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Flexibility: The Next Competitive Battle: The Manufacturing Futures Survey

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Abstract: Over the past 4 years research teams from INSEAD (Fontainebleau), Boston University and Waseda University (Tokyo) have administered a yearly survey on the manufacturing strategy of the large manufacturers of the three industrialized regions of the world. In this paper the results for the 1986 survey are compared. One of the most striking results of that year's survey is the emphasis some of the more advanced manufacturers put on their efforts to overcome the trade-off between flexibility and cost efficiency. In particular for the Japanese respondents these attempts become clear. Europeans and North Americans are not yet seizing the opportunity to cut costs through rapid production and design changes, and are focusing more on traditional cost reduction programmes and the improvement of quality. This might mean that they are preparing the basis on which they can build to obtain added value from flexible automation. If this is the case then the Japanese are clearly ahead.

INTRODUCTION

Over the past decade, interest in the use of manufacturing and manufacturing strategy as a competitive weapon has gradually been rising. Managers and management scholars have discovered that the company's technologies in general, and particularly those relating to manufacturing, are not neutral in the determination and implementation of a company's strategy. The works of Skinner (1985), Hayes and Wheelwright (1984) and Hill (1984) have greatly contributed to a better understanding of what the issues, questions and variables are when defining and implementing a manufacturing strategy.

Most of this work is based on experience and cases. As a consequence the majority of the results demonstrate a deep insight, but can be challenged when generalizations are derived from them. To complement this type of work, since 1983, research teams at INSEAD (Fontainebleau, France), Boston University (Boston, U.S.A.) and Waseda University (Tokyo, Japan) have been carrying out a yearly 'Manufacturing Futures' survey on large manufacturers. The objective of this research effort has been to understand the competitive environment in which the large manufacturers have to operate, and the types of manufacturing strategies and policies they develop in order to provide a response to this environment.

The goal of the study is not only to examine the state of manufacturing strategy at one particular moment in time or in one particular region, but to collect comparable data over time and in different regions. In this paper the results of the 1986 survey will be discussed, and to some extent compared with the results of previous campaigns (Ferdows *et al.* 1986; De Meyer, 1986b; Miller and Roth, 1986; Nakane, 1986).

METHOD AND SAMPLE DESCRIPTION

The typical respondents to the 1986 Manufacturing Futures questionnaire were senior manufacturing managers or technical officers. The questionnaire focuses on four broad categories of questions. The first group of questions determines the profile of the company or business unit for which the questionnaire is answered. The second group addresses the competitive priorities the respondents will pursue in manufacturing. In the third section the respondents are questioned on their concerns about manufacturing in their company or business unit. The fourth and largest group of questions probe the actions and efforts in which the respondents and their companies or business units firmly intend to invest over the ensuing two years.

The underlying logic of this structure was established in the first survey administered at Boston University in 1982 (Miller, 1982) and is as follows: the profile of the business unit, concerns about manufacturing and the environment as expressed by the senior manufacturing manager, and competitive priorities pursued by the manufacturer interact with each other. Out of this interaction a manufacturing strategy will be determined. This manufacturing strategy will be reflected in the actions and efforts to which the manufacturers have committed themselves.

It is important to understand that the questionnaire does not focus on actions or objectives in the distant future, but attempts to measure the emphasis the respondents will place on certain efforts and actions over the ensuing two years.

The mechanics of the questionnaire are quite simple. In those cases where no exact response is requested, the respondents are invited to indicate their opinion or perception on a five-point scale. In most cases the options on concerns or actions are presented as closed questions. In some questions the possibility is left to add 'other' concerns or actions, etc. In those cases a content analysis was performed to interpret these answers. The number of answers that went beyond the boundaries of the closed question remains very limited.

In 1986, 214 Japanese manufacturers, 186 American manufacturers and 174 European manufacturers responded to the questionnaire. In each region the sample represents a large variety of industries (Table 1) and in the case of Europe, companies from 12 countries participated in the survey.

The particular bias reflected in all three sets of respondents to the questionnaire is that they represent large companies (Table 2). Although average sales figures are difficult to compare, due to the wide fluctuations of dollar, yen and

European currencies, the data in Table 2 indicate that on average the elements of the three samples are fairly comparable. The North American companies tend to be bigger, and in particular have more employees, than their European and Japanese counterparts.

