

# MANUFACTURING: COMPETITIVE EDGE OR CORPORATE MILLSTONE

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## PART I

### 1. What is a Manufacturing Strategy?

The main proposition which I would like us to consider is that in order to remain successful a manufacturing company must have a coherent manufacturing strategy which matches with its market and corporate strategy: in short that it has a manufacturing structure which is appropriate to the manufacturing task which it has set itself. Moreover, it is my firm belief that this proposition is as true for the Nation as a whole as it is for individual companies.

There can be no future for the United Kingdom as a manufacturing nation unless we can produce goods for world markets which offer ever improving performance, delivery, features or value over those of our competitors. The solution of protectionism against the sweat shops of the developing world I find not only impractical but also morally indefensible. The developed economies of the world have no choice but to pursue the design and manufacture of new and higher technology or performance products and allow the emerging nations to manufacture the simpler less exotic products.

A recent study (Ferdows 1984) of the areas of major concern to senior managers in European companies operating in the electro-mechanical assembly industries revealed the following "top 5" list of priorities for the next five years:

Factor	% Respondents
1. Lead time reduction	84
2. Direct labour motivation	68
3. Manufacturing reorganisation	64
4. Quality circles	64
5. Computer Aided Manufacturing	60

These topics have all clearly been reflected in the papers presented over the last three days so at least there is some commonality of objectives, between operating and senior management.

Indeed it is this commonality and clarity of objectives with which we will start. The first and most important question to ask of any manufacturing business is quite simple:

**"What do you sincerely want to be good at?"**

But when we ask such a question what sort of answer does this usually generate?

Let us examine the elements of market competitiveness and the key criteria for success which can be identified. Figure 1 shows a simplified overview of the framework for analysis of a company's manufacturing strategy. Specifically the company must decide the relative weights to be given to the various market criteria for success:

- Reliability of delivery
- Delivery lead time offered
- Product quality
- Design flexibility
- Volume flexibility
- Price

Looking at each of the criteria in turn:

**Reliability of delivery:** Although a plant may not offer as short a delivery lead time or as low a price as competitors, its reputation for meeting its delivery quotation can be a major strength particularly where capital goods are concerned.

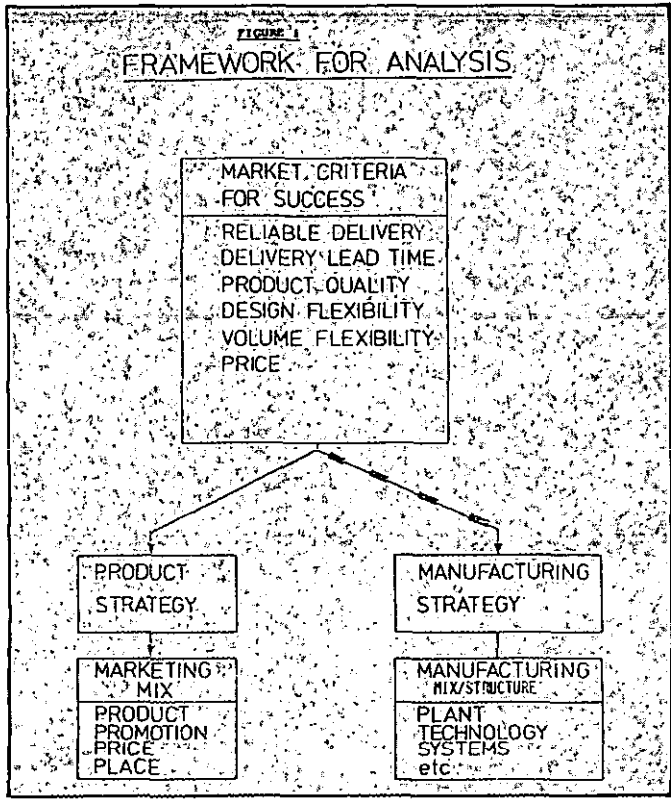
**Delivery lead time:** In some markets such as the supply of urgent spares it will not be enough to offer reliable delivery; it will have to be fast as well.

