

# Teaching Manufacturing Strategy

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*The struggle for survival of giant manufacturing companies has become part of everyday life in the 1980s. Production decision-making in manufacturing industries has not changed to meet new challenges. Part of this failure to change and provide the manufacturing perspectives within the corporate strategy resolution is the lack of a language and the failure to develop the necessary concepts within the manufacturing function. This paper is designed to stimulate teaching interest in this important field and to encourage those involved to develop programmes whose structure, content and style match the learning requirements of those concerned.*

## Introduction

In the 1980s, there has been a noticeable change in the level of interest shown by businessmen and academics towards the subject area of production/operations management (POM). Stimulated by the impact of world competition, companies are increasingly recognising the contribution which POM can make to the success of their business. Led by the notable examples of Japan, West Germany and France, it has become clear that many markets are being won and retained not by the contribution of marketing endeavours alone but by a combined strategy which embraces the perspectives of marketing and manufacturing in the drive for market share.

A principal by-product of this change in strategic awareness is the increasing attention which has been given to manufacturing strategy. Late in the field, it is currently under-developed. It lacks language. It is short of ways to explain the strategic implications for manufacturing of corporate marketing decisions. Industry is looking, in part, to the academic world to contribute to the development of the required conceptual base. The demand for manufacturing strategy courses, and appropriate inputs into general management courses is high and is growing. Caught in the age-old dilemma of balancing short-term teaching commitments and administrative responsibilities with the need for teaching and material development, faculty often find it difficult to review progress and shine the light ahead. This paper is intended to go some way towards such a review and to help teachers to undertake these essential developments. It comprises, therefore, an outline of some of the issues involved and general indicators on some of the teaching points to watch for.

### Define the Boundaries

As with any other area, one of the first tasks before teaching manufacturing strategy is to define the boundaries involved. Until, and unless, a clear understanding has been reached of what the area comprises then clear direction in course construction will be difficult to achieve. As an area which is in the early stages of development (there are only a small number of relevant articles and even fewer books — listed at the end of this article) the task of defining what comprises strategy teaching in manufacturing is difficult to establish.

A helpful summary is provided by striking the difference between *operational efficiency* as opposed to *strategic effectiveness*. The manufacturing contribution to corporate strategy is, and has traditionally been perceived as, achieving operational improvements. Maximum efficiency or engineering perfection are typically what constitutes manufacturing's corporate contribution in the view of most executives. However, manufacturing strategy provides much more than this by bringing a coherent thrust within manufacturing and raising the level at which this is agreed and implemented. It represents a co-ordinated approach which strives to achieve consistency between functional capabilities and policies and the agreed current and future competitive advantage necessary for success in the market place.

As it does for many executives, the difficulty of changing from operational issues to strategic thinking presents many problems for the POM teacher. To teach at the strategic level requires a clear separation of aims and objectives so that the basis for selecting relevant material and issues for discussion can be clearly differentiated. This is not only essential for sound teaching but is also a prerequisite to avoid distractors in the learning process. Failure to establish and maintain this differentiation will create problems not only for the teacher but, more importantly, for the class participants. Manufacturing strategy in the classroom, and in reality, may often be little more than what is currently taught or provided under another title. POM and strategy issues and perspectives need, therefore, to be clearly distinguished.

Manufacturing strategy entails one of two basic forms.

- The first is the provision of manufacturing processes which will give the business a distinct advantage in the market place. In this way manufacturing will offer to provide a marketing edge through the adoption of distinct, unique technology developments in its process and manufacturing operations which competitors are unable to match. This edge can manifest itself in several ways. An example would be a stepped reduction in manufacturing costs or the ability to manufacture products at a level of quality which is distinctly superior to that produced by existing processes.
- The second is the provision of co-ordinated manufacturing support for the essential ways in which products win orders in the market place at a level which is better than its competitors are able to achieve[1].

