

**SWP 29/91      TOWARDS A UNIFIED THEORY OF  
STRATEGIC MANUFACTURING MANAGEMENT**

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**PAPER TITLE: TOWARDS A UNIFIED THEORY OF  
STRATEGIC MANUFACTURING MANAGEMENT**

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**Abstract**

There is a need for a unified theory of the strategic management of manufacturing. Current theory encourages the strategic management of manufacturing by seeking to match the use of production resources with the need to satisfy the order winning criteria of the target markets. Such an approach suggests but one strategic role of manufacturing. Hayes and Wheelwright have suggested there are four strategic roles of manufacturing.

The purpose of this paper is to use the previous research findings on a taxonomy of generic manufacturing strategies, the author's own research and recently published academic theory to propose a unified theory of strategic manufacturing management. The theory links competitive strategy with four strategic roles of manufacturing. A strategic planning model is proposed to facilitate the preparation of a development plan which will not only enable manufacturing to support the competitive strategy of the firm but also to establish a strategy for manufacturing-led competitive advantage.

TOWARDS A UNIFIED THEORY OF STRATEGIC  
MANUFACTURING MANAGEMENT

THE MISSING CONCEPTUAL LINK

During the last twenty years management theory on the subject of the strategic management of manufacturing operations has, in the main, concentrated on emphasizing the need to marshal the manufacturing resources of a business to support the competitive strategy of the firm. Following Wickham Skinner's initial and most influential work on this problem (1966<sup>1</sup> and 1969<sup>2</sup>), the objective of much subsequent research in manufacturing strategy has therefore been to provide a better understanding of how to focus manufacturing strategy in this way. Buffa<sup>3</sup>, Hayes and Wheelwright<sup>4</sup> suggest that decisions taken on a number of critical manufacturing resource categories, such as capacity or process technology, are the key determinants of the capabilities of the manufacturing function. Therefore, any decision made which defines the scale or the nature of these resources will also determine, by design or default, the company's manufacturing strategy. However, opinions differ on the categorisation of these key manufacturing performance drivers with both Hill (1989)<sup>5</sup> and Buffa (1984) proposing some alternatives to those detailed in Hayes and Wheelwright (1984).

In addition to this recommended approach to managing manufacturing strategy, an alternative methodology has been proposed. The purpose of this alternative approach is the same as that for the method described previously. Hill (1985)<sup>6</sup> recommends that management first define the order winning criteria of the target market and these data then help set the manufacturing performance goals. It is the specification of these market success criteria that defines the desired manufacturing capability of the firm and therefore, these data are used to deduce the needed infrastructure design and the most appropriate production process to be used.

There is therefore, general agreement on the approach to be used to determine a firm's manufacturing strategy (Wheelwright 1984) but little guidance has been given on how to manage the complexity of the problem. Many authors have detailed the trade-off nature of manufacturing policy decisions but very little is written on how to select which manufacturing capabilities are required to satisfy the competitive strategy of the business.

An approach to simplifying this complex management task could be to use generic manufacturing strategies and adapt them to meet the specific needs of the firm. However, it is still unclear whether generic manufacturing strategies do actually exist.

If they do and they can be incorporated into a framework which shows how they relate to different market requirements, then such a framework could aid the selection of the most appropriate strategy that is consistent with the competitive strategy of the company. It could also help the creation of a vision of the manufacturing capabilities which will be required to gain a competitive advantage in the targeted markets. It seems inconceivable that there are no common approaches to how the manufacturing function is managed strategically and that every manufacturing strategy used is significantly different from those implemented by other companies experiencing the same or similar competitiveness problems.

Hayes and Wheelwright (1984)<sup>7</sup> have defined four stages in the evolution of manufacturing's strategic role.

Stages one and two are more reactive strategies. Stage one of manufacturing's strategic role is limited to ensuring that manufacturing does not prevent the achievement of the company's objectives through inefficiencies and high costs. Therefore manufacturing management's role is primarily an improver of operational

performance. Manufacturing managers are not usually asked to contribute to strategic planning discussions. Stage two of the development of manufacturing's strategic role is an enlargement of its purpose to one with the objective of neutralizing or eliminating the competitive advantage gained by other businesses. For example, to produce an increased range of products to match the choice offered to customers by competitors.

The third evolutionary stage of development is when manufacturing's strategic role is to support the firm's competitive strategy. The fourth and final stage is a proactive strategic role because manufacturing is used as a means for gaining or sustaining competitive advantage.

This four stage definition of the development of manufacturing's strategic role provides a helpful construct upon which to classify generic manufacturing strategies. The four stage definition provides a description of the range of strategic objectives that a company could set for its manufacturing function.

However, although the Hayes and Wheelwright model of the evolution of manufacturing strategy includes some descriptions of the objectives of each stage, their model is limited because it is a static one. It does not include an explanation of how to manage the transition from one strategic role to another.

This is the missing conceptual link, i.e. how to manage the development of the manufacturing capabilities of the firm to not only properly satisfy the future competitive strategy of the business, but also how to create a competitive advantage through manufacturing. To be able to do this not only requires the use of generic competitive strategies, which can help define the future competitive strategy of the firm, it also requires a taxonomy of generic manufacturing strategies. This taxonomy is the means for establishing a conceptual link between the range of generic

competitive strategies used by companies and the role that manufacturing must fulfil to support each type of generic competitive strategy.

With such a taxonomy of generic manufacturing strategies, the nature of the changes in manufacturing capability may become clearer and more easily quantified.

Therefore, the means of achieving the desired changes may also become more obvious.