Respondent companies are not only large, but also important manufacturing companies. Total manufacturing costs amount to about two-thirds of the total sales overall. This number is higher in Japan where it becomes almost three-quarters of the total sales. It is slightly lower in North America.

The Japanese spend relatively more on materials and semi-finished goods and components. The European companies have, in relative terms, a higher direct labour cost. The high proportion of overhead costs (absorbing capital equipment, indirect labour and management systems) for the American respondents is striking. Where in a Japanese context only one-sixth of the costs are manufacturing overheads, in the American case almost one-third of the manufacturing costs are allocated to manufacturing overheads. The structure of these manufacturing costs has remained quite stable over the past 4 years.

Table 1. Industry profile of the sample (percentages)

| | Europe | North America | Japan |
|----------------------|--------|---------------|-------|
| Machinery | 23 | 30 | 31 |
| Electronic | 23 | 25 | 30 |
| Consumer | 12 | 9 | 5 |
| Industrial and basic | 42 | 32 | 33 |

Table 2. Respondent Profile

| | Europe | North America | Japan |
|--|--------|---------------|-------|
| Average sales in million US \$ | 689 | 1028 | 1037 |
| Average number of manufacturing employees | 2026 | 4452 | 1840 |
| Percentage of sales for R&D | 4.0 | 4.3 | 3.0 |
| Total manufacturing costs as a percentage of sales | 65.1 | 60.1 | 72.3 |
| <i>Allocation of manufacturing costs (as a percentage of total manufacturing cost)</i> (This table gives the median and not the averages and does not add up to 100%) | | | |
| Materials and components | 50 | 51.3 | 58 |
| Direct labour | 17 | 12 | 15 |
| Energy | 5 | 5 | 4 |
| Manufacturing overheads | 20 | 27 | 16 |

CONCERNS

In order to map the concerns of the manufacturers a list of 34 items was offered. The respondents were asked to indicate on a five-point scale whether each concern was unimportant or very significant.

The European top ten list of concerns (Table 3) can be summarized around four groups. First of all, there is a group of concerns about costs: high or rising overhead and materials costs and high or rising inventories. A second group of concerns relates to the speed of the response to challenges in a turbulent environment: introducing new products on schedule, inability to deliver on time, poor sales forecasts, making new process technology work, and the risk of falling behind in process technology. This is the fastest-rising group of concerns. The technology-related concerns are quite new in the European top concerns. This could be either a genuine concern about the importance of technology or a reflection of a fashion. A third group of concerns is related to people. The only real concern here is the availability of qualified supervisors. Given the European economic context and the current high levels of unemployment, this cannot indicate a lack of people, but must reflect the lack of qualifications. The fourth group of concerns is related to quality. Producing to high quality standards has been very important over the past 4 years. But this concern is not translated in concrete concerns on defects, yield rates, etc.

This last issue is quite different from the Japanese list of concerns, where producing to high quality standards is immediately followed by a concern about yield problems and rejects. This reflects the conviction of the Japanese managers that quality and productivity (yield) are inseparable. Going through the rest of the list of concerns one finds similar worries about qualifications, overheads, inventories and the inability to deliver on time.

The main differences between the Japanese and the North Americans and Europeans are the concern shown for an ageing workforce. When one goes to the eleventh and twelfth concerns, which for the Japanese results are at the same level as the tenth, one can notice a significantly greater concern about excessive engineering changes and overly broad product lines. These concerns have been important for the Japanese over the past 2 years. We interpret this change as an indication of the extent to which market demands for flexible manufacture have upset the traditional formula for productivity improvement in Japan (Ferdows *et al.*, 1986).

North American concerns with quality mirror those of Japan. Indeed 1985 was called the 'year of quality' by the North American research team (Miller and Vollmann, 1985) because the overriding concerns with quality in the U.S. were matched by the actions manufacturers there took to improve it. The U.S. has also been especially

preoccupied with its high overhead costs, compared to its global competitors, as shown by the consistently high ranking given to this item and to ‘indirect labour productivity’. More recently, we see the North Americans increasingly concerned with time. This new and uniquely high concern of the North Americans is shown by the recent high ranking given to concerns about vendor lead times and increasing concern with internal production lead times. We interpret these changes to be an indication of their overall concern with increasing the velocity of the materials flow through the industrial system as a way to decrease inventories, improve quality, and reduce overheads.