An extension of the latter strategic approach is available through a company's systematic exploitation of any spin-offs available as by-products of the choice of manufacturing process and/or infrastructure it has adopted or is considering adopting. Examples are selling speed-of-response-time to meet customers' requests for new

designs or modifications to existing designs available with computer-aided design facilities, and recognising the improved delivery speed opportunities which go hand-in-hand with numerically-controlled machine investments. In these situations, companies can and should build on this opportunity by assessing the viability of making or selling products where the order-winning criteria fit the alternative market segments under review. However, where this potential enters the strategy decision-making arena, and is likely to form part of the strategic evaluation, then it is most important to ensure that the spin-offs are marketable, and not just theoretical, and can be provided by the process/infrastructure under review.

It is important, therefore, to distinguish between these two aspects in order to appreciate which perspective is being taught. As most companies do not have superior technology (i.e., most companies' competitors can purchase the same technology themselves) then the emphasis in course construction must arguably reflect this and concentrate attention on the second facet.

#### **Establish the Course Orientation, Predominant Level of Learning and Course Aims**

As mentioned earlier, the difference between POM (reflecting the operational activities) and strategy is a difficult distinction to make in terms both of managing and teaching the overall subject area. A just criticism of many production/operations managers is that they singularly fail to address the strategic part of their role and spend most of their time on day-to-day matters and tasks. A similar criticism can also be levelled at POM teachers. Caught in the difficulties associated with any developing area, they are often trapped in the position of addressing operational issues with strategic overtones; the mutton-dressed-as-lamb syndrome. It is clearly mandatory that good POM issues are not thought to have become strategic because the course or session title has been changed. It is essential to teach well both POM and strategy. To achieve this it is necessary for them each to have their own distinct orientation and for the teaching material selection to reflect this.

A second issue concerns the level of learning which the course should be designed to achieve. It should be recognised that strategic formulation is associated with the higher levels of learning, illustrated in Table I, and this should be an important factor in course design, whether for POM or manufacturing strategy.

**Table I. The Levels of Learning\***

Increasingly higher levels of learning	Levels of learning	Description
↑	Evaluation	Appraise, compare, conclude, interpret and explain
	Synthesis	Classify, compile, reorganise, formulate, reconstruct and substitute
	Analysis	Select, separate and distinguish
	Application	Relate, use and prepare
	Understanding	Explain, generalise, infer, summarise and estimate
	Knowledge	Know, identify, list, name and outline

\*Taken from Bloom and Krathwohl[2].

The final issue is to clarify the course aims and session objectives. Because of the need to establish and to comprehend the boundaries of manufacturing strategy which are to be embraced by a programme, only once the aims are set can individual session objectives then be decided. Following on from the last point, the emphasis in a strategy course needs to be on the application of knowledge and the evaluation of the issues, options and alternatives under review at the corporate level. With aims and objectives therefore clearly in mind, the teaching approach and material selection can then be determined accordingly.

### **Appropriate Areas of Teaching**

It is important to recognise that the teaching of manufacturing strategy will be more appropriate at some levels of study than others, and that there is a range of approaches to be considered at each level. Reviewing the degree of relevance and the alternatives for undergraduate, postgraduate and post-experience courses will help to distinguish these differences.

#### *Undergraduate*

As a rule it will not be appropriate to teach a full course in manufacturing strategy at the undergraduate level. However, it has been found to be most valuable to use an introductory strategy case to whet the appetite as well as to illustrate the link between production and the business as a whole. In addition, one or two linked sessions between, for example, a production/operations analysis course and a corporate planning or strategic orientated course have merit for students at this level.

#### *Postgraduate*

Manufacturing strategy forms an important and integral part of any relevant postgraduate programme. Its natural position within (say) a taught MBA programme is following the functional and discipline based courses (including production/operations management) and congruent with other strategically orientated teaching. Although many participants remark that teaching strategy would have proved most beneficial before studying the POM perspectives, it is important to differentiate between learning enhanced by completing the circle and as a consequence of reinforcement, and that has to do with course positioning and appropriateness. It is considered that operational understanding, especially since many students will be new to POM, needs to precede the strategic review.

#### *Post-experience*

Manufacturing strategy inputs into post-experience courses vary in terms of the level of participants' experience and corporate position and the number of sessions allocated within the area.