A recent MIT study (Derouzos et al, 1989)<sup>8</sup> of eight industries in the manufacturing sector concluded that business management's perception of the role of production must change. Manufacturing should not be constrained to only supporting the firm's business strategy, management should develop a strategy to exploit the full potential of its manufacturing resources. Such a role would include the use of the manufacturing function to create competitive advantage as well as supporting the marketing strategy of the business.

### THE SEARCH FOR GENERIC MANUFACTURING STRATEGIES

It is generally accepted that differentiated manufacturing strategies do exist and Skinner (1969) linked such forms of differentiation to the emphasis and priority given to specific manufacturing missions such as quality, cost efficiency etc. At that time the general consensus of research opinion was that a business needed to choose a mission such as low cost or quality because to be competitive at both was not possible. Each mission made conflicting demands upon the production operation and therefore striving to be the best at both would result in achieving neither.

Consequently, such a line of thought lead to the conclusion that perhaps low cost manufacturing and high quality manufacturing would constitute the list of generic manufacturing strategies.

However, the achievements of Japanese manufacturing industry have shown that the simultaneous attainment of both these objectives is indeed possible and should be the goal for all manufacturing businesses.

Three recent studies of manufacturing strategy in practice have also provided some evidence that there are common approaches adopted by production businesses of differing types. Stobaugh and Telesio (1983)<sup>9</sup> studied 100 case studies and concluded that there were three groups of international manufacturers, i.e. organisations that adopt a cost, technology or market driven strategy.

Roth and Miller (1989)<sup>10</sup> in a study of 188 North American companies, examined strategic manufacturing management in practice and were the first to create a taxonomy of manufacturing strategies. They identified three groups of generic manufacturing strategies being practised, these they named as caretakers, marketeers and innovators. Caretakers are those businesses that specify price to be the dominant competitive capability with delivery reliability and quality consistency as their secondary manufacturing capability requirements.

Marketeers' policy is to broaden their product lines, but their main emphasis is to raise the capability of manufacturing to produce to a consistent quality. This was the largest group identified comprising approximately 50 per cent of the sample of firms that collaborated in their study. They also reported a high priority given to dependable delivery and product performance.

Innovators' strategic mission is to develop their ability to make a quality product with superior performance characteristics. They are similar to marketeers because quality consistency is considered to be the greatest need for their businesses. These firms too are concerned about a capability to provide reliable delivery but what

distinguishes this group from the others is the desire for design flexibility, i.e. the capability to make design changes quickly with the speedy introduction of new products.

De Meyer carried out a similar study to Roth and Miller but his study consisted of the use of the European Manufacturing Futures Survey data. The data used were questionnaire results from surveys carried out in 1987 (sample size 211) and 1988 (sample size 176). De Meyer (1990)<sup>11</sup> reported that he also identified three groupings of manufacturing strategies, he named these as the marketing oriented group, high performance products group and the manufacturing innovators.

De Meyer described the marketing oriented group as companies which "emphasize a manufacturing scope of dependability and serving the market". The competitive capabilities that companies in this group emphasize are quality consistency and reliable delivery (both are the same as the Roth and Miller classification) with speed of delivery as their third in priority ranking. The major difference between the Roth and Miller and De Meyer's findings on this type of manufacturing strategy is that the formers' results show a higher ranking for a capability to provide high performance products.

The second group identified was very innovative in all areas of operations management. "They give more planning responsibility to their workers, they pursue zero defects and improved vendor quality, reduction in manufacturing and vendor lead times, have emphasized more strongly the capability of introducing new products, have developed more new processes for new products, have invested more heavily in CAD, CAM, JIT, FMS and robots". This group he called "manufacturing innovators" and considered them to be similar to the innovators in the U.S. sample. He also stated that these priorities and action plans are usually identified with world class manufacturing.



The third group he called the "high performance products group". These he described as "a group of focused manufacturers which emphasize the performance of their products. They seem to be a bit more oriented towards the development of their technology in their emphasis on CAD, FMS and strive for a good production process characterised by worker safety. The difference with the second cluster (manufacturing innovators) is however not so large". His conclusion about this group was that because of its emphasis upon top performing products that it was not similar to any of the North American groupings. The most striking characteristic of this group of companies is the high degree of emphasis given to the need for the capability for quick production plan changes and delivery by these firms. It would appear from De Meyer's findings that this unique group of companies uses manufacturing flexibility as their hallmark of distinction.

A parallel study of the existence of generic manufacturing strategies, similar to the one performed by De Meyer, has also been carried out by the Author. However, the research methodology for this work has been to use the problem centred approach. During the last three years over twenty manufacturing strategy development assignments have been completed in British firms. The problems addressed have ranged from reducing product unit cost to the design a manufacturing system for a new product with the capability to establish a manufacturing competitive edge.

Qualitative research on these practical experiences, in terms of an examination of the relationship between the competitive strategies of the businesses and the linkage with the strategic objectives of the firms' manufacturing function, led to the development of a conceptual framework showing one form of interrelationship. The initial findings of this qualitative research were published in Sweeney (1990)<sup>12</sup> and concurred with some of the findings of a similar study carried out by Edmondson and Wheelwright (1989)<sup>13</sup>.

A re-examination of all the qualitative and quantitative research results described has shown a considerable degree of consistency. The evidence suggests that four generic manufacturing strategies have been identified, although their titles do differ, i.e. caretaker and quick fix strategy, innovator and breakthrough strategy (see table 1).