**Product quality and reliability:** In certain markets, such as nuclear power equipment, product reliability is a sine qua non; in others the product may not be the cheapest or the best designed or the shortest delivery but it is guaranteed to work when you get it, and in the case that it doesn't, product support is immediate. Actual product quality in terms of both product design and manufacture is essentially a balance with price unless competitive products are indistinguishable. A plant must choose either a high absolute quality level or simply one which is consistent with market price.

**Product design flexibility:** Product design may either be internally controlled or specified by the customer. In some markets, a plant can choose to offer a standard product range or to specialise in custom-built, non-standard products.

**Output volume flexibility:** It may be an essential ingredient of market success to be able to vary total output very quickly in relation to market needs. This is a characteristic required by plants competing on price in highly cyclic industries. A plant may choose to have inflexible capacity but if it does so it cannot also choose to be both a low unit-cost producer and to offer a short reliable delivery lead time.

**Price:** Price is rarely as isolated a competitive variable as some economists would have us believe. Price and quality are obviously directly related, but delivery lead times and delivery reliability also have price implications. The U.K. economy relies extensively on the export of



capital goods, in which direct price comparability is difficult to establish and where non-price competition is often dominant.

The most important thing to realise about these criteria is that they all contain implied trade-offs both within themselves and against the other criteria.

It is impossible for any manufacturing system to be equally effective on all these criteria simultaneously and if a plant tries to be "all things to all people" it will generally fail to please anybody very much.

Out of the criteria for success a company needs to develop a corporate product strategy covering its marketing mix and *should* develop a corporate manufacturing strategy defining carefully the *appropriate* manufacturing mix (or structure) needed to meet the manufacturing task defined. This manufacturing structure is concerned with:

1. Manufacturing Hardware: plant, technology etc.
2. Manufacturing Software: production control systems, quality systems etc.
3. People: skills, employment terms etc.

#### 4. Organisational Structure and Management

While most companies develop fairly detailed product strategy statements the development of detailed manufacturing strategies is often neglected despite its obvious importance. Statements of manufacturing strategy more often than not take the form: "supply on time on the shortest possible lead time a product of the highest possible quality to any design marketing can sell in any volume at the lowest price in the market". Such a statement is best described as a set of pious incompatible hopes.

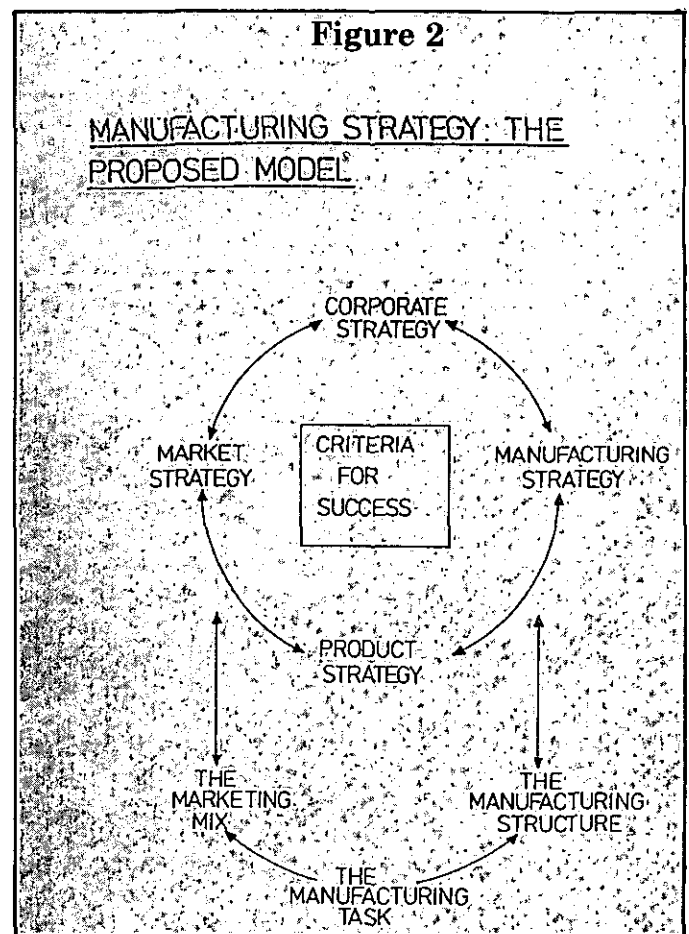
No marketing director would consider using the same marketing mix to sell a high reliability, custom built, critical delivery product as he would to sell a low margin, standard product ex-stock. Yet no one seems concerned that a single manufacturing facility is expected to produce such products equally effectively using the same facilities, systems and people. If you hand the manufacturing function an inherently impossible task it is small wonder that they cannot achieve it.