Traditionally, the programme allocation for the subject area covered by POM teaching in these types of courses has tended to be inadequate in time and makeshift in terms of position. Although expediency may initially exclude choice, the inherent importance and growing recognition of the critical nature of manufacturing strategy inputs, particularly within post-experience courses of a general management nature, are such that the second time round sees marked changes in attitude and subsequent

programme redevelopment. The need for adequate time is self-explanatory. The need for appropriate positioning is less obvious.

A substantial element of manufacturing strategy teaching is linked to the corporate marketing decisions of a business. It has been found that significant gains are to be made when the relevant inputs on these latter issues precede the manufacturing inputs. These gains come in the form of:

- enabling the participants to review the build-up of corporate strategy development in a coherent way;
- providing strategy background in terms of content and orientation which prepares participants for greater acceptance and recognition of the manufacturing perspective; and
- following the normal progression of the in-house corporate strategy debate and the procedure which is advocated later for the resolution of manufacturing strategy.

Given this scenario, manufacturing strategy is often best taught towards the end of the programme and as the last, strategic, functional input prior to the corporate strategy overview.

#### **Some Basic Teaching Issues**

At all levels of teaching it is most important to provide the POM inputs first and the manufacturing strategy concepts afterwards, except where a strategy input is being provided as an introductory, front-end session similar to the undergraduate suggestions given earlier. Where time constraints put pressure on session content, it is often helpful to differentiate between essential concepts and application detail. Particularly at the post-experience level, time pressures are often best handled by providing a comprehensive overview of strategy reinforced by substantial examples of its applications. Staying at the conceptual level and using cases to reinforce and illustrate these issues has been found to enhance the participants' learning, particularly in a post-experience programme where time is short.

The course structure we have adopted is to examine first the overall approach to the development of a manufacturing strategy. Using the framework provided as Table II, the steps involved are often best taught initially through a lecture/discussion format and then reinforced by the use of a number of case studies, as time allows.

Although largely self-explanatory, experience has shown that an explanation of the five steps embodied in this approach proves worthwhile at this introductory stage. When handling this session it makes most sense to start at the right side of the framework by highlighting the fact that the objective is to produce a manufacturing strategy for a business (Steps 4 and 5). In all instances, this will comprise a review of existing products and a review of proposed product introductions. Both will be based upon current and future market expectations. As manufacturing needs to support each product over the whole and not just part of its life cycle, it is this total decision which the business needs to consider. As product requirements change, so will manufacturing's task. The range of support requirements, therefore, will invariably affect the choice of process (Step 4) and infrastructure (Step 5) considered appropriate for the business.

However, to get to Stages 4 and 5 the earlier three steps need to be taken. With some understanding of what is to be achieved in a manufacturing strategy statement, it is now opportune to go through each step in turn and to explain how the necessary inter-relation between these parts comes together.

**Table II.**  
**Framework for Reflecting Manufacturing Policy Issues in Corporate Decisions[3]**

Corporate objectives	Marketing strategy	How do products win orders in the market place?	Manufacturing strategy Process	Infrastructure
<i>Step 1</i>	<i>Step 2</i>	<i>Step 3</i>	<i>Step 4</i>	<i>Step 5</i>
<ul style="list-style-type: none"> <li>● Objectives</li> <li>● Growth</li> <li>● Profit</li> <li>● ROI</li> <li>● Other financial measures</li> </ul>	<ul style="list-style-type: none"> <li>● Product markets and segments</li> <li>● Range</li> <li>● Mix</li> <li>● Volumes</li> <li>● Standardisation versus customisation</li> <li>● Level of innovation</li> <li>● Leader versus follower alternatives</li> </ul>	<ul style="list-style-type: none"> <li>● Price</li> <li>● Quality</li> <li>● Delivery               <ul style="list-style-type: none"> <li>— speed</li> <li>— reliability</li> </ul> </li> <li>● Colour range</li> <li>● Product range</li> <li>● Design leadership</li> </ul>	<ul style="list-style-type: none"> <li>● Choice of alternative processes</li> <li>● Trade-offs embodied in the process choice</li> <li>● Role of inventory in the process configuration</li> </ul>	<ul style="list-style-type: none"> <li>● Function support</li> <li>● Manufacturing systems</li> <li>● Controls and procedures</li> <li>● Work structuring</li> <li>● Organisational structure</li> </ul>

Note: Although the steps to be followed are given as finite points in a stated procedure, in reality the process will involve statement and restatement, for several of these aspects will impinge on each other.