**TABLE 1**

**Bibliography of Names Given to Manufacturing Strategy Types by Researcher Name**

Generic Manufacturing Strategy Name used in Figure 2	Stobaugh and Telesio	Roth and Miller	De Meyer	Edmundson and Wheelwright	Sweeney	Hayes and Wheelwright
Caretaker	Cost Driven Strategy	Caretaker		The Quick relief mode of response to manufacturing challenges (1st Mode)	Quick Fix	Internally Neutral
Marketeer	Market Driven Strategy	Marketeer	Marketing Oriented Group		Stretch	Externally Neutral
Reorganizer			High Performance Product Group	(2nd Mode) The use of organizational tools mode of response	Catch up	Internally Supportive
Innovator	Technology Driven Strategy	Innovator	Manufacturing Innovators	To develop a Competitive Edge through manufacturing - (3rd Mode response)	Breakthrough	Externally Supportive

**THE STRATEGIC MANAGEMENT OF MANUFACTURING MODEL**

Porter (1980)<sup>14</sup> was the first to propound the existence of two generic competitive strategies. He also considered that a strategy of striving to be both a least cost producer and a differentiator was undesirable. This he termed as being "stuck in the middle". However, Kay (1990)<sup>15</sup> has shown that this may be a desirable strategy for

achieving a high return on investment. Therefore, this research evidence seems to suggest that such a strategy should be considered as an alternative to Porter's range of competitive strategies. Kay's research seems also to ratify the circumstantial evidence of the success of many businesses claiming to be implementing both the least cost and differentiation strategies, e.g. Sainsburys and Benetton.

Figure 1 shows the range of generic competitive strategies that manufacturing businesses can adopt, including an uncompetitive strategy which may be being implemented by default.

**Competitive Strategy Options**

Relative Degree Of Differentiation	High	World Class Competitor	Market Differentiator
	Low	Least Cost Producer	Uncompetitive
		Low	High

**Relative Production Costs**

**Figure 1**

The competitive strategies shown may be used for either competing in a niche market or in a total market. The world class competitor strategy combines both the strategies of least cost and differentiation which would seem logically to be the ultimate goal of all businesses. The inclusion of this strategy, to supplement those defined by Porter, is fundamental to the classification of generic manufacturing

strategies. This is because of the need to ensure that all the generic competitive strategies that a manufacturing business can elect to adopt are linked with an appropriate generic manufacturing strategy.

If manufacturing businesses have followed the Skinner (1969) approach to establishing their strategies for manufacturing, there must be generic manufacturing strategies appropriate to support the least cost competitive strategy, the differentiation strategy and the world class competitor strategy, as shown in Figure 1.

Figure 2 is the proposed solution to the missing conceptual link for the strategic management of manufacturing. Its design was originally based upon the findings of the Author's research (Sweeney, 1990). However, this case research was performed in collaboration with a small sample of companies and therefore, the findings were only tentatively proposed as representative of the strategies used in industry generally.

It was for this reason that the results of other studies were sought and used for the design of the manufacturing strategy planning matrix. However, the Author is responsible for the interpretation of these results as detailed in this paper.

The Relationship Between Generic Manufacturing  
Strategy Types And Competitive Strategy