The overall picture which emerges from this comparison shows considerable similarities among the regions. The average European, American and Japanese manufacturer is concerned about quality, high indirect and overhead costs and providing a shorter response time to the need for the introduction of new products. Indeed, the respondents compete in the same global economy and have to try to match each others’ strengths and to exploit each others’ weaknesses. Many of these overriding concerns have remained equally important over the past 4 years. This indicates that some manufacturing problems have no easy solution or are, as in the case of costs of quality, moving targets. It also shows that though the measures taken to remedy these concerns are consistent and appropriate, results are not easily obtained.

Having said this, there remain important differences between the different regions. The strong technology orientation and the worry about the reaction time to market demands are typically European. Problems associated with an ageing workforce, and increasing complexity associated with a broader range of products and production processes, seem to get more attention in Japan. Concerns with higher overheads dominate the U.S. scene, along with an increasing concern with vendor lead times.

Table 3. The Most Important Concerns*

| | Europe | North America | Japan |
|----|---|---|--|
| 1 | High or rising overhead costs (1)(2)(1) | Producing to high quality standards (1)(1)(2) | Producing to high quality standards (1)(1)(1) |
| 2 | Producing to high quality standards (2)(1)(1) | High or rising overhead costs (7)(6)(1) | Yield problems and rejects (2)(2)(2) |
| 3 | Introducing new products on schedule (5)(5)(4) | Introducing new products on schedule (8)(7)(4) | Introducing new products on schedule (4)(3)(2) |
| 4 | High or rising material costs (4)(5)(3) | Poor sales forecasts (8)(7)(4) | Availability of qualified supervisors (3)(3)(4) |
| 5 | Availability of qualified supervisors () () (12) | Yield problems and rejects (10)(5)(5) | Falling behind in process technology (4)(5)(4) |
| 6 | Inability to deliver on time (10)() (8) | Making new process technology work () () () | Ageing workforce (8)() (6) |
| 7 | Poor sales forecasts (6)(7)(5) | High or rising material costs () () (10) | Inability to deliver on time (7)(7)(6) |
| 8 | Making new process technology work () () () | Vendor lead times () () () | Availability of qualified workers (8)(5)(10) |
| 9 | Falling behind in process technology () () () | Indirect labour productivity (5)(4)(8) | High or rising overhead costs (8)(9)(10) |
| 10 | High or rising inventories (9)(8)(7) | High or rising inventories () () (9) | High or rising inventories () (9)() |

*The numbers in parentheses indicate the ranking of the ‘concerns’ in 1983, 1984 and 1985 respectively. Where the previous ranking is omitted these concerns did not occur within the first 15 concerns for the given year.

COMPETITIVE PRIORITIES

What kind of priorities do manufacturers pursue in the context of these concerns (Table 4)? The first conclusion one can reach is the remarkable stability of the pattern of competitive priorities in manufacturing over the past 4 years. Our survey results confirm that manufacturing priorities are not that easily changed. The second major finding is the strong similarity between the North American and European list of manufacturing priorities. Both have the same top three priorities: the ability to provide consistent quality, the ability to deliver high-performance products and the ability to be a dependable supplier. For both Europe and North America flexibility either in design or volume remains at the bottom of the list.

Table 4. Competitive priorities* (the ability to provide)

| | Europe | North America | Japan |
|---|--|--|--|
| 1 | Consistent quality (1)(1)(1) | Consistent quality (1)(1)(1) | Low prices (1)(1)(1) |
| 2 | High-performance products (3)(2)(2) | High-performance products (2)(2)(3) | Rapid design changes (2)(2)(2) |
| 3 | Dependable deliveries (2)(3)(3) | Dependable deliveries (3)(3)(2) | Consistent quality (3)(3)(2) |
| 4 | Fast delivery (6)(6)(5) | Low prices (6)(5)(5) | Dependable deliveries (4)(4)(5) |
| 5 | Low prices (5)(5)(6) | Fast delivery (4)(4)(4) | Rapid design changes (6)(6)(6) |
| 6 | Rapid design changes (5)(5)(6) | Rapid design changes (7)(5)(7) | High-performance products (4)(4)(4) |
| 7 | After-sales service (8)(8)(7) | After-sales service (5)(7)(6) | Fast delivery (8)(7)(7) |
| 8 | Rapid volume changes (7)(7)(8) | Rapid volume changes (8)(8)(8) | After-sales service (7)(8)(8) |

*The priorities are listed according to their importance as ranked in the 1986 survey. Numbers within parentheses indicate the ranking of the competitive priorities in the 1983, 1984, 1985 respectively.

