layout

In process layouts, also termed as functional layouts, similar activities are grouped together in departments or work centers according to the process or function that they carry out. Figure 4. 8 conveys a process layout in a manufacturing facility, were different processes and machines are located within their respective work center.

This type of layout is characteristic of intermittent operations, service shops, job shops, or batch production, were different customers with different needs are served (Russell and Taylor, 2003). Equipment found in this particular layout is often general purpose, and workers are usually trained to make use of equipment in their department. One of the advantagous of this system is flexibility, however a high level of inefficiency takes place. This inefficiency arises since jobs and customers do not flow through the system in an orderly manner, movement from one department to another could take a long time, and queues tend to be developed (Russell and Taylor, 2003).

Product Layout

In product layouts, which are also known as assembly lines, activities are set up in a line according to the sequence of operations that have to take place in order to produce a particular product. Therefore, each product being produced must have its own ' line', which is designed in a unique way to meet its requirements (Russell and Taylor, 2003). The flow of work is carried out in an orderly and efficient manner, moving from one particular processing station to the next down the assembly line until the product is successfully produced (Russell and Taylor, 2003). These type of layouts are often incorporated for mass production or repetitive operations, where demand is normally stable and volume is high. In such cases, the product being produced is standard, and one which is produced for the general market. Figure 2. 9 conveys a simplified configuration of a product layout.

The product or line layout is known to be a very efficient production system because the use of dedicated equipment in a balanced line allows a much throughput time than in any other layout used (Andrew Greasly, 2007).

However, this particular layout often lacks the flexibility found in the process layout since it only able to produce a standard product or service. Another issue which often concerns manufacturing companies is that if any particular processing station fails, the output from the whole line is lost. Therefore, it lacks the robustness to loss of resources such as equipment failure or staff which are not present at work that the process layout provides (Andrew Greasly, 2007).

Cellular Layout

A cell layout tries to combine the flexbility found in the process layout together with the efficiency found in the product layout. Machines and activities which are unalike are grouped into work centers, referred to cells, in order to create groups of parts or customers which have similar requirements (Russell and Taylor, 2003). The aim of this layout is to arrange different cells in such a way that materials movement is minimized.

Figure 2. 10 conveys how a process layout which has similar resurces has been grouped into three different cells. Through this redesigning, the routing of products has been simplified and products can now be processed in a single cell and need not be transported between different departments.

2. 2 Quality Management

There is a widespread acceptance that organisations view quality as an important strategic core competence and a vital competitive weapon which should be used to gain a competitive advantage at the expense of rivals. Several organisations have been able to reep a number of benefits, such as substanstial cost savings and higher revenues, after implementing a quality improvement process into their operations. Subsequently, this led them to invest substantial amounts of money yearly on implementing and sustaining quality programmes and intiatives.

The American National Standards Institution (ANSI) and the American Society for Quality Control (ASQC) define quality as " the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs". Similarily, Feigenbaum (2005), who is an American quality control expert, has defined quality as " the total composite product and service characteristics of marketing, engineering, manufacture, and maintenance through which the product and service in use will meet the expectation by the customer". Put simply, this refers to an organisation's ability to manufacture a product or deliver a service which satisfy the customers' requirements and needs, and which conform to specifications.

Keith Lockyer, in his book Production and Operations Management (1992), noted that organisations must be dedicated to the continous improvement of quality and must implement systematic control systems that are designed to prevent the production or delivery of products or services which do not conform to requirements. To facilitate this process, organisations should first set up a quality policy statement which describes their general quality orientation and which is used to assist as a framework for action. Once set up, top management would be required to:

- ensure that is it understood at all levels of the organisation;
- identify the needs of the organisation's customers;
- evaluate the organisation's ability to meet these needs;

- make sure that all the materials and services supplied fit the required standards of efficiency and performance;
- continously train the workforce for quality improvement;
- assess and monitor the quality management systems in place.

Quality Control and Assurance in the Conversion Process

Ray Wild (2002) has noted that the capability of the conversion process directly influences the degree to which the product or service conforms to the given specification. If the conversion process is capable of producing products or services at the specified level, then the products or services are provided at the desired quality level. Once the specification of the output is known and an appropriate process is available, management must ensure that the output will conform to the specification. In order to achieve this objective Ray Wild (2002) has defined three different stages which are outlined in figure 2. 4; each discussed below.

