

**"FMS AS INDICATOR
OF MANUFACTURING STRATEGY"**

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Abstract

Statistical analysis of questionnaire data from 163 large European manufacturers show that those who put high emphasis on the development of Flexible Manufacturing Systems (FMS) also pay more attention to many other elements in the management of their production systems. Authors suggest that FMS is being used, apart from its technological benefits, as a managerial tool for pushing new modes of thinking and performance in production, with the underlying objective of upgrading the strategic role of manufacturing in the company.

FMS AS INDICATOR OF MANUFACTURING STRATEGY

Our aim in this paper is to show the link between a firm's efforts towards development of Flexible Manufacturing Systems (FMS) and its manufacturing strategy. FMS has received increasing attention in recent years [Gold (1982), Gerwin (1982), Voss (1986), Jaikumar (1986), Ferdows and Skinner (1986)]. There is a consensus in the literature that flexible manufacturing, by definition, is a relative concept. It means being able to react faster and at less costs than competitors to changes in the marketplace (requiring different product mix, volume, delivery quantities and lead times, or new designs) or in production factor inputs (i.e., changes in costs or availability of materials, labour, equipment, and energy). Investment in FMS can therefore be regarded as an improvement programme much like many other programmes launched in production. However, the rise of interest in FMS seems to be coinciding with another trend which is intriguing.

In recent years we have also witnessed a growing interest in the reevaluation of the potential contribution of the manufacturing function towards corporate performance. Many authors have argued that a carefully formulated manufacturing strategy can change the role of the manufacturing function from being a restricting factor to a "spearhead" in a tough competitive environment [Skinner (1985), Hayes and Wheelwright (1984), Hill (1985), Schonberger (1986)]. To do that, the firm must develop unique capabilities in its manufacturing function--i.e., capabilities which are not easily matched by competitors. The intriguing question is the relationship between this "reawakening" to the strategic role of manufacturing and the increasing attention paid to FMS: Are the firms which are investing in FMS driven primarily by strategic concerns, or are they merely embarking on another

programme to improve manufacturing efficiency? In this paper we have used the empirical data collected in the 1985 European Manufacturing Futures Survey to answer this question.

DATA

Manufacturing Futures are a series of annual surveys of large manufacturers in Europe, North America, and Japan which have been conducted since 1983 by INSEAD (Europe), Boston University (North America), and Waseda University (Japan). Each survey consists of a detailed questionnaire which is sent to the 800-1000 largest manufacturers in each region. Between 15% to 20% have responded each year [see Ferdows et al (1986) for more information]. The data used in this paper are from the 1985 European survey.

One hundred and sixty three manufacturers from thirteen European countries responded to the 1985 European survey. Table 1 shows the breakdown by country; Table 2 shows the breakdown by industry.

TABLE 1

Number of Respondents by Country

United Kingdom	33	Spain	12	Ireland	2
Germany	31	Belgium	11	Austria	1
France	21	Sweden	5	Finland	1
Italy	19	Denmark	5		
Netherlands	19	Switzerland	5	<hr/>	
				Total	163

TABLE 2

Classification by Industry Groups

Electronics and Instruments	22 Respondents
Chemicals	36
Machinery	28
Electromechanical Assembly	34
Consumer Non-Durables	25
Other	18
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Total	163 Respondents

As it can be seen from the tables, no industry groups or countries dominate the sample.

METHODS

The sample was divided into two groups: The "FMS Group" and the rest. The basis for the division was simply the degree of emphasis which the respondent was placing on the development of FMS in the next two years. One of the questions in the questionnaire specifically asked for an indication of this on a five point scale, ranging from "1: no emphasis" to "5: critical emphasis." Those indicating a score of 4 or 5 were put in the FMS Group.

The FMS Group was then compared to the total sample along a multitude of dimensions and attributes (detailed list later). The null hypotheses for all the comparisons were that there were no differences between the FMS Group and the total sample. The null hypotheses were rejected at 5 % significance level in two-tail t tests.

The next step was to look into the number and nature of the rejected hypotheses. Did they amount to an overall effort to upgrade the manufacturing function in the company, or was emphasis of FMS an isolated effort? This last analysis formed the basis of our conclusions.

