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Arnoud De Meyer

Singapore Management University, [arnouddemeyer@smu.edu.sg](mailto:arnouddemeyer@smu.edu.sg)

**DOI:** [https://doi.org/10.1016/0263-2373\(88\)90016-3](https://doi.org/10.1016/0263-2373(88)90016-3)

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### Citation

De Meyer, Arnoud. German, French and British Manufacturing Strategies Compared: A Growth Towards Each Other. (1988).  
*European Management Journal*. 6, (2), 92-101. Research Collection Lee Kong Chian School Of Business.

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# German, French and British Manufacturing Strategies Compared: A Growth Towards Each Other

*Arnoud De Meyer*

*Associate Professor, Technology Management  
Institut Europe'en d'Administration des Affaires (INSEAD)  
Fontainebleau, France*

Definitive version published in *European Management Journal*, Volume 6 (2), Summer 1988, 92–101.  
doi: [10.1016/0263-2373\(88\)90016-3](https://doi.org/10.1016/0263-2373(88)90016-3)

**Abstract:** Manufacturing has gained over the last years in attention as a tool to create competitive advantage. For four years now a survey has been carried out by a research team at Insead to build a database on the manufacturing strategies as they are defined and implemented by large European companies. In this paper some of the 1987 data are presented, and a comparison of manufacturing strategies of large companies in the three most important European countries is made. Though the most important conclusion is that there are only slight differences between the three countries, one can see some difference in emphasis. The French companies seem to invest heavily to catch up with respect to quality, the German manufacturers invest heavily in technology, and the British seem to pay more attention to the improvement of the labour/management relations. The data on the manufacturing strategies of these groups of companies is also analysed in function of an increased need for flexibility, as it was perceived in previous surveys.

## **Introduction**

The strategic use of manufacturing to create a sustainable competitive position has recently received a lot of attention in the trade press (*Business Week*, 1986, 1987; *The Economist*, 1987), and in the more academic literature (Hayes and Wheelwright, 1984; De Meyer and Ferdows, 1987; St John, 1986). At Insead, over the last four years, we have carried out a survey of manufacturing practices in large European companies. This survey, the “Manufacturing Futures Project”, is realized with the collaboration of a Japanese and a US research team.’

In the global report of the 1986 survey (De Meyer, et al., 1987) we concluded that

“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. [. . .] The next competitive battle will be waged over manufacturers’ competence to overcome the age old tradeoff between efficiency and flexibility. Some of the world’s best competitors have already moved considerably in that direction and as the results of the global 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.”

This emphasis on flexibility has been confirmed by other reports (Davis, et al., 1986; Gerwin, 1987). Tombak and De Meyer, 1986) argued on the basis of data from previous surveys that those European companies who intended to invest more in flexible manufacturing systems wanted to do so to reduce uncertainty at the input side rather than at the output side, and focus in particular on reducing the total manufacturing lead-time. It is the objective of this paper to analyse how European companies develop a competitive manufacturing strategy in this environment and to explore whether there are any differences between West German, French and British companies in this respect.

## **Method and Sample**

As is explained in previous papers (De Meyer, 1986; Ferdows, et al., 1987; De Meyer et al., 1987) a questionnaire is sent every year to a sample of large European manufacturers. The questionnaire consists of four main parts: (1) the business profile of the responding unit (either a plant, a business unit or a company); (2) the competitive priorities for the manufacturing function; (3) the concerns for the senior manufacturing manager; and (4) the action plans which have been implemented or will be implemented over the next two years. The logic of this questionnaire lies in the fact that business profile, concerns and competitive priorities form a triad on which the action plans are grafted as symptoms of an underlying manufacturing strategy. In this paper we will only focus on competitive priorities and action plans.

At the end of 1986, the questionnaire was mailed to senior manufacturing managers of about 1000 companies in fourteen European countries. We received 223 answers during the first trimester of 1987. Tables 1 and 2 give the distribution of the sample per country and per customer and/or market focus.

Although the sample is definitely not representative of the European industry, it is not biased towards a particular industry nor country. There is also no significant industry difference between the various European countries represented in the sample.