The major difference between the Americans and Europeans is that the ability to offer low prices has been steadily increasing as a priority for the Americans over the past 4 years, while it has been decreasing for the Europeans. To some extent this is undoubtedly due to the high dollar exchange rate over these periods. It will be interesting to see whether these trends reverse in 1987-1988. However, the North American team argues that this trend may also be the result of fundamental changes in internal U.S. marketing strategies that seek to offer more value to the customers (Miller and Roth, 1986).

Priorities are quite different for the Japanese respondents. The ability to offer low prices, which in manufacturing means the ability to have low cost production, is Japanese objective number one. This is no recent phenomenon due to the increasing strength of the yen, but has consistently been top priority for the Japanese over the past 4 years. The capacity to deal with rapid design changes comes second. The ability to offer consistent quality comes third. Does this mean that the Japanese have given up on quality? Competitive priorities do not have to be the reflection of existing strengths. It is more probable that their present performance on quality gives them enough lead time over American and European competitors to spend time on overcoming the trade-off between flexibility and cost-efficiency.

The Japanese research team argues this in the following way (Nakane, 1986). Competitive priorities in manufacturing are defined by four dimensions: quality, dependability, cost-efficiency and flexibility. To offer dependability a company needs at least to qualify for a minimum level of quality. To be cost-efficient it has to qualify for a minimum level of quality and dependability. And to become flexible it has to have a minimum level of quality, dependability and cost-efficiency. Thus the Japanese paradigm considers quality, dependability, cost and flexibility as priorities which a firm addresses sequentially over time, rather than as alternative points of emphasis. Given this it appears that Japanese manufacturers have reached an appropriate level of quality, dependability and cost-efficiency to start pursuing flexibility as a competitive priority. This does not mean that they have given up on the other competitive priorities. Quality remains in this context a fundamental priority which enables these companies to focus on enhancing flexibility.

In previous reports these differences have been summarized such that 'Americans and Europeans are trying to overcome what they perceive to be the relative deficiencies of their manufacturing compared with the Japanese, whereas the Japanese, having been successful in both quality and delivery management, are now aiming at developing a new competitive edge, which combines low cost manufacture with flexibility' (Ferdows *et al.*, 1986). One can argue that the decade 1975-85 can be labelled as an era where manufacturers discovered that there was no tradeoff to be made between quality of product and service and the efficiency of the production system, but rather that guaranteeing quality and dependability were a prerequisite to become cost-efficient. The international comparison of the Manufacturing Futures Survey suggests at this point that the decade 1985-95 has the potential of becoming the era where manufacturers will discover that flexibility in all its aspects is not necessarily contradictory with the pursuit of cost-efficiency.

If this hypothesis holds, the Japanese competitors seem to be further down the road in making this 'cost-efficient flexibility' into a reality. The previous analysis of the concerns shows, however, that these leading Japanese manufacturers are also encountering some problems in handling the increased levels of production complexity associated with the implementation of this strategy.

ACTION PLANS

The combination of the respondents' company profiles, the competitive priorities and the internal and external concerns creates fertile soil for interpreting manufacturing policies. These manufacturing policies are translated in the questionnaire into a list of 37 action programmes and efforts. Respondents are asked to indicate the emphasis they will put on implementing each of these programmes over the ensuing 2 years. A 2-year time frame was chosen to avoid the respondents describing their dreams rather than their concrete action plans.