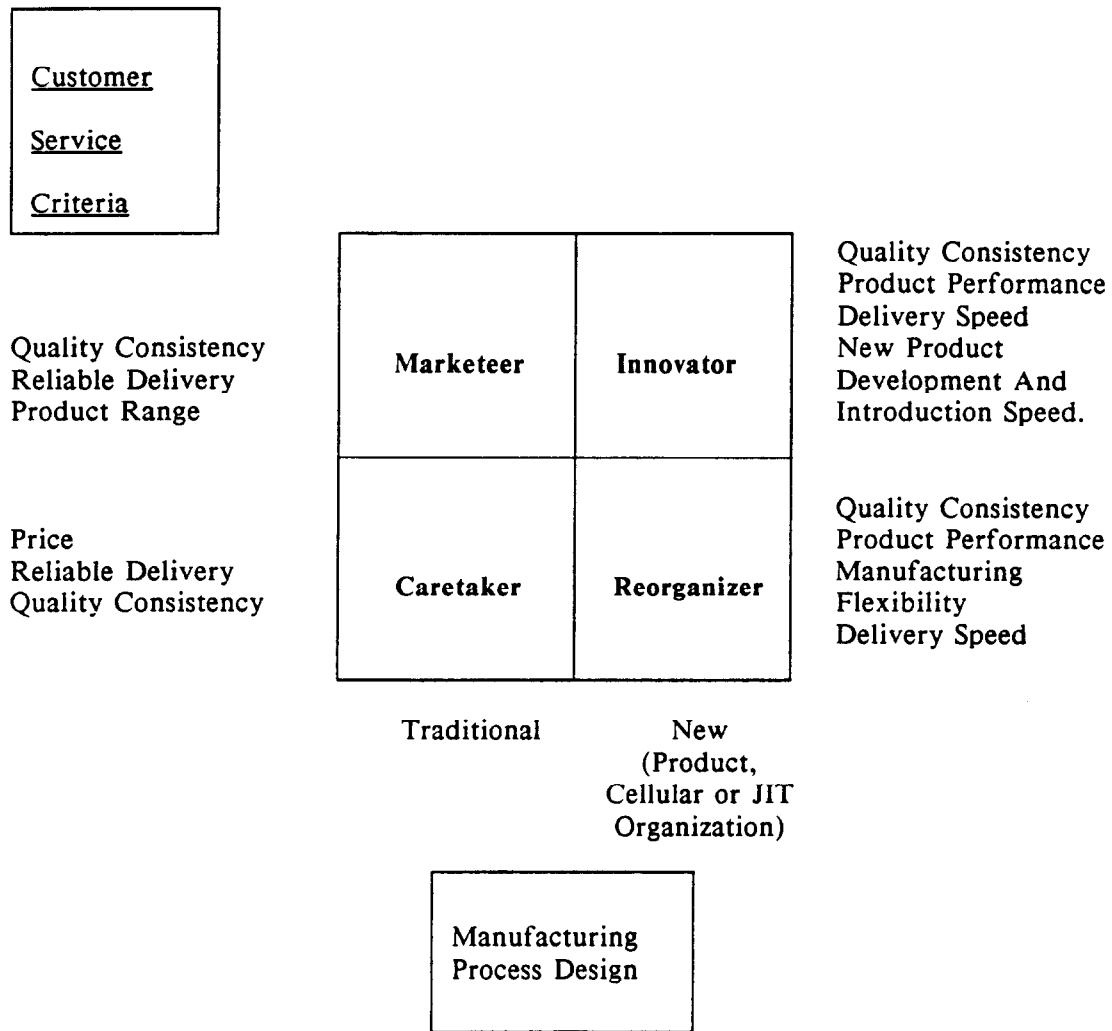


Figure 2

The four generic manufacturing strategies have been entitled caretaker, marketeer, reorganizer and innovator. Their relationships with the names given by the other researchers are shown in Table 1.

The objectives of these proposed generic manufacturing strategies are as follows:

### The Caretaker Strategy

The caretaker strategy is employed when senior management consider that little competitive advantage can be gained through differentiation. Senior management's expectations about the performance of the manufacturing task are to produce efficiently and to provide a reliable delivery service to the customers. It is therefore the manufacturing strategy applied by business adopting the least cost producer competitive strategy.

The manufacturing organization is not usually expected to proffer strategic plans for gaining competitive edge through manufacturing, other than a low cost advantage. Therefore, the kind of manufacturing capability changes made under this perceived role of manufacturing is milking the old as much as possible, e.g. cutting excesses and subcontracting or investing in new technology to increase manufacturing productivity.

Such a strategy would correspond to the Hayes and Wheelwright "Internally Neutral" approach of minimising manufacturing's negative potential.

It is most appropriate to implement this strategy when it is only necessary to make incremental improvements to the methods of production to satisfy the current order winning criteria of the targeted market. It is the least complex strategy to adopt and therefore, can be used as the strategy to manage a quick corporate response to a change in competitiveness.

The adoption of the strategy should not be considered to be purely a negative one since it is the type of strategy adopted by the higher volume production industries, when incremental productivity improvements are achieved through technological changes made to specific stages of the production process.

### The Marketeer Strategy

The marketeer strategy is frequently used by organizations that are experiencing increased competition and their need is to enhance and extend the standards of customer service they offer. Such responses could be to broaden their product lines, seek to obtain broader distribution or to improve the quality and specification of the products offered to the market.

The catalyst for a change to this type of manufacturing strategy is the company's marketing function. Marketing-led organizations seek new opportunities to sell and differentiate their products. However, the introduction of new customer service criteria, adopted for example to respond to a competitor strategy of an extended warranty guarantee, may necessitate higher quality standards to be practised by the production personnel of both the competing businesses. Such changes in competitive strategy are not usually considered to require significant structural changes to the manufacturing hardware system.

The marketeer strategy is therefore often implemented in response to competitor actions or it is adopted in an attempt to establish a strategy of differentiation through an improved customer service. The emphasis of the marketeer strategy is to strengthen the manufacturing function usually through infrastructural changes such as total quality management and delivery performance reporting. Broadening the product range often results in the use of manufacturing management information systems to facilitate the management of the increased complexity of production operations. An example of this is an investment in a material requirements planning system.

The changes made to the firm's manufacturing capability are often considered to be incremental, for example, a redefinition of quality standards or a specific training programme for the production work force. Usually little restructuring of the manufacturing process is considered because the increased manufacturing capability is expected to be achieved from the existing manufacturing system.

Such a strategy, when actions are taken to neutralise the competitive advantage of other firms, is similar to the Hayes and Wheelwright "Externally Neutral" approach of achieving parity with competitors.

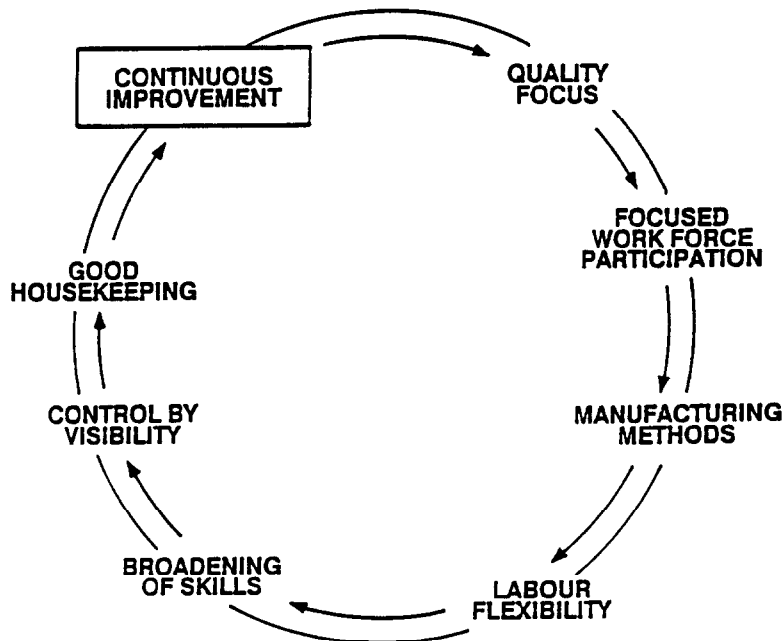
This strategy is an often adopted one because very little capital investment is required for its implementation and therefore, it is considered to be a low cost method of strategic change. However, imposing additional requirements upon the production system, which may be very different from those that the original manufacturing system was designed to meet, can increase the complexity of system management and that may create additional costs. The critical choice for senior management to make, when a change in competitive strategy is to be made is whether the company can alter the manufacturing capability of the firm through infrastructure changes, i.e. adopt a marketeer strategy, or whether a fundamental change to the design of the manufacturing process is required.