### *Step 1. Corporate Objectives*

For each business, the objectives will be different in nature and emphasis. They will reflect the nature of the economy, markets, opportunity and judgements of those involved. Typical measures concern profit in relation to sales and investments, together with targets for growth in absolute terms or with regard to market share.

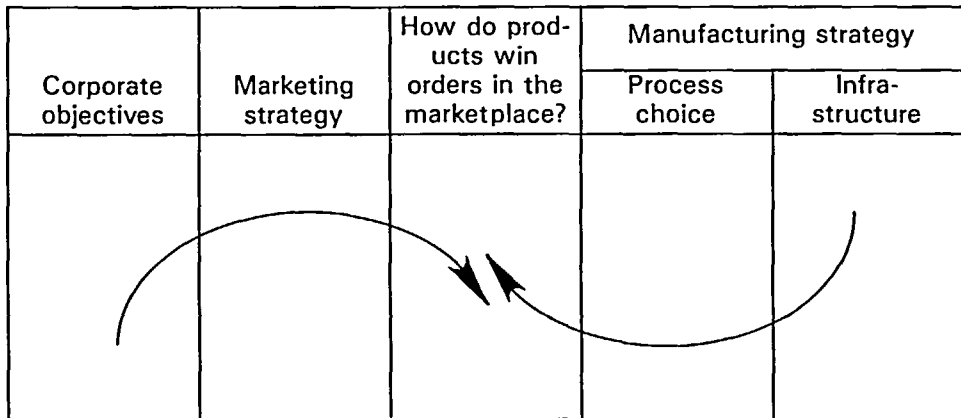
### *Step 2. Marketing Strategy*

Linking closely to the provision of the agreed corporate objectives, a marketing strategy needs to be developed and will usually include statements concerning product market and segments, product range and mix, volumes and level of innovation.

### *Step 3. How do Products Win Orders in the Market Place?*

Manufacturing's task is to provide those criteria which win orders in the market place better than its competitors' manufacturing functions are able to do. This step is the essential link between corporate marketing's proposals and commitments and the manufacturing processes and infrastructure necessary to support them (Figure 1).

**Figure 1. How Order-winning Criteria Link Corporate Marketing Decisions with Manufacturing Strategy[4]**



The procedure requires marketing to review all current and proposed products, divide them into types having similar order-winning characteristics and to provide actual and forecast sales volumes for each product. Because companies commit themselves to selling and manufacturing a product over a period of time and not just in the current year, future time periods need to be chosen which are appropriate to the business itself. When this information has been gathered, marketing has to award percentages to each relevant order-winning factor with weighted percentages being assessed for both current and relevant future time periods.

#### *Qualifying and Order-winning Criteria*

It is important when discussing the order-winning criteria to distinguish between those which win orders in the market place and those which qualify the product to be there. The implications for manufacturing are that certain market criteria win orders whilst others qualify them for being in the market place. For manufacturing it means that it must provide the qualifying criteria in order to enter or stay in the market place. But these will not win orders. They merely prevent a company losing orders to its competitors. Once the qualifying criteria have been achieved, manufacturing has to turn its attention to ways in which orders are won and then aim to provide these better than anyone else.

#### *Step 4. Process Choice*

Manufacturing can choose from a number of alternative processes in order to make the product involved. There are five conventional processes which can be adopted (namely, Project, Jobbing, Batch, Line and Continuous Process) together with a number of hybrids and a range of numerically-controlled alternatives. Each option embodies a set of distinct trade-offs for a business which need to be understood when considering these major investment decisions. These are the subject of *Process Choice*[5].