Control of Inputs

Before accepting any items as inputs, organisations must make sure that they conform to the required specifications and standards. Normally, before items are supplied to an organisation, they are subjected to some form of quality control by the supplier. The organisation might also ask its suppliers for information about the quality of the items whilst they are being prepared, ask for a copy of the final inspection documentation, or ask a third party such as an insurance company to make sure that all the items supplied conform to the required quality standards.

Even so, organisations still find the need to inspect the items supplied once they are recieved and before they are inserted into the conversion process. This inspection can be carried out by either inspecting every item recieved from suppliers, or by making use of the acceptance sampling procedure, which consists of taking a random sample from a larger batch or lot of material to be inspected. Organisations might also make use of the vendor rating procedure whereby suppliers are rated by taking into account a number of quality related factors such as the percentage of acceptable items recieved in the past, the quality of the packaging, and the price.

Control of Process

All manufacturing organisations must make sure that appropriate inspection is carried out during operations to ensure that defective items do not proceed to the next operations, and also to predict when the process is most likely to produce faulty items so that preventive adjustments could be adopted (Ray Wild 2002). The quality control of the production process is facilitated by making use of control charts, which convey whether the process looks as though it is performing as it should, or alternatively if it is going out of control. One of the benefits of this procedure is that it helps management to take action before problems actually take place. Ray Wild (2002) also notes that organisations should establish procedures for the selection and inspection of items which are used in the conversion process, for the recording and analysis of data, scrapping of defectives, and for feedback of information.

Control of Outputs

Organisations must ensure that the qulity inspection of output items is carried out effectively since any undetected defective items would be passed on to the customer. The inspection of output items is normally carried out by making use of a sampling procedure, such as acceptance sampling, or by carrying out exhaustive checks. Ray Wild (2002) notes that it is vital for an organisation to have in place suitable procedures designed for the collection and retention of inspection data, for the correction, replacement or further examination of defective items, and for the adjustment or modification of either previous inspection or processing operations in order to eliminate the production of defective items.

HACCP – Hazard Analysis and Critical Control Points

Nowadays, the food industry is responsible of producing safe products and also for conveying in a transparent manner how the safety of food is being planned, controlled and assured. In order to do so, organisations in the food industry need a system which will ensure that food operations are designed to be safe and that potential hazards are taken into account (Bob Mitchell 1992). One such system is the Hazard Analysis of Critical Control Points which is a scientific and systematic method used to assure food safety, and a tool for the development, implementation and management of effective safety assurance procedures (Ropkins and Beck 2000). The HACCP is known to be one of the best methods used for assuring product safety and is considered as a prerequisite for food manufacturing companies who wish to export their products into international markets.

The objective of the HACCP system is to guarantee that the safe production of food by implementing a quality system which covers the complete food production chain, from the promary sector up to the final consuming of the product (Fai Pun, Bhairo-Beekhoo 2007). It is capable of analysing the potential hazards in a food operation, identifying the points in the operation where the hazards may take place, and deciding which of these may be harmful to consumers (Bob Mitchell 2002). These points, which are referred to as the critical control points, are continously monitored and remedial action is effected if any of these points are not within safe limits. The HACCP is the system of choice in the management of food safety; one which is highly promoted by the food safety authorities in the United States, Canada and European Union.

Just-In-Time Scheduling

Scheduling in Manufacturing

Decision making with regards to scheduling has become a very important factor in manufacturing as well as in service industries. Scheduling is a decision making process whereby limited resources are allocated to specific tasks over time in order to produce the desired outputs at the desired time (Psarras, Ergazakis 2003). This process helps organisations to allocate their resources properly, which would further enable them to optimise their objectives and achieve their goals. A number of functions, conveyed in figure 2. 5, must be performed whilst scheduling and controlling a production operation.