The adoption of the marketeer strategy often necessitates a greater delegation of responsibility to the shop floor in order to achieve the increased manufacturing capability that the firm desires. Increased complexity can only be managed effectively through either its reduction or the sharing of the problem. Therefore firms implementing a marketeer strategy are usually implementing changes to the manufacturing function's infrastructure, i.e. working practices, production planning and materials control procedures and quality management methods.



Many authors, for example Schonberger (1982)<sup>16</sup>, have reported on the types of infrastructural changes that can enhance the manufacturing capability of the firm. The objective is to attain the continuous improvement of all value added activities and the operational flexibility of the manufacturing unit to cope with increased complexity. Figure 3 is an illustration of an approach to the realization of that goal.

Improved Competitiveness through People Management



OBJECTIVE:

CONTINUOUS IMPROVEMENT  
IN QUALITY AND QUICK  
RESPONSE TO CHANGE

Figure 3

The continuous improvement of quality or delivery performance would be activities that would be consistent with marketer strategy implementation. Greater emphasis tends to be placed upon the intangible solutions to improved manufacturing capability rather than the physical or technological ones. However, technological

investments to improve quality management would obviously also constitute management action in support of the marketeer manufacturing strategy.

### The Reorganizer Strategy

The reorganizer strategy is adopted by manufacturing businesses to enhance the quality and the performance of their products and to change their manufacturing operations to reduce their customer delivery lead time. Therefore, reorganizers place greater emphasis on developing new production processes for new products and on the efficient manufacture of the product. This may not only involve investments in new manufacturing technology but it may also include innovations to the process flow, for example quick response manufacturing methods such as cell production or a plant within a plant.

A greater emphasis is therefore given to the management of the more tangible elements of manufacturing strategy, i.e. capacity, facilities and technology management. The adoptors of the reorganizer strategy consequently invest in computer aided design and manufacture, dedicated and/or flexible manufacturing equipment and in the installation of plant configurations which simplify managing the control of the flow of the work through them.

The organization's motivation for implementing a reorganizer strategy is often because of the inability of the firm to satisfy the order winning criteria of its established markets to a better standard than that provided by its competitors. Such an approach would therefore be similar to the Hayes and Wheelwright "Internally Supportive" role for manufacturing, i.e. to provide credible support to the business strategy.

The main objectives of the reorganizer strategy is to achieve an efficient product design to manufacture capability and a high throughput efficiency for the manufacturing process itself.

The throughput efficiency for the manufacture of the product can be measured as follows:

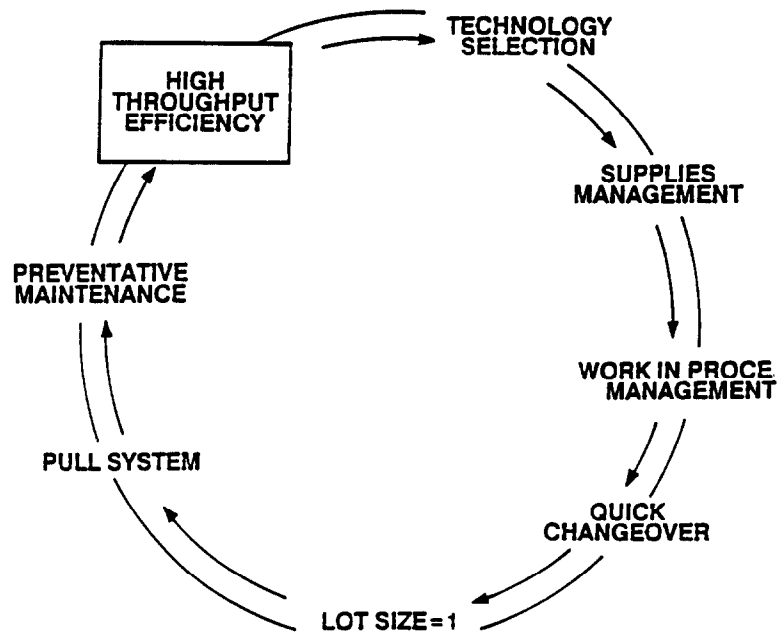
throughput =  $\frac{\text{processing time required to manufacture the product}}{\text{the total elapsed time between the release of the works order into production and the completion of the product or batch of products}} \times 100$   
efficiency

The throughput efficiency for a continuous processing operation will often average close to 100 per cent. However, in the many businesses that batch manufacture components prior to final assembly, the throughput efficiency may be as low as 10 per cent to 15 per cent. If this is the case, it means that for 85 per cent to 90 per cent of the time the order is in the production system no value is being added to it, and therefore additional costs will result. Such costs would be storage costs, handling cost and perhaps interest charges on the finance required for the increased working capital needed to fund the work in process. Setting a goal for throughput efficiency establishes a focus on reducing the cost adding delays, which obviously also reduce the speed of the organization to respond to changes in market demand.