The North Americans seem to have developed consistency between priorities and action plans (Table 5). The three top-rated action plans are all related to quality improvement, and this through improving methods of statistical quality control, creating a different attitude internally through zero defects programmes as well as externally by emphasizing vendor quality. The North American survey has shown that each of these action plans has made a dramatic rise in importance over recent years. The integration of information systems in manufacturing, as well as across functions, has, on the contrary, dropped considerably in importance. This has been interpreted as a rethinking of the proper sequence of improvement in the U.S. (Miller and Roth, 1986). Many Americans saw automation and integrated manufacturing as a quick answer to problems several years ago. Now, after much difficulty in implementation, there seems to be a widespread belief that good quality and short cycle production (just-in-time) must proceed successful automation and system integration.

Consistency between priorities and action plans can also be found in the Japanese responses to the survey. If cost-efficient flexibility is Japanese manufacturers' priority, then they are working on it. The introduction of flexible manufacturing systems, the reduction of the lead times in production, the development of new processes for new products, the reduction of set-up times and giving workers a broader range of tasks all point in the same direction: flexibility. This trend is even stronger in the so-called leadership industries, e.g. high-growth companies

in the electronic industry (Nakane, 1986). The concern about inventories is translated in investments in production and inventory control systems, and the traditional total quality approach is reflected in quality circles and worker safety. The quality circles remain one of Japan's major programmes to increase manufacturing effectiveness, and the number of respondents who intend to create or strengthen quality circle programmes is still increasing. The objectives of these quality circles are not limited to quality improvement. Increasing of productivity and reduction of production costs are equally important goals. Also for Europe one sees a pattern of action plans which is fairly consistent with concerns. Overcoming the cost concerns will be done by automation of jobs, manufacturing reorganization and improvement of production and inventory control systems. Of course one has to motivate the direct labour which is left after this reorganization, and consistent with the lack of qualified supervisors, there is quite a lot of effort going on in supervisor training.

Automation of jobs, and the intention to integrate information systems, in manufacturing as well across the different business functions, shows a major effort with respect to the renewal of the technological base of the European manufacturing companies. In combination with the action plan to reduce the lead time in production, and eventually the intention to put effort into redefining the manufacturing strategy, the European team has explained this interest in technology as a way for European manufacturers to decrease their delivery reaction time. This is consistent with the rising importance of the ability to deliver fast, and the expressed concern about the inability to deliver on time.

The European concern about quality is reflected in the effort going into vendor quality. Though consistency between concerns and action plans appears to exist, one can wonder about the limited consistency between priorities on quality and actions on quality. The European team stresses that precisely on this issue of quality there are differences between companies from the different European countries. In particular in northern Europe and Germany, the emphasis on quality is high, and the actions are in agreement with this emphasis. In France and Italy, on the contrary, there seems to remain a gap between the 'slogans' about quality and the implementation of action plans (De Meyer, 1986b).

Table 5. The ten most important action plans*

| Europe | North America | Japan |
|--|--|--|
| Direct labour motivation (3) | Statistical process control (7) | Flexible manufacturing systems (1) |
| Production and inventory control systems (4) | Zero defects () | Quality circles (3) |
| Automating jobs (2) | Vendor quality (2) | Production and inventory control systems (4) |
| Integrating information systems in manufacturing (1) | Improving new product introduction capability () | Automating jobs (2) |
| Supervisor training (6) | Production and inventory control systems (1) | Lead-time reduction (9) |
| Manufacturing reorganization (10) | Statistical product control () | Introduction of new processes for new products (2) |
| Integrating information systems across functions (7) | Integrating information systems across functions (1) | Reducing set-up time (10) |
| Defining a manufacturing strategy (11) | Developing new processes for new products (10) | Direct labour motivation (8) |
| Lead-time reduction (12) | Direct labour motivation (8) | Worker safety (6) |
| Vendor quality (5) | Lead-time reduction () | Giving workers a broader range of tasks () |

*Numbers in parentheses indicate rank order in 1985. If no rank order is indicated this means that in 1985 the rank order was higher than 12. For previous years these data were collected somewhat differently, and comparisons of rank orders are difficult to make.

REDUCING WORKFORCE

A common theme in all three regions is reductions in workforce due to the programmes identified above, or to other external forces. In North America and Europe especially, there is a concern with implementation of new technologies (Table 3), and much of this concern has to do with the effects of worker displacement.

As is shown in Table 6, materials handling and fabrication are the two areas where most manufacturers who will put more than moderate emphasis on automation will invest. Fabrication is the most important in Europe, materials handling is the most important in North America and Japan. Assembly comes third. Relatively more North American companies see this area as a focus of their automation attention, and this is consistent with their 'just-in-time' thrust.

