SWP 15/95 MANUFACTURING STANDARDS OF PERFORMANCE FOR SUCCESS

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SYNOPSIS

This paper details the findings of a study of the manufacturing performances and practices of 140 engineering companies in the UK. From this study, significant differences in the manufacturing competitiveness of these firms have been identified. Causes for the performance differences are discussed and recommendations are made for the design of a manufacturing strategy to improve manufacturing competitiveness.

INTRODUCTION

To determine which manufacturing plant qualifies for the award of United Kingdom Best Factory requires a comprehensive understanding of the production methods and the manufacturing performance of each applicant for the award. This information is gathered, in the first instance, by the use of a questionnaire. The aggregation of this survey data, which is performed to protect the confidentiality of individual company information, constitutes a unique set of facts that could prove to be beneficial for the empirical research of both manufacturing strategy and manufacturing performance.

The uniqueness of this database is the strategic and the operational information that it holds. The strategic management information collected is the type of customer service that each company strives to deliver to gain a competitive advantage. The operational data gathered are the measurements of current performance for both manufacturing and customer service. The range of manufacturing performance information sought includes data on both the key performance indicators and their principle drivers. For example, information is requested on the total manufacturing lead time of a product and the production lead time of a typical or average component.

This database is a valuable source of information for another reason. A recently published review of empirical studies of manufacturing strategy, carried out by Minor III et al. [1], concluded that even the most carefully planned surveys are adversely affected by lack of response and by lack of standards in reporting financial and manufacturing data. They emphasized that the development of databases for empirical analysis would be a definite contribution to the discipline and for this to happen manufacturing managers must have an interest in the research, or something to gain by making the effort to respond. The data supplied for this empirical research

meets this condition for improved data integrity. It is in the interest of those who enter the Best Factory competition to complete the questionnaire as accurately as possible because all factories short-listed as a potential award winner are visited to audit their manufacturing practices and performance. There is also considerable prestige to be gained by winning a Best Factory award.

The UK Best Factory Award competition has therefore helped the creation of a comprehensive database that contains factory performance data completed by those companies that are confident that they could be considered as the UK Best Factory. Thus, through this process of self-selection, the Best Factory database contains factory practice and performance details of companies that judge themselves to be both competitive in their industry and successful.

This paper examines the manufacturing practices and performance of companies in the Engineering Industry only. This is the first of a number of similar studies to be carried out on different types of manufacturing industries.

BACKGROUND

A problem for those who choose to study dynamic processes, such as manufacturing companies adapting to a change of demand for their products, is the contextual interpretation of what is currently observed. This is not a problem that is unique to business management research.

A study methodology found to be helpful for dealing with this difficulty is an analysis of previous process behaviour. The objective of such a study is the identification of historical cause and effect relationships. These are needed to gain an understanding of current process behaviour and to forecast what changes may take place in the future. Sweeney [2,3] adopted such an approach for the development of a conceptual model that links the competitive pressure changes, experienced by many UK manufacturing companies during the last thirty years, with the business strategies adopted by them. This conceptual model is shown in Figure 1.

Figure 1

Evolution of Competitive and Manufacturing Strategies in the Engineering Industry