What are the constituents of a reorganizer strategy for manufacturing operations.

Figure 4 shows an example of a reorganizer strategy targeted to improve the throughput efficiency of production.

### Competitive Process Management



#### OBJECTIVE:

**A FLEXIBLE AND  
FAST THROUGHPUT  
PRODUCTION PROCESS**

Figure 4

The reorganizer strategy is appropriate to adopt in order to improve the flexibility of production, reduce the uncertainty of the delivery lead time through better throughput control and reduce operating costs.

#### The Innovator Strategy

The adoption of an innovator manufacturing strategy is in essence the synthesis of the marketer and reorganizer strategies. However, there will inevitably be a further development of both these strategies to achieve the strategic goal of manufacturing being used to gain a competitive advantage for the firm. This strategy is therefore, the equivalent of Hayes and Wheelwrights fourth stage in the development of manufacturing's strategic role, i.e. it is "Externally Supportive" and is managed to pursue a manufacturing-based competitive advantage.

The strategy is therefore an aggressive one and the objective is to outperform the competition in terms of product performance and the quality of service to the customer. To achieve this goal requires the highest standards of design and manufacturing performance. However, to successfully implement the innovator strategy will require emphasis to be given to improving the integration of the design, manufacturing and manufacturing support functions in order to achieve a time-based competitive advantage.

De Meyer and Edmondson and Wheelwright have identified this type of manufacturing strategy in use. Edmondson and Wheelwright (1989) have also explained the dynamic nature of changes in competitiveness when competing with international competitors. They suggest that constant attention needs to be given to the action of competitors because continuous improvements to both products and customer service are needed to sustain any competitive advantage gained previously.

An approach to implementing an innovator strategy is firstly to ensure that the firm's total management team maintains a customer focus in order to ensure the identification of any opportunities for improved competitiveness. How such a focus can influence the planning of the innovator strategy is shown in Figure 5.

## Competitive Business Operations Management

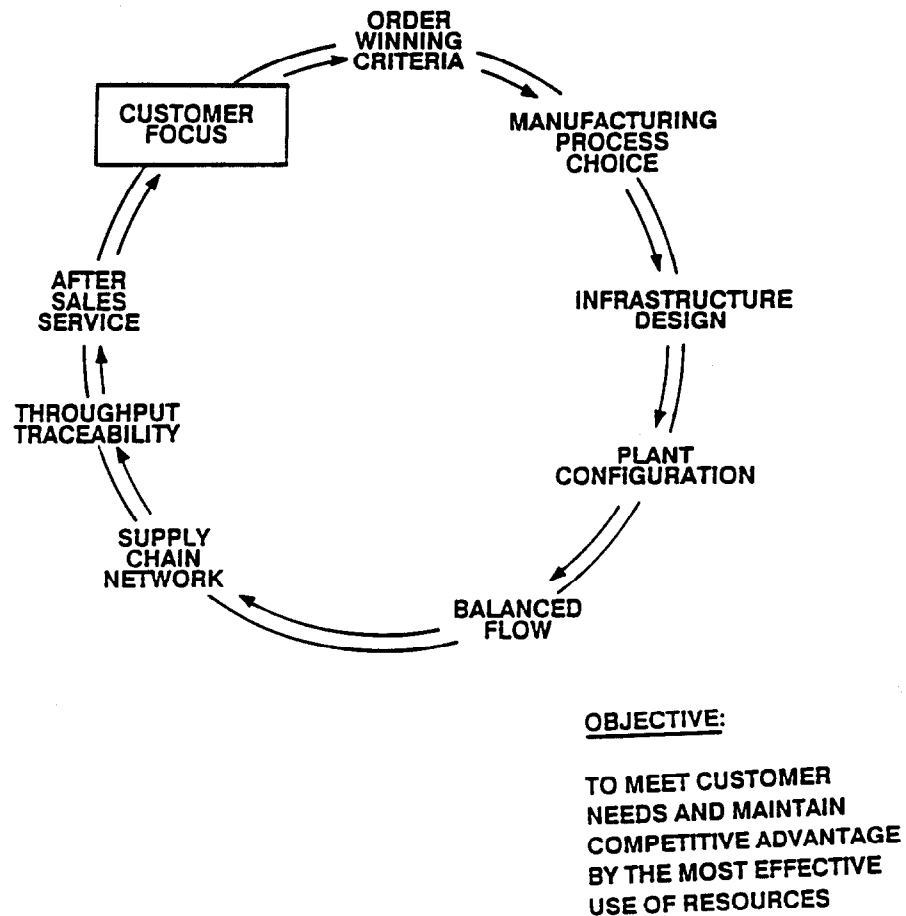


Figure 5

The order winning criteria shown in Figure 5 are the four primary competitiveness criteria which consist of price, product innovation and performance, quality and speed of response to the demand of the customer.

However, the emphasis given to these critical success factors may change as a consequence of a change of competitor strategy and such an action may warrant a change to the listed competitiveness criteria. Any such change will require an examination of its effects upon how the firm's major operating resources are to be managed. The major operating resources used for the manufacturing and customer support operations of a business are also shown in Figure 5.

## THE INNOVATOR STRATEGY THROUGH INTEGRATION

Figure 6 shows the integration of the marketer and reorganizer strategies and how they are to support the customer focused activities of the firm (Stickler 1990)<sup>17</sup>.