Consider for example the problem of a company supplying components to the vehicle industry. There are two sets of 'customers': the large original equipment (OE) purchasers buying the current limited product set in high volume on schedules and the spares supply system requiring a vast range of items in relatively small quantities for supply ex-stock. If both sets of orders are produced in the same facility the powerful OE customers call the tune — and from a strategic viewpoint always will because without their sales the long term spares sales would die anyway. The result is always the same: unacceptable cost performance on the high volume OE supply and poor customer service on the high margin spares sales encouraging competitive action. I know of at least one wholly owned distribution organisation which actually buys from the competitors in order to maintain any sort of respectable product availability!

The three basic rules of manufacturing strategy are deceptively simple to state:

1. There are many ways to compete besides by producing at low cost.
2. A factory cannot perform well on every yardstick.
3. Simplicity and repetition breed competence.

The traditional model seems to be that corporate strategy is often set with little reference to the existing



manufacturing structure, is carefully translated into product strategy and marketing mix and the manufacturing function is simply expected to cope with the outcome.

The proposed model (Figure 2) provides for a coherent statement of corporate, market, product and manufacturing strategy set around the criteria for success. From the market strategy comes a statement of the marketing mix and from the manufacturing strategy a statement of the manufacturing structure.

Which comes first is a sterile question; it is like the chicken and the egg. It does not matter which comes first but you do need *both* for survival of the species.

Definition of a manufacturing structure involves two types of interacting decisions: asset decisions which define the physical structure and systems decisions which define the control, personnel and organisational structure. We will generally be concerned with two problems: firstly with analysis of an *existing* manufacturing structure to assess its suitability to perform a particular manufacturing task, secondly with definition of an *appropriate* manufacturing structure to meet a particular task.

Again within the manufacturing structure we emphasise the need to make explicit trade-offs: choices must be made on each dimension. Each choice generally restricts the possible choices on other dimensions and has a major impact on matching task and structure.

Moreover, it must be appreciated that these trade-offs between performance criteria have to be made somewhere. If they are not made at the level of manufacturing strategy then they will be made in an ad hoc manner at an operating level with no consistency either with corporate strategy or indeed with each other.

The three common problems which arise in matching manufacturing task and structure would summarise as:

1. Multiple tasks required of the same structure.
2. Structure inappropriate to the current task.
3. The structure itself contains inconsistencies.

The company which attempts to produce customer specials on a quoted lead time and standards for supply ex-stock on the same set of facilities is asking its plant to be "all things to all people".

The product innovator with a 'tweak it and see' plant finds himself shut out of a mature market because he has become uncompetitive on price; replaced by the mass-producer with a purpose-built plant.

A manufacturing structure in which the formal performance system concentrates on unit cost while the production control system is totally dedicated to meeting delivery promises is basically inconsistent.

Why do so many companies have such mismatch problems and how can they be avoided? The answer to the first part of the question lies in the role which the manufacturing function plays in the business. In most companies manufacturing is viewed as a cost sink, rather than a profit source — "the corporate millstone effect".

What is needed is a positive "input" from manufacturing based on an objective appraisal of existing manufacturing capability. Many senior managers involved in setting corporate strategy will have little, if any, experience in manufacturing. On the other hand the senior manufacturing manager has traditionally been given little say in setting corporate strategy. His contribution must be positive, rather than negative — what manufacturing can do well rather than a list of reasons why it cannot do what is asked of it.

In the short term possible market strategies will inevitably be constrained by the existing manufacturing structure but in the long term the manufacturing structure must change to meet market needs. It is tempting to interpret what I have said as "stick to what you are good at" but the market characteristics will inevitably change over time. Such a policy is as naive and as dangerous as having no policy at all.