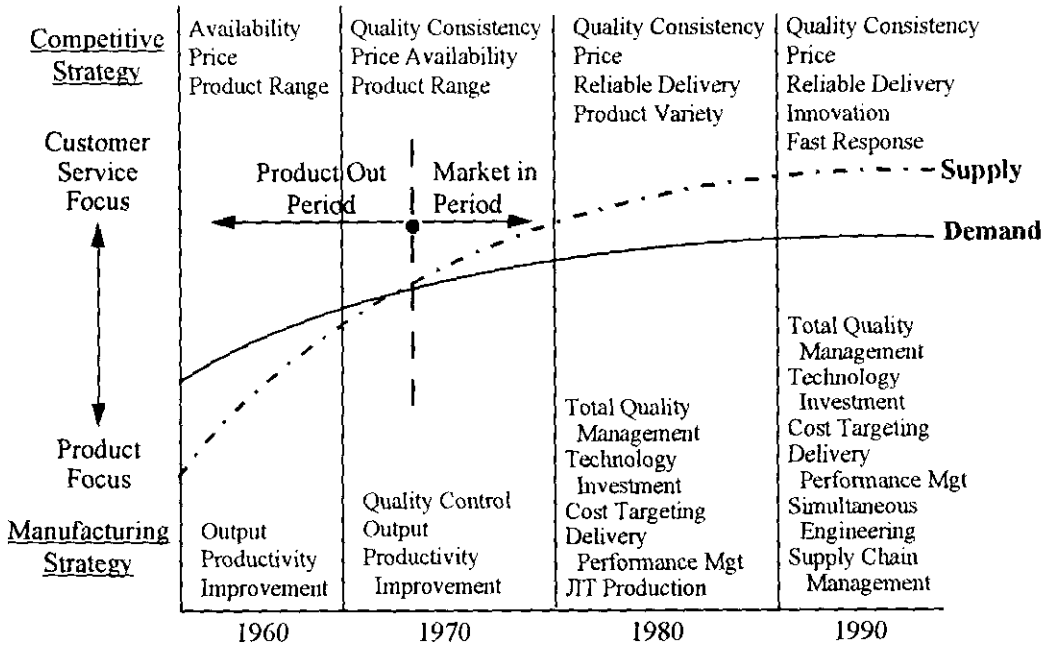


Figure 1 shows the changing relationship between the supply and demand curves for many of the markets for manufactured goods in the West. Economists would stress that supply cannot exceed demand indefinitely as shown. Therefore the demand curve will be drawn closer to the level of supply, by for example the introduction of new products, or the capacities of the suppliers will reduce.

To cope with the increased competition, which has been brought about by the growth in the number of international suppliers, some UK manufacturing companies have adopted a competitive strategy of progressively increasing the scope and the speed of their customer service. The last decade has been one when radical change to competitive and functional strategies have been necessary. The transformation of some companies, for example UK motor vehicle manufacturers, to a capability of achieving customer service standards of performance that are better than those of their international competitors is an illustration of the enforced changes made and depicted on Figure 1. The International Motor Vehicle Program study findings [4] clearly benchmarked the scale of the changes needed by some of the Western manufacturing organizations to become world class competitors.

Figure 1 also shows some of the manufacturing practices adopted by companies in their effort to establish the production capabilities demanded by their competitive strategies. The lists of practices shown are those that were found to be the most consistent with the generic competitive strategies adopted by a sample of manufacturing companies in the UK. They derive from a research project consisting of twelve case studies of strategic manufacturing management [5]. Figure 1 therefore shows examples of the relationship between environmental change, competitive and manufacturing strategies but the link between manufacturing strategy and

performance is missing. However, the figure does provide a time-based conceptual model of how competitive and manufacturing strategies have evolved during the last thirty years and the practices that have been developed by some companies during the periods shown.

RESEARCH OBJECTIVE

The purpose of this study was to attempt to discover the practices used and the performances achieved by the highest performers in the UK manufacturing industries. From such a study it may be possible to learn what explicitly specified or implicitly applied manufacturing strategies are being implemented by these companies.

To understand how the adoption of different manufacturing strategies led to the use of specific manufacturing practices and how these, in turn, result in different levels of performance is knowledge that has been sought for some considerable time. This study was an attempt to contribute to a better understanding of these complex relationships.

RESEARCH METHODOLOGY

The research consisted of a statistical analysis of the 1993 and 1994 Best Factory performance data. Only engineering industry data was used for this study because focusing on one industrial sector ensures that the findings relate to only one type of manufacturing method, which is the discrete processing method of production in the engineering industry. The reason for separating the engineering industry performance data from that of the continuous processing industry is because their aggregation may conceal higher standards of performance that are unique to a specific type of industry.

The research method recommended by Cool and Schendel [6] was adopted, which is to use business scope and resource commitments to identify strategic groups at the business level. The questionnaire responses used to assess the scope of the manufacturing operations were those that detailed the number of different products produced. What was also researched was how they were manufactured, that is whether the company made for stock, assembled to order, made to order or used a combination of these practices. These data were sought to obtain an insight into how the company is dealing with its manufacturing scope policy. A manufacturing business that chooses to supply a wide range of products from finished goods stocks will probably require a higher investment in stock holdings than a company supplying a similar range of products but quickly manufacturing them to order. Therefore, if these two characteristics of manufacturing operations are known, the stockturns of a factory will indicate whether it has adopted lean manufacturing practices or not as its solution to supplying its customers with wide product choice.