**Step 5. Manufacturing Infrastructure**

This involves a company in developing the appropriate controls, procedures, payment systems, work structuring alternatives, organisational issues and so on, involved in the non-process aspects of manufacturing to meet the order-winning criteria in the market place.

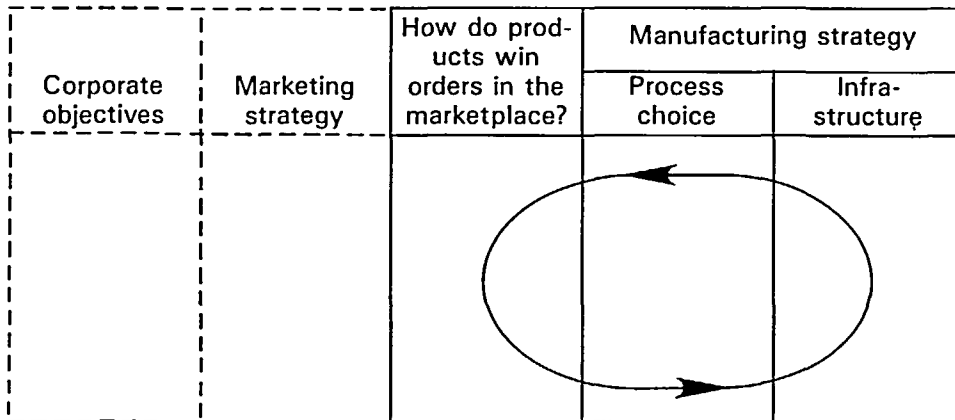
**Developing Key Issues within a Teaching Programme**

Working within the time constraints of a given teaching programme, a selection of the following key issues within manufacturing strategy needs to be made in line with the aims of each course, programme or seminar and the objectives agreed for each subject area.

***The Implications of Corporate Marketing Decisions***

There are two outputs which directly accrue from the framework provided in Table II. It is essential in a postgraduate course to teach both these concepts through appropriate case studies. This is not only to reinforce the principles embodied in its formulation but also to illustrate the integrated nature of strategy resolution and to demonstrate the obvious, but too often ignored, and fundamental nature of manufacturing's essential contribution to a successful business strategy. However, in a post-experience situation where the session allocation is usually significantly restricted it is often more effective to use the time available to address some of the issues listed later whilst ensuring that the order-winning aspects are deliberately reinforced as an integral part of one or more of the sessions chosen. This should obviously be reflected in the choice of teaching material.

**Figure 2. Assessing the Implications for Manufacturing Processes and Infrastructure of Order-winning Criteria[6]**



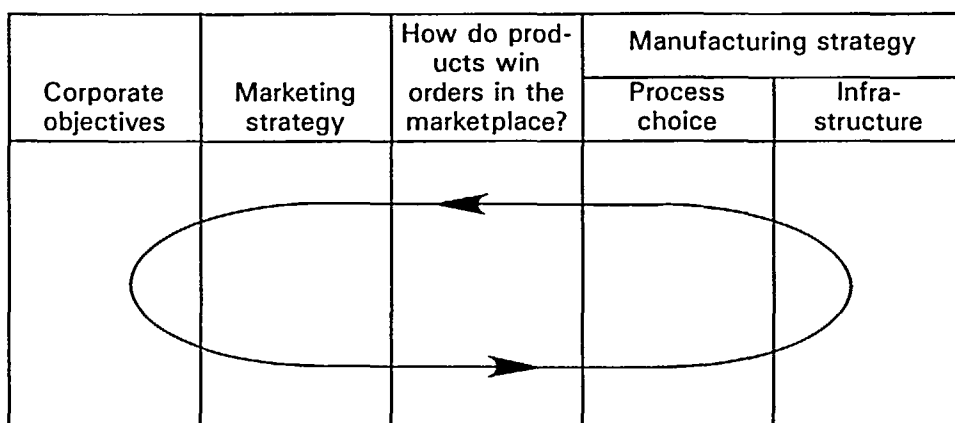
Figures 2 and 3 represent the two outputs referred to earlier in terms of manufacturing supporting the order-winning criteria of different products over a relevant time



horizon. Figure 2 concerns the manufacturing review of the implications for manufacturing processes and infrastructure support for current and future products and volumes. This will result in an assessment of the degree of match between what exists in manufacturing and those processes and infrastructure features needed to provide the relevant order-winning criteria.