Too often senior management regard manufacturing's input to corporate profitability as being no more than the achievement of high output and low cost. Apparently routine manufacturing decisions made without proper recognition of corporate goals and market strategy can tie a company into facilities, personnel policies and systems which are totally inappropriate and will take many years to reverse.

My unhappy proposition is that many of us here find ourselves in just that position.

## 2. The Challenge of New Technology

The challenge of incorporating new developments in manufacturing technology into manufacturing strategy can be seen as the laying down of a series of major challenges to conventional manufacturing thinking:

1. Reduce Work in Process by 50% or more.
2. Reduce lead times by 50% or more.
3. Reduce "support" labour by 50%.
4. Facilitate the introduction of new products at two to three times the existing rate on half the current design/development lead times.

It is not enough to think of mere "tinkering" with existing systems and technologies, such radical changes require a totally novel approach. Yet such an approach is perfectly feasible if one examines the current "norms" for manufacturing in most engineering companies, even those with relatively high volume final assembly processes. The normal conditions are quite well known for the typical cost build up over time through the manufacturing system. The key factors are:

- Bought out content 50%.
- Throughput efficiency in component manufacturing, that is the ratio of work content to total lead time of

20% (or 80% of the time queuing or idle).

- Throughput efficiency relatively high in final assembly.
- Additionally we need to recognise: extensive periods in materials stores, finished component stores and often finished goods stores.

Any approach which can reduce the time spent in the "idle" portions will in fact achieve objectives 1,2 and 4 automatically and is likely to make objective 3 far easier to accomplish. However, instead of concerning itself with the "idle" portions of the time productivity diagram, most Western management seems to have been concerned with the (much smaller) "busy" periods, that is with concentration on the actual work task. While this is clearly not to be ignored it seems to have been a case of not seeing the wood for the trees.

## 3. Some Alternative Approaches to Improving Time Productivity in Manufacturing

### 3.1 The Japanese (Just-in-Time) Approach

This involves tight control over the flow of orders through the system to maintain very low queues. It requires considerable delegation to operators, a very directed application of manufacturing engineering to reduce set-up time and high levels of commitment to continuous and relatively constant production. Even the Japanese have only been able to apply this approach in a limited range of industrial environments but these have shown major benefits.

A European version of the courage + control + people-power approach can be seen in the application of Group Technology principles, which incidentally are very much the current vogue in the U.S. despite their relatively unfashionable image in the U.K. currently.

### 3.2 The Systems Intensive Approach

The more usual Western approach has been through sophisticated data processing systems in order to "solve" the manufacturing problem. This involves extensive data collection and daily scheduling of every operation. While this approach seems to have been more broadly applicable than the JIT approach, its effects have been far less dramatic: a move from "one operation per week" to "two or three operations per week" is certainly an advantage but it may still mean only say 10 hours work in a 40 hour week, throughput efficiency of only 25%.

### 3.3 The Capital Intensive Approach

The use of capital investment in high technology manufacturing equipment in order to effect time productivity is not new. It started with multi-axis machining centres and other multi-operation machines, the objective being to reduce the number of operations, the ultimate aim being one operation per part. Too often however, the promise was unfulfilled because although 10 components of a 100 component assembly were produced in 4 weeks instead of 14 the other 90 still took 14 with no effect on the customer lead time. Alternatively, the planners went overboard in putting as many components as possible on such machines only to generate major bottlenecks ahead of them. The successful application of the capital intensive approach requires a plant wide view to be taken and careful planning of capacity.

### 3.4 The Time Intensive Approach

This simple approach has often been neglected; multi-shift operation is a very effective method of shortening the total elapsed lead time, since throughput efficiency relates hours of work to available

hours. Thus at an efficiency of 25%, 100 hours work would take 10 weeks at 40 hours per week but only 5 weeks at 80 hours per week on a 2 shift basis.

The likely impact of the newest manufacturing technologies can best be understood by seeing them as providing the vehicle through which all of the four fundamental approaches described above can be implemented simultaneously.