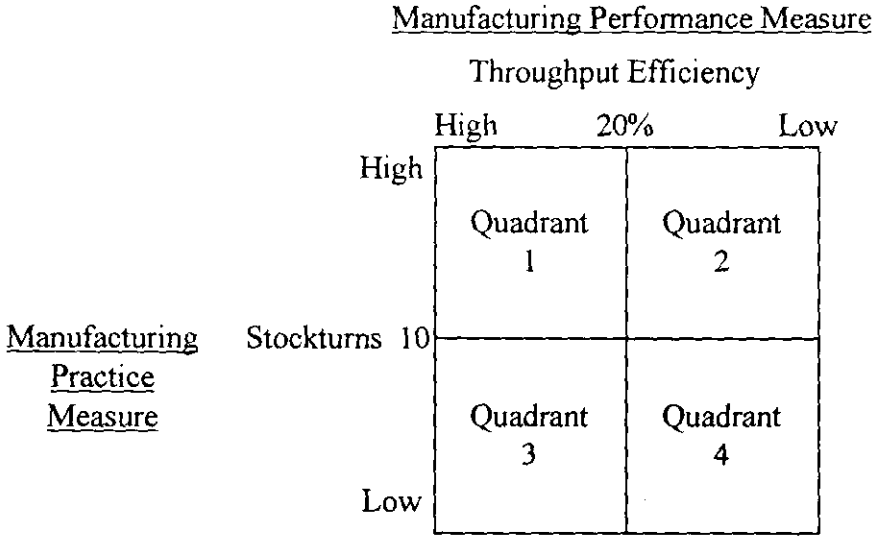
The performance measure selected to differentiate resource commitments for strategy grouping purposes was throughput efficiency. This is defined as the total value adding time to produce a product, or a component, as a percentage of its total manufacturing throughput time. The average manufacturing lead time of a typical component was used to calculate the throughput efficiency of each factory. Throughput efficiency provides a measure of how much process engineering resource

has been committed to developing efficient and flexible production systems within a factory that are capable of giving a quick response to market demand changes.

Four performance and perhaps strategy groupings were established from the database of 179 engineering companies. The selection of the performance grouping of each company was determined by its stockturns and the throughput efficiency of its operations. The matrix created by the use of these manufacturing practice and performance measures is shown in Figure 2.

Figure 2

Manufacturing Practice and Performance Matrix



RESEARCH RESULTS

Figures 3 and 4 show the spread of the stockturns and the throughput efficiency performances for the sample of engineering companies studied. These results were used to set the intermediate limits between the high and low performance standards shown on Figure 2, that is a throughput efficiency of twenty percent and a stockturn of ten.

Figure 3

Stockturns Analysis for the Engineering Industry

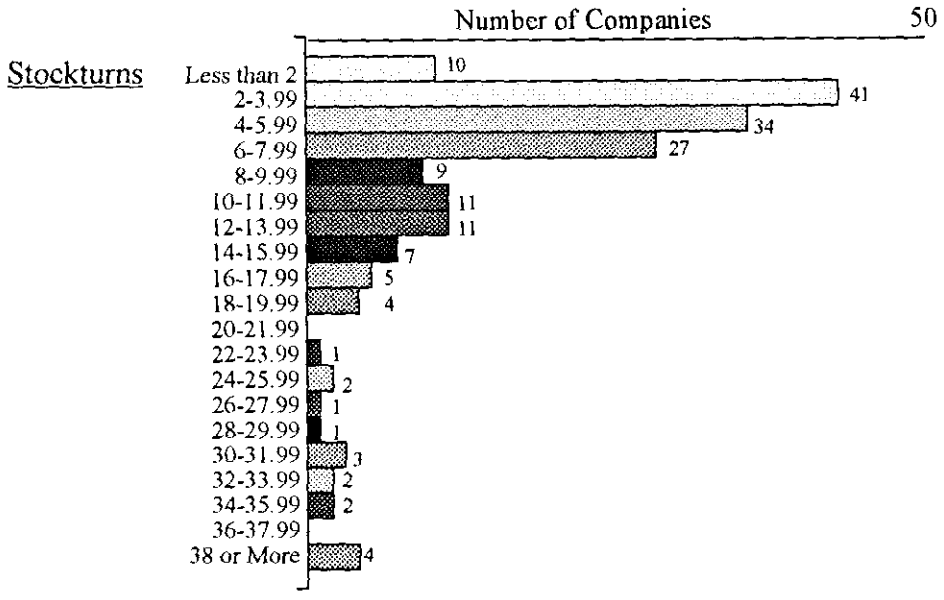
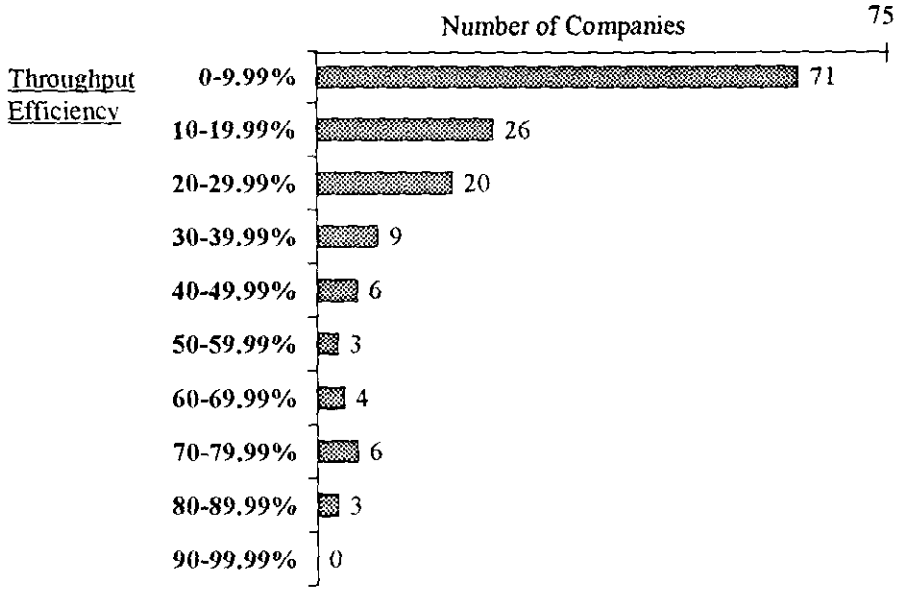