The overlapping areas of the model indicate how the objectives of integration can be achieved. Labour flexibility and involvement cannot be developed without the work force understanding the competitive strategy to be employed to outperform the competitors and their role in helping to put into effect that competitor strategy.

They must be much more informed about business plans and the management of the business finances.

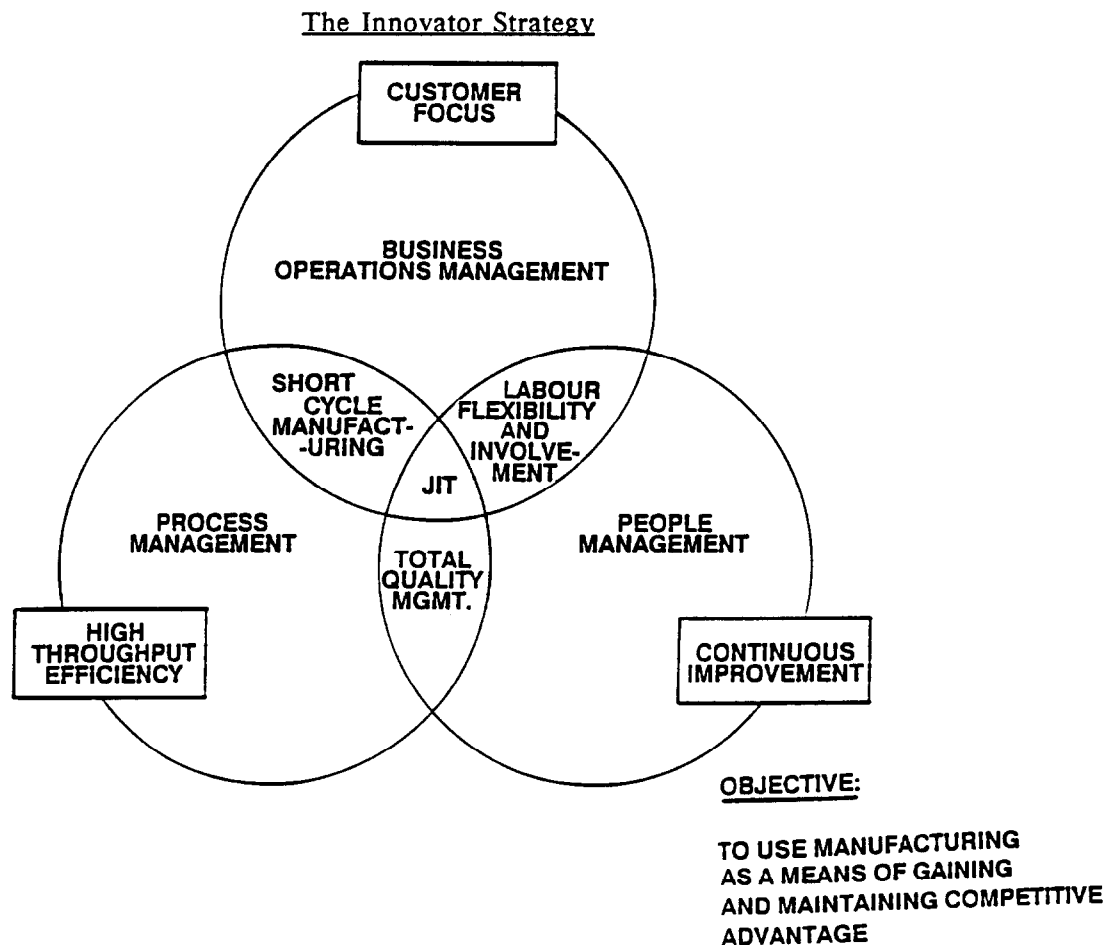


Figure 6

Fast response to the changing needs of customers can be achieved by producing within a short manufacturing cycle time. This will require high throughput efficiency systems which, when implemented, challenges all the rules of traditional process management such as large batch quantities and the need for high levels of work in process.

To achieve a faster response may require some excess manufacturing capacity to cope with unpredictable surges in total demand and the variability of customer preferences for specific product types. The trade-off is maximising capacity utilisation against delivery reliability.

Total quality management requires senior management involvement in the drive for the continuous improvement to quality. It can only be achieved by the combination of knowing the capability of the process technology and encouraging the involvement and commitment of the work force.