Table 6. Locus of the automation of jobs (as percentages of the number of respondents putting more than moderate emphasis on automation of jobs)

| Automation of | Europe | North America | Japan |
|--------------------|--------|---------------|-------|
| Materials handling | 48.1 | 58.3 | 42.3 |
| Fabrication | 59.4 | 51.7 | 32.1 |
| Assembly | 34.0 | 43.3 | 32.1 |
| Inspection | 23.6 | 36.7 | 28.6 |
| Clerical | 34.0 | 23.3 | 25.6 |
| Other | 1.9 | 6.7 | 0.0 |

Table 7. Cause of reduction of size of the workforce (as percentages of the respondents who planned a reduction of the workforce)

| Type of reduction | Europe | North America | Japan |
|-------------------|--------|---------------|-------|
| Consolidation | 21.7 | 29.8 | 11.2 |
| Automation | 29.3 | 17.0 | 44.2 |
| Reduced demand | 11.0 | 17.9 | 9.3 |
| Outside sourcing | 12.9 | 8.5 | 8.6 |
| Improved methods | 22.3 | 22.1 | 23.9 |
| Other | 2.5 | 4.0 | 2.5 |

Automation is not the only cause for the reduction of the size of the workforce, though it is the most important in Europe and in Japan. In this last region more than 40 per cent of the reduction of the labour force (if there is any) is due to automation. The only other important factor in workforce reduction is in the improvement of methods. This indicates that in the Japanese context the replacement of labour is really related to improving the manufacturing system. The situation is different when one looks at North America. Though improvement of methods is the second most important factor of the reduction of the workforce, consolidation and reorganization is the most important one. In North America the reduction in the number of workers seems to be due to external business factors, large-scale reorganizations and attempts to reduce excessively high overhead costs, rather than to direct improvements in manufacturing. The European data suggest a situation which is somewhat in between the North American and Japanese.

Reduction of the workforce is only one aspect of people management. The employees one keeps have to be motivated. How does one do it? Which tools are deployed to motivate direct labour (Table 8)? Education, and providing more information, is obviously the most important tool for the Japanese, as well as North American and European manufacturers. Relatively more European respondents seem to believe in financial incentives to motivate direct labour. The North American and Japanese respondents emphasize the strengthening of interpersonal relationships more than the Europeans. Also striking is the Japanese emphasis on improving

physical working conditions. This fits very well their emphasis on the improvement of the manufacturing system as it became clear in previous paragraphs.

Table 8. Most important tools used for direct labour motivation (in % of the people who put more than moderate emphasis on direct labour motivation)

| Tool | Europe | North America | Japan |
|--|--------|---------------|-------|
| Through direct financial incentives | 15.8 | 11.5 | 1.6 |
| Improvement of the physical working conditions | 7.9 | 3.4 | 18.8 |
| Strengthening interpersonal relationships | 16.6 | 25.3 | 20.5 |
| Fringe benefits and job security | 2.3 | 2.3 | 2.9 |
| Educating and informing | 54.8 | 51.7 | 56.0 |
| Other | 2.3 | 5.7 | 0.0 |

VENDOR QUALITY

Since improving vendor quality came up as an important aspect of the quality improvement programmes, especially in North America, it is worth looking at the ways manufacturers intend to do something about it (Table 9). There are still a large number of companies in Europe who believe in the quality ‘policing’ function. Nearly one-sixth of them considers tightening specifications to be an important means of improving the vendor quality. Stressing the importance of quality to the vendor is mentioned by more than 4 out of 10 European respondents. This policing and communication policy is less popular among the North American and Japanese respondents. On the other hand working with vendors on the improvement of process controls is used by almost 60 per cent of the Japanese respondents, and has become the most-used approach in North America. The relation of trust and collaboration between the manufacturer and his vendor seems to be very strong in Japan, and Americans seem to be trying to emulate them. One-sixth of the European and North American respondents who emphasize vendor quality as an important action plan, will engage in joint process and product development work.