Figure 4

Throughput Efficiency Analysis for the Engineering Industry



The number of companies in each of the four quadrants of the manufacturing practice and performance matrix were as follows:

Quadrant 1-high throughput efficiency and high stockturns- 12 companies.

Quadrant 2-high stockturns and low throughput efficiency- 25 companies.

Quadrant 3-low stockturns and high throughput efficiency- 35 companies.

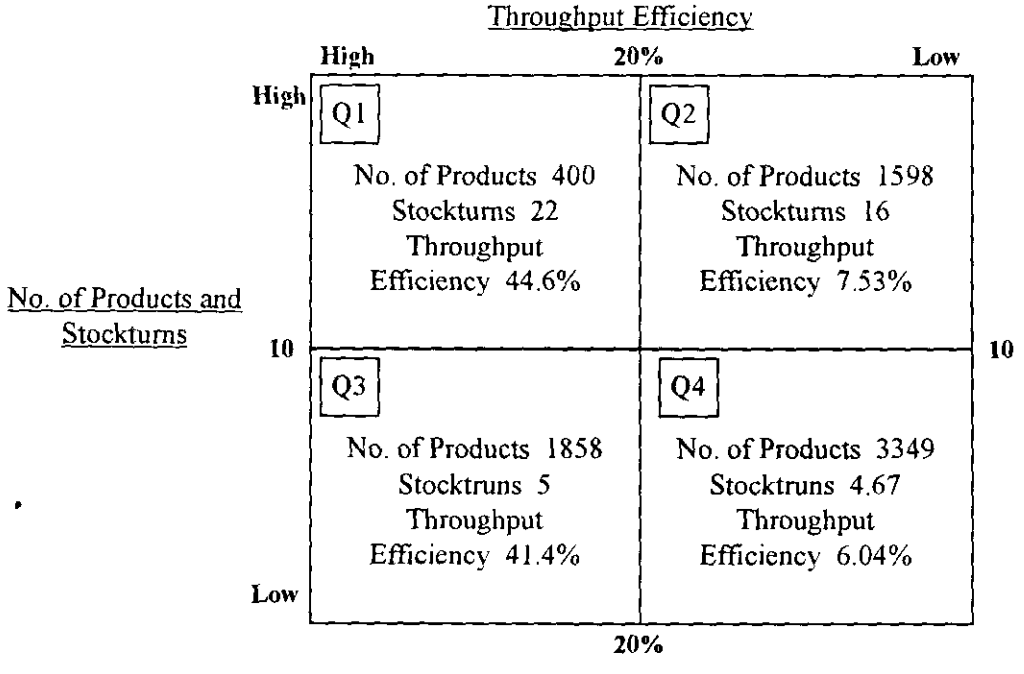
Quadrant 4-low stockturns and low throughput efficiency- 68 companies.

39 companies were not included in the sample of firms because of either obvious misinterpretations of the questions asked or incomplete questionnaire submissions.