- Just-in-time production is made possible through few operations, tight deterministic scheduling and minimum tool change times.
- Again because of the high level of predictability obtained and reduction in lot sizes for manufacturing close coordination of component requirements is not only necessary but is also significantly facilitated.
- The solution is clearly part of the capital intensive approach but it is important to re-emphasise the point that it must be a plant wide view that is taken in the overall system design.
- Multiple (unmanned) shift operation becomes a reality.

The comparison between the overall real productivity of conventional manufacturing and that achieved under an FMS approach is illustrated in Figure 3 which shows against a total available hours of 8760 (= 365 x 24) per annum:

- Under conventional manufacturing using 2 shifts the best one might achieve is around 29% or 2555 hours per annum.
- Under very conservative assumptions about the changes under FMS and even allowing for an increase in total downtime due to technical problems of 180% a figure of 4420 or 48% is achievable, that is a 65% increase in real output.

Moreover, this change is accompanied by other equally significant changes because while under conventional manufacturing throughput efficiencies of the order of 25-30% must be considered good under FMS throughput efficiencies of 80-90% should be achievable with consequent reductions in work in process inventories and lead times.

Thus the first major impact of new technology on manufacturing strategies for the future lies in dramatically shorter more reliable lead times with consequent reductions in inventories.

Incidentally, while we are considering the concept of time productivity I feel obliged to comment on the current "my approach is better than yours" row which seems to be being generated — in most cases by not disinterested parties — concerning JIT/KANBAN, MRPII, FMS/CIM, OPT etc. The arguments are largely sterile because to compete in future world markets you will need all the tools you can get. It is 'horses for courses' and the only real issue

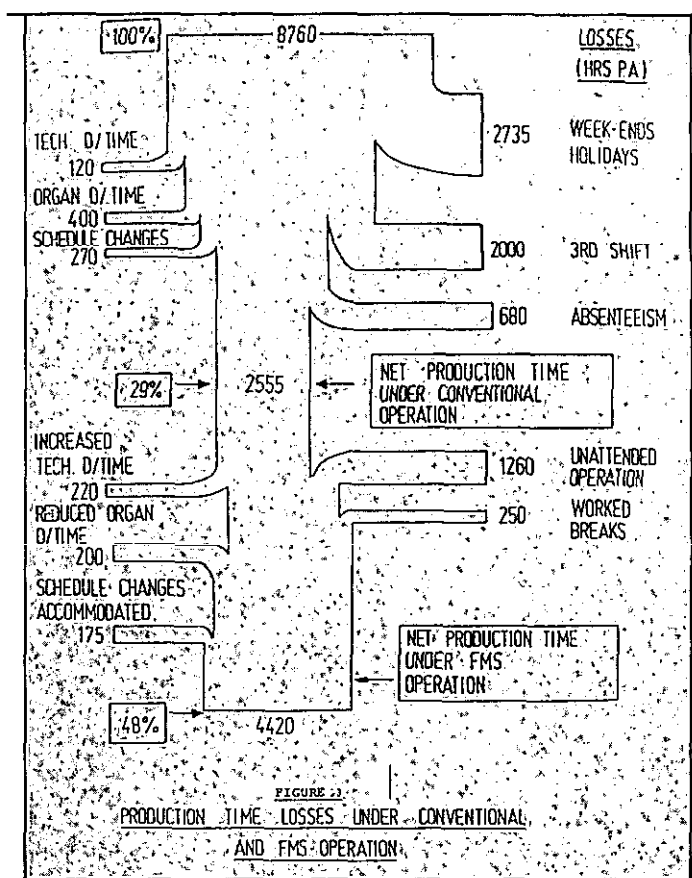


FIGURE 3. PRODUCTION TIME LOSSES UNDER CONVENTIONAL AND FMS OPERATION.

is the priority order in your business for the sequence of implementation. It is no accident that Japanese companies using JIT in high volume standard product systems are looking to MRPII to meet other requirements and that U.K. companies using MRP in the special products business are looking to JIT methods to improve material flow. The 'ultimate' approach is to my mind the happy co-existence of MRP/JIT/CIM using OPT type scheduling, which if you think about it will actually be a hell of a lot simpler than any one of them on their own!!

(This article is continued in the next issue of CONTROL)

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