Table 9. Ways to improve vendor quality (in % of the respondents who put more than moderate emphasis on improving the vendor quality)

| Planned improvements | Europe | North America | Japan |
|---|--------|---------------|-------|
| Tightening of specifications | 15.4 | 5.8 | 2.2 |
| Communicating the importance of quality to the vendor | 43.3 | 37.4 | 25.5 |
| Working with vendor on process controls | 22.7 | 38.0 | 59.0 |
| Joint work on process & product development | 17.5 | 17.5 | 11.9 |
| Other | 0.8 | 1.3 | 1.1 |

DISCUSSION AND CONCLUSION

To summarize all this, one can compare the consistency between the action plans, concerns and priorities for the average manufacturer in each of the three regions. The Japanese have been fairly consistent over the past 4 years. The North Americans seem to be enjoying a newfound consistency. But the Europeans seem on some points to show less consistency between stated priorities, on the one hand, and concerns and action plans, on the other.

The Japanese respondents are apparently focusing on overcoming the traditional conflict between cost-efficiency and flexibility. How do they justify this objective? The Japanese team summarizes as follows: ‘The results of the [Japanese] manufacturing futures survey seem to indicate that an increasing number of Japanese manufacturers suffer from shortening product life cycles and increasing market/demand fluctuations. To cope with these changes production is required to offer a vast variety of products, designs and volume fluctuations. On top of that one can see that Japanese manufacturing costs as a percentage of sales are the highest of the three

regions. This places a high pressure on Japanese manufacturers to lower their costs. The reaction of the Japanese respondents seems to be to invest heavily in factory automation (flexible manufacturing systems, computer aided design, computer aided manufacturing, introduction of robots, etc.) and to spend a lot of management effort into the increase of design and volume flexibility' (Nakane, 1986). The series of programmes related to the reduction of lead times, the reduction of lot sizes, and the broadening of the workers' task range have become increasingly popular with Japanese manufacturers, and show a deeply rooted strategy on the part of the Japanese manufacturers. But pursuing an objective is, of course, no guarantee of results. The concerns of the Japanese manufacturers indicate that they wrestle on the factory floor with the consequences of that choice: complexity in product range and production process.

The European respondents also seem to be under a strong cost pressure and behave accordingly. They invest in technology, automate, and work on production and inventory control systems. Moreover, they translate their concerns about the need to respond quickly (with their existing products) to a fast-changing market into automation programmes. All this suggests consistency between concerns and action plans, if one believes, as they seem to, that advanced production technology is the best solution to these concerns. But there is less consistency with the competitive priorities expressed by the average European manufacturer. Indeed, lower consistency in the European case is especially clear when it comes to the attitudes surrounding quality. The European respondents assert that quality is objective number one, but do not seem to be doing much to improve it. The European research team has tried to explain this in two ways. One of the reasons for this lower consistency is, of course, the complexity of the European manufacturing landscape. Europe is simply less homogeneous than Japan or North America. Secondly, though European manufacturers seem to understand the need for quality as a precondition to high productivity, they are under considerable pressure from other functions in their companies to carry out short-term cost reduction programmes. This is reflected in the action programmes for the ensuing 2 years.

The North Americans are now focusing heavily on quality. Priorities and actions are very well in line with each other. They seem to be betting that by duplicating the Japanese approach on 'quality first' and 'just-in-time second' they can ultimately position themselves better for technological breakthroughs of the kind the Japanese now appear to be attempting. They seem to understand that doing the basic things right, especially with respect to quality and overall product and process definition, is a prerequisite to successful automation. Flexibility has not yet become a major competitive priority for American manufacturers. Perhaps they are implicitly subscribing to the view that a flexible response to competitive threats is only possible if the basic quality and process problems are solved.

Manufacturers in the three regions each prepare in their own way for the oncoming competitive battles. Though our empirical base is small, as a conclusion we would like to risk formulating the following hypothesis. Those manufacturers in the States and Europe who thought that they would be on a par with their world competitors, once they had overcome the unfavourable exchange rate with the yen and the quality advantage of Japanese products, will come to a new discovery. The next competitive battle will be waged over manufacturers' competence to overcome the age-old trade-off between efficiency and flexibility. Some of the world's best competitors have already moved considerably in that direction and, as the results of the Manufacturing Futures Survey indicate, the average Japanese competitor seems to be farther down the road in implementing this strategy and discovering the problems related to it.

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