RESULTS

The FMS Group consisted of 63 respondents (of the total sample of 163). No statistically significant concentration of any industry group or production process (from batch to continuous flow) could be detected in the Group. These indicate that emphasis of FMS is not necessarily specific to certain industries or production processes.

A section of the questionnaire was designed to gauge the importance of eight different competitive priorities to the company. The eight included flexibility related priorities such as ability to deal with rapid changes in production volumes or product designs. A priori, one expects the FMS Group to put higher emphasis on the flexibility related priorities. But the t tests do not show a significant difference there. The t tests show a significant difference only along one competitive priority:

The FMS Group place a greater importance on high performance products-- i.e., they put greater emphasis on adding more features and value to the products that they produce.

Another section of the questionnaire asked for the current concerns of the senior manufacturing manager. A list of 34 items potential concerns--such as high or rising overhead costs, direct labour productivity, rejects, poor sales forecasts, availability of qualified supervisors, and alike--was presented in this section, and the respondents could add more. Compared to the total sample, the FMS Group show a higher concern (again at 5% significance in a two-tail t test) over three items:

The FMS Group are more concerned with long production lead times.

The FMS Group are more concerned with insufficient manufacturing capacity.

The FMS Group are more concerned with direct labour absenteeism.

The concern over long production lead times is logical, and an indication that a drive behind FMS is to reduce the production cycle time, thereby increasing the ability of the production system to react faster to market fluctuations and changing trends.

The concern over insufficient manufacturing capacity requires a closer examination. The FMS Group must be operating closer to capacity. If new capacity has to be added, FMS provide an attractive alternative. If the variety and complexity of the firm's products are using up scarce manufacturing capacity, (and as we saw before, these firms are placing a higher priority on adding even more features to their products and moving closer to premium products) then FMS provides a solution. Either case, or both, explain why the FMS Group show a greater concern over insufficiency of manufacturing capacity.

A corollary to this is that those with excess manufacturing capacity are less likely to be emphasizing FMS. This is not derived from our data, but makes intuitive sense.

The concern over absenteeism, in our view, does not provide important insights on why FMS should be emphasized. One can merely say that it is consistent with being also concerned with insufficient manufacturing capacity.

In another part of the questionnaire the respondents were asked to indicate the degree of emphasis that they were placing on various improvement programmes in manufacturing. A list of 36 items was provided and the

respondents could add more. The results of the two-tail t tests for all 36 items are shown in Table 3. As it can be seen in Table 3, at 5% significance level, FMS Group is placing greater emphasis on 16 programmes; and this is not at the expense of putting less emphasis on any of the other 21 programmes. In other words, the FMS Group is generally pursuing improvement programmes in manufacturing more aggressively.

We have grouped the 16 programmes on which the FMS Group is placing a greater emphasis into five categories as described below:

The FMS Group is paying more attention to management of production flow.

They are putting more emphasis on programmes for "reduction of lead times," "reduction of set up times," and "production and inventory control systems."

The FMS Group is paying more attention to quality.

"Zero Defects," "Quality Circles," and "vendor quality" programmes are more emphasized by them.

The FMS Group is paying more attention to labour on the factory floor.

They are "training supervisors," "motivating direct labour," and "changing labour-management relationships" more than the average respondent.

The FMS Group is paying more attention to production technology.

More "computer aided design (CAD)," "computer aided manufacturing (CAM)," "automation of jobs," "Group Technology," and generally

"development of new production processes for new products" are indicated by the FMS Group.

The FMS Group is paying more attention to redefining the strategic role of manufacturing.

They put a higher emphasis on "reorganisation of manufacturing" and "definition of manufacturing strategy."

CONCLUSIONS

The picture that emerges is sharp. Companies emphasizing FMS are working on a broad spectrum of improvement programmes in their manufacturing functions. These programmes focus on almost every element of production management-- production planning and control, quality management, management of workers and shop supervisors,, process technology and automation, and the organisation of production. Through these programmes, they seem to be after the latest ideas, models, and tools in the management of production, for example, Zero Defects, Just-in-Time production, computer aided manufacturing and design, and Quality Circles. In short, those who are emphasizing FMS are also emphasizing many of other things in production.