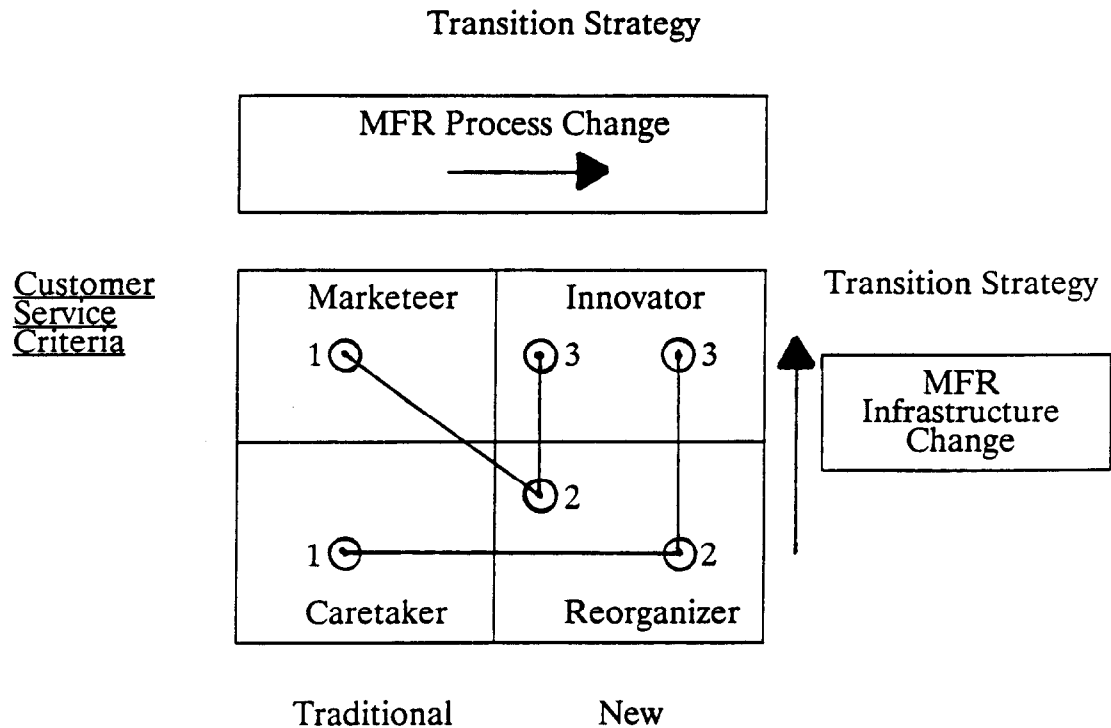
The nucleus of the innovator strategy is just-in-time production which is achieved by either a technology-push approach of using flexible manufacturing methods or installing a Kanban or pull system of production control. Flexibility is the very essence of the future to satisfy the customers' continued preference for choice, therefore the manufacturing system must be designed to service that market requirement.

#### THE ROUTES TO IMPLEMENTING AN INNOVATOR STRATEGY

Figure 7 shows the two recommended routes to the development of a manufacturing function capable of implementing an innovator strategy.



## The Route to World Class Manufacturing



### Manufacturing Process Design

Figure 7

Figure 7 also shows the nature of the changes in emphasis required to effect the transition from one manufacturing strategy type to another, i.e. when process or infrastructure changes constitute the transition strategy. Consequently, to make the transition from a caretaker strategy to a marketeer strategy requires attention to be given to infrastructural change. However, to change from a marketeer strategy to the reorganizer strategy, management would be investigating process changes.

The transition from reorganizer to innovator is the most difficult because it requires a change of approach by the manufacturing management team, i.e. to become more competition conscious and therefore more creative in their strategic thinking about

the potential of the engineering and manufacturing functions to establish a competitive advantage.

The nature of the infrastructural changes required would be to establish high levels of interdependence with suppliers, perhaps with some customers and across the functions of the firm. Also for some firms greater integration would be achieved through CIM (computer integrated manufacture). These changes could create opportunities for time-based competitiveness, as detailed by Stalk (1988)<sup>18</sup>, and firms therefore will require the establishment of team working methods such as simultaneous engineering, problem solving groups and cellular management organization structures if they are to succeed in competing in this way.

## CONCLUSIONS

There appears to be a degree of consistency in the findings of the researchers listed in Table 1 on the subject of generic manufacturing strategies. However, the first two studies (by Stobaugh and Telesio 1983, Roth and Miller 1989) did not isolate the quick delivery competitive strategy which has been named in this paper as the reorganizer manufacturing strategy.

The findings from research by De Meyer (1900), Edmundson and Wheelwright (1989) and this study did identify a type of manufacturing strategy distinct from those classified as caretaker, marketeer and innovator.

This may be explained by the fact that the reorganization of the production process is a part of a longer term strategy leading to world class manufacturing. At present in the UK the adoption of cellular production methods is still limited although there has been a dramatic change in attitude to the benefit of organizing production in this way during the last five years (Ingersoll Engineers 1990)<sup>19</sup>.

It is clear that to change to a cellular JIT method of production requires a substantial change of company culture and this could be considered as phase 1 on the path to world class manufacturing.

De Meyer's study did identify 42 companies striving to establish a fast response manufacturing capability which may fit the time-based competitive strategy described by Stalk (1988). However, the fast response manufacturing capability is only a part of the time-based competitive strategy described by Stalk. Such a strategy also includes the rapid design and introduction of new products which is a capability sought by the innovators identified by Stobaugh and Telesio (1983) and Roth and Miller (1989). This could be considered as phase 2 on the path to world class manufacturing. Their results also show that the capability to deliver products quickly was next in order of priority to the capability to design and introduce new products quickly. Such a strategy is consistent with the description of a time-based competitive strategy that Stalk has described.

The research results seem to show that the establishment of quick response manufacturing systems are a first phase of the transition to world class manufacturing, i.e. the implementation of a reorganizer manufacturing strategy. The goal is to further develop this strategy into one that is designed to give a design and manufacturing time-based competitive advantage which is the desired manufacturing capability of the innovator manufacturing strategy. The research results have provided evidence of two forms of manufacturing strategy which appear to be designed to achieve the same ultimate goal. However, for manufacturing strategy planning purposes perhaps it is better to use a two stage development plan to achieve the goal of world class manufacturing and therefore, it would be useful to use a taxonomy which distinguishes the two types of manufacturing strategy needed to achieve that goal.

There are therefore four types of generic manufacturing strategy being used. Knowledge of these four types can help prepare a longer term strategic plan for manufacturing by linking the competitive strategy required to a definition of the manufacturing capabilities needed, as show in figures 2,3,4,5 and 6. The use of the strategic manufacturing planning matrix will also aid the process of conceptualizing and designing an integrated plan for developing manufacturing's strategic role in a business.

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