Having split the 140 engineering companies into four groups, based upon their relative performances for throughput efficiency and stockturns, it was of interest to determine the mean value of each group's performances. Such an analysis could provide benchmarks of performance for organizations to set as future targets. They may also provide some evidence that different competitive and/or manufacturing strategies have been adopted by firms within each quadrant of the matrix shown in figure 2. The results of this data analysis are shown on Figure 5.

Figure 5

Manufacturing Practice and Performance Matrix



It would appear from the results detailed on Figure 5 that there are significant differences in the mean performances of the firms in each quadrant of the matrix. Clearly the manufacturing capabilities of the companies in each of the four quadrants of the matrix also significantly differ. Whether this constitutes the implementation of different strategies by these firms is dependent upon the validity of using the number of products with stockturns and throughput efficiency as the Cool and Schendel identifiers of strategic groupings, that is as measures of manufacturing scope and resource commitment. The Authors believe that they do and that different manufacturing strategies are being implemented.

To test this conclusion, an analysis was carried out to determine whether companies make for stock, to order or attempt to do both of these manufacturing operations. The results of this analysis is shown in Table 1.

Table 1

	QUAD 1	QUAD 2	QUAD 3	QUAD 4
Percentage of Companies making to order (MTO/ATO) only	50%	62%	27%	33%
Percentage of companies making for stock only (MFS)	8%	0%	0%	2%
Attempting both activities	42%	38%	73%	65%

The most interesting findings of this analysis is how the majority of companies in quadrants 1 and 2 have adopted a different manufacturing management practice to that implemented by firms in quadrants 3 and 4. It has been well understood for some time that the management practices required to manage a make for stock operation differ considerably from those required to control making to order. The emphasis of making for stock rests upon planning activities and to make to order requires good manufacturing control procedures. To attempt to perform both activities employing a single manufacturing resource is counterproductive to achieving manufacturing excellence in either activity.

This analysis may in part explain the positioning of these firms on the stockturn axis of the manufacturing practice and performance matrix.

To explain the positioning of firms on the throughput efficiency axis of the manufacturing practice and performance matrix, it is generally accepted that throughput efficiency is determined by the level of work in process. This, in turn, is a consequence of either poor production throughput management, the size and complexity of the product and/or the degree of vertical integration that the company has chosen to incorporate in its manufacturing operations.

An analysis of the Best Factory data shows that the firms in quadrant 2 are predominantly capital goods manufacturers and therefore much of their work in process is a consequence of the make and the assembly times required to manufacture complex products. Firms in quadrant 2 have demonstrated, by the high stockturns, a greater proficiency to manage raw material and finished goods inventories than those in quadrants 3 and 4, but it appears that throughput management is their Achilles heel.

Conversely, it would seem that it is raw material and finished goods stocks management that are the causes of the poor stockturns of firms in quadrant 3.

CONCLUSIONS

The majority of the firms in quadrants 1 and 2 of the matrix manufacture only for stock or to order. The research shows that these firms offer a narrower product portfolio and have a more focused production philosophy.

To be competitive at making only to order will require a lean and flexible supply chain to ensure the quick delivery of parts and materials in low volumes. It would

seem that the firms in quadrants 1 and 2 of the matrix have established this critical resource because of the significantly higher stockturns that they achieve.

The achievement of manufacturing flexibility is also dependent upon a production process that is capable of a high throughput efficiency. Manufacturing flexibility and delivery speed as figure 1 shows, are the capabilities that are the most desired to be competitive in the 1990s. For these reasons, it would seem that those manufacturing companies that have achieved levels of performance that are greater than ten stockturns and a throughput efficiency of greater than twenty percent are striving to establish the capabilities of manufacturing flexibility and fast response. These are the firms that are grouped in quadrant 1 of the manufacturing practice and performance matrix, twelve companies in total. It is also clear that such a manufacturing strategy is different from those adopted by firms in the other three quadrants of the manufacturing practice and performance matrix.

It would also seem that those firms in quadrant 4 of the matrix lack any clear vision for the development of their manufacturing operations.

The evidence for this conclusion is the considerable production planning and throughput control they are striving to perform within factories manufacturing in excess of three thousand products. It is essential that a clearer and more focused competitive strategy for each of these companies is established and that the manufacturing system and practices are designed to reduce the complexity of their manufacturing tasks.

FUTURE RESEARCH

It is the Authors' intention to continue this preliminary analysis of manufacturing strategy, practices and performance in order to investigate the levels of performance that can result from the adoption of specific types of manufacturing strategy and the practices used for their implementation. Current research is focused on identifying whether the manufacturing strategies employed by the firms in the four quadrants of figure 5 are similar to any of those briefly defined in figure 1.

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