The second output is that, having determined the manufacturing strategy position and the necessary investments and time periods for change involved, these now form part of the corporate strategy debate illustrated in Figure 3.

**Figure 3. Manufacturing's Input into the Corporate Strategy Debate[7]**



The consequences are that the company as a whole is now required to review the business in both marketing and manufacturing terms. In this way it changes the style and substance of corporate decisions from functionally-based argument and perspectives to those which resolve functional differences by deciding between various trade-offs at the business level.

#### *Process Choice*

Step 4 in Table II concerns the important strategy issue of determining the process in which it is most suitable to invest. Past corporate procedures have tended to make production engineering or similar functions the custodians of this choice.

However, this decision should not be regarded as having an engineering solution. It is not a question of what is best in engineering terms. The decision must be based on what is best for the business today and tomorrow. Linked to the order-winning criteria associated with each product or set of products, an assessment needs to be made of any current and any proposed corporate investment in terms of the trade-offs embodied in each choice.

Linked to volumes, processes are chosen in the light of sales forecasts. However, businesses need to be fully aware of the trade-offs involved in the areas of products and markets, manufacturing, investment and cost, and organisational infrastructure

which are embodied in that investment. The important trade-offs which exist concern the business implications inherent within each process alternative. For, whilst many processes can meet the engineering/functional needs of products, alternative ways of manufacturing them will have their own distinct sets of business implications. As processes normally involve high investment and take years to change, companies need to be fully aware of these trade-offs and how well they meet the needs of the market place currently and may meet them in the future.

#### *Focus*

It is most important that manufacturing units are configured by the grouping together of like tasks. In many situations the assumption has been made that demands on manufacturing are the same over time or are similar from one product to another. This is not so. The way in which orders are won in the market place is different from product to product and for one product over its life cycle.

In order to ensure that these differences are well understood, the concept of product and process focus (and the potential for a company to undertake actions which will lead to focus progression or regression) are of paramount importance and need to feature in appropriate teaching sessions.

#### *Process Positioning*

An important facet of a company's manufacturing strategy concerns the question of process position. This comprises the width of a firm's internal span of process, the degree and direction of vertical integration alternatives and its links and relationships at either end of the process spectrum with suppliers, distributors and customers. The process positioning decision therefore, has major ramifications within the business itself.

In order to highlight the strategic strength or weakness of a company's process position it is necessary to highlight not only the critical nature of this issue with regard to growth or survival but also the possible restrictive nature of investments in terms of their size and lead time.

#### *Manufacturing Infrastructure*

The need for a business to resolve the issues of process choice in line with the manufacturing strategy requirement has been given the greatest emphasis so far. However, the task facing manufacturing is not simply based upon the process choice; when this has been analysed and the trade-offs reconciled, the emphasis shifts. It now becomes equally important to ensure that the structure and composition of the component parts or functions which provide the systems and communications within a manufacturing company are developed in line with the strategy requirements.

These structures, controls, procedures and other systems are collectively known as the manufacturing infrastructure. It is important, therefore, that the teaching of manufacturing strategy places equal stress on all elements of this function, including the controls, procedures, systems and communications combined with the attitudes, experience and skills of the people involved. Together these form the infrastructure and constitute an essential part of manufacturing's support in achieving the corporate objectives agreed for a business.

### Concluding Thoughts

The POM subject area is wide ranging and is relatively under-resourced in educational and training institutions. When this is recognised then one of the most important tasks facing teachers is the pooling of ideas and approaches within the various aspects of the subject. This paper is an attempt to start the ball rolling in manufacturing strategy, an area chosen because of its growing importance and the inherent interest executives and students show in the concepts and issues involved; it is an invitation to others to contribute to the pool of ideas.

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