In manufacturing systems, scheduling is highly dependent on the volume and variety mix of the manufacturing system itself. Mass process-type systems, which normally make use of a flow (product) layout where a standard item is produced in high volumes, make use of specialised equipment dedicated to achieve an optimal flow of work throughout the system (Andrew Greasly 2006). Greasly notes that this is very important since all items follow the same sequence of operations. One of the most important objectives of a flow system is to make sure that production is kept at an equal rate in each production that takes place. This could be ensured by making use of the line balancing technique, which makes sure that the output of each production stage is equal and that all resources all fully utilised (Andrew Greasly 2006).

Just-In-Time

The Just-In-Time Philosophy in Operations

The just-in-time philosophy originated from the Japanese auto maker Toyota after Taiichi Ohno came up with the Toyota Production System whose aim was to interface manufacturing more closely with the company's customers and suppliers. This particular philosophy is an approach to manufacturing which seeks to provide the right amount of material when it is required, which in turn leads to the reduction of work-in-progress inventories and aims to maximise productivity within the production process (Singh, Brar 1991). The authors, Slack, Chambers and Johnston, of Operations Management (2001) defined the JIT philosophy as “ a disciplined approach to improving overall productivity and elimination of waste”. They also state that it “ provides for the necessary quantity of parts at the right quality, at the right time and place, while using a minimum amount of facilities, equipment, materials and human resources”. Thus, put simply the JIT system of production is one based on the philosophy of total elimination of waste, which seeks the utmost rationality in the way production is carried out.

Bicheno (1991) further states that " JIT aims to meet demand instantaneously, with perfect quality and no waste". In order to achieve this, an organisation requires a whole new approach in how it operates. Harrison (1992) identified three important issues as the core of JIT philosophy, namely the elimination of waste, the involvement of everyone and continous improvement. The following is a brief description of these three key issues (adapted from Operations Management by Andrew Greasly).

Eliminate Waste

Waste may be defined as any activity which does not add value to the operation. Ohno (1995) and Toyota have identified seven types of waste, which apply in many different types of operations, in both manufacturing and service industries. All of these types of wastes are displayed in figure 2. 6 below.

The involvement of everyone

Organisations that implement a JIT system are able to create a new culture where all employees are encouraged to continously improve by coming up with ideas for improvements and by performing a range of functions. In order to involve employees as much as possible, organisations would have to provide training to staff in a wide range of areas and techniques, such as Statistical Process Control and more general problem solving techniques (Andrew Greasley 2002).

Continuous Improvement

Slack and Johnston (2001) note that JIT objectives are often expressed as ideals. Futhermore, Greasly (2002) states that through this philosophy, organisations would be able to get to these ideals of JIT by a continuous stream of improvements over time.

The Benefits of Just-In-Time

According to Russell and Taylor (2003), after fives years from implementing JIT a number of U. S. manufacturers were able to benefit from 90 percent reductions in manufacturing cycle time, 70 percent reductions in inventory, 50 percent reductions in labour costs, and 80 percent reductions in space requirements. These results are not achieved by each and every organisation that implements a JIT system, however JIT does provide a wide range of benefits, including:

- Reduced inventory
- Improved quality
- Lower costs
- Reduced space requirements
- Shorter lead time
- Increased productivity
- Greater flexibility
- Better relations with suppliers
- Simplified scheduling and control activities
- Better use of human resources
- Increased capacity
- More product variety

Health and Safety Management

The International Labour Organisation (ILO) and the World Health Organisation (WHO) define occupational health as “ the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; and the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities”.

Many countries have introduced legislation which requires employers to manage the health and safety of their employees, and others who might be affected (Alan Waring, 1996). To honour health and safety legislation, organisations have found it necessary to introduce active programmes of accident prevention. The preparation of a properly though-out health and safety policy, which is continously monitored, could dramatically reduce or eliminate injuries and damage to health (Oakland and Lockyer, 1992).

Responsibilities for Safety

All employees in an organisation should be active in creating and maintaining healthy and safe working conditions which are aimed to avoid accidents. Once a health and safety policy is established in an organisation, roles and responsibilities should be allocated within the management structure (Oakland and Lockyer, 1992). As with other areas such as quality and production within an organisation, health and safety would only be able to progress successfully if all employees are fully co-operative and committed in doing so. A number of organisations have encouraged this ‘

total involvement’ by creating safety representitives, committees, and group discussions w