One explanation for this is that FMS, to be effective, requires adjustments and general upgrading of many elements in production. That is certainly true. But examination of the results we have reported in this paper suggests that the extent of manufacturing improvement efforts undertaken by the companies that are emphasizing FMS go beyond just making the FMS work. Deeper commitments for upgrading the strategic role of manufacturing function in the company seem to be involved. We speculate that management is using FMS as a means for pushing the manufacturing function into new modes of thinking and performance, eventually into a position which provides a definite competitive advantage for the company.

High emphasis of FMS can thus be considered as an indicator of high attention to the manufacturing function in a company (especially under the conditions of tight production capacity). As such, FMS is probably different from many other efficiency and effectiveness improvement programmes which have been introduced in the manufacturing function in the last years. Many such programmes have been introduced usually as remedies or answers to specific problems or competitive challenges. What seems to be different in the case of FMS is that the underlying objective is not only to make the production system more flexible in specific dimensions (of reaction time to scheduling or design changes or disruptions of factor inputs), but to upgrade the overall role of manufacturing in the company.

TABLE 3

Comparison of the Emphasis of Manufacturing Improvement Programmes
FMS Group versus Total Sample

P R O G R A M M E	Significance Level (2-Tail T Test)
Computer aided manufacturing (cam)	0.001
Reorganisation of manufacturing	0.001
Set-up time reduction	0.003
Computer aided design (cad)	0.003
Lead-time reduction	0.004
Production and inventory control systems	0.005
Developing new processes for new products	0.005
Automating jobs	0.006
Supervisory training	0.006
Group technology	0.027
Vendor quality	0.038
Quality Circles	0.044
Changing labour-management relationships	0.046
Zero Defects	0.048
Defining a manufacturing strategy	0.050
Direct labour motivation	0.050
Developing new processes for existing products	0.060
Value analysis	0.067
Integrating manufacturing information systems	0.095
Giving workers broader range of tasks	0.100
Improving maintenance	0.103
Narrowing product lines/standardisation	0.128
Purchasing management	0.150
Introducing robots	0.202
Integrating information systems across functions	0.215
Office automation	0.284
Reducing size of manufacturing units	0.293
Worker safety	0.301
Reconditioning physical plants	0.409
Reducing size of workforce	0.411
Plant relocation	0.414
Capacity expansion	0.453
Giving workers more planning responsibilities	0.468
Statistical quality control--process	0.685
Statistical quality control--product	0.813
Closing plants	0.891

Note:

FMS Group average score for all items was greater than the average for the total sample.

Source: 1985 Survey of European Manufacturers (Manufacturing Futures Project)

REFERENCES

- Ferdows, K., & Skinner, W., 1986. **Manufacturing in a new perspective**. Working Paper, INSEAD, Fontainebleau, France.
- Ferdows, K., Miller, J.G., Nakane, J., & Vollmann, T.E. 1986. **Evolving global manufacturing strategies**. Working Paper, Boston University/INSEAD/Waseda University, Graduate School of Management, Boston, MA.
- Gerwin, D., 1982. Do's and don'ts of computerized manufacturing. **Harvard Business Review**, March-April 1982, 107-116.
- Gold, B., 1982. CAM sets new rules for manufacturing. **Harvard Business Review**, November-December 1982, 88-94.
- Hayes, R. H., & Wheelwright, S. C., 1984. **Restoring our competitive edge: Competing through manufacturing**. New York: John Wiley & Sons.
- Hill, T. E., 1985. **Manufacturing strategy**. London: MacMillan.
- Jaikumar, R., 1986. Postindustrial manufacturing. **Harvard Business Review**, November-December 1986, 69-76
- Schonberger, R.J., 1986. **World class manufacturing**. New York: The Free Press.
- Skinner, W., 1985. **Manufacturing: The formidable competitive weapon**. New York: John Wiley & Sons.
- Voss, C.A., 1986. **Managing new manufacturing technologies**. Operations Management Association (available through the Graduate School of Business Administration, Michigan State University, East Lansing, MI).

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