There is one important bias in the sample. The companies involved tend to be big companies or large business units of big companies. The average of the business unit's sales is 2,888,734 million ECU (exchange rate at 1 January 1987). The manufacturing cost as a percentage of sales is 57.2% (+ 22.2%)\*. Of this total manufacturing cost 52.3% (+ 19.6) is spent on materials, 17.0% (+ 12.3) on direct labour. 5.5% (+ 7.4) on energy and 24.1% (+ 14.1) on manufacturing overhead. Of the total sales 4.8% (+ 5.6) is spent by the business units on research and development. The nationality of each company has no significant influence on any of these figures.

For most of the questions, the respondents had the possibility of indicating a seven point Likert scale to what extent they put emphasis on specific competitive priorities, concerns, action plans, etc. The questions asked during the 1987 campaign were very similar to those asked in previous years. A number of questions on performance were added in 1987. The way in which respondents could answer the questions was changed, however, from a five point continuous scale to the seven point interval scale. This reduces considerably the possibility of making more than qualitative comparisons of the 1987 results with those of previous years.

Since our sample is a composite of a number of countries which have often a different industrial tradition and policy, we decided to study the results for the subsamples of the Federal Republic of Germany, France and the United Kingdom. The rationale behind the choice of these three countries is obvious: they are respectively the third, fourth and fifth industrial nations of the Western World, and they are all three fairly well represented in the

sample. Though we will discuss the results for each of these samples as “German, French and British results”, it is clear that none of them can be really representative for the entire industrial activity in each of these countries. The results are offered here more as hypotheses than as final results.

To compare these three groups, we have assumed that respondents have interpreted the scale from one to seven in the same way, i.e. none of the national groups have a tendency to score consistently higher or lower on a seven point scale. We have indeed tested the hypothesis that the means of the answers to all questions would be different from one nationality to another. This hypothesis has to be rejected.

Table 1 Distribution of Responses by Country

Austria	4	2
Belgium	22	10
Denmark	28	13
United Kingdom	39	18
Finland	8	4
France	26	12
Federal Republic of Germany	41	19
Holland	14	6
Ireland	5	2
Italy	13	6
Norway	1	1
Spain	7	3
Switzerland	7	3
Sweden	7	3
Total	222	100

Table 2 Distribution of the Responses by Customer/Market Focus

Consumer durables	44	20
Consumer non-durables	47	21
Industrial capital goods	58	26
Raw or semi-finished materials	21	10
Components for finished goods	29	13
Industrial supplies/consumables	12	5
Natural resources	1	1
Others	10	4

## Results

### *Business Unit Profile*

Performance of the business units can, in the first place, be measured by net profit and growth as a percentage of sales. The net profit of the business units for which the questionnaire was answered was reported to be 6.1% ( $\pm 6.9$ ) and growth rate in physical units 10.3% ( $\pm 17.0$ ). There is no significant difference between the three national groups with respect to the growth rate. In terms of profit as a percentage of sales, the UK business units report a profit ratio of 9.2%, the French group reports 5.8% and the German group reports 3.9%. The difference is significant on a 5% level. One has to be careful with these results as profits are often, if not always, heavily influenced by tax considerations and public relations *vis-a-vis* the financial community.

Performance of the answering business unit was, therefore, also measured by asking the respondents to indicate for eight performance measures on a seven point scale ranging from significantly below to significantly above the goal, how they performed last year relative to their goals. They were also asked to indicate on a seven point scale going from a significant decrease to a significant increase how the relative performance had changed over the last three years. The eight performance measures are: overall performance, profit, unit production cost, market share, return on investment, inventory, quality and customer service.

Quality and customer service stand out as the two goals where the companies performed best in comparison to their goals. The other parameters all had a very average score (i.e. goals were met) (Table 3a).

The order of relative performance change over the last three years is somewhat different (Table 3a). Overall performance, quality, customer service, and profit have increased in similar ways. This is confirmed by other data elements. While four years ago more than one third of the respondents reported losses, this year only eight of the respondents reported losses. Overall performance and profits have indeed gone up. Quality has been the number one objective of European companies over the last four years (see also 3.2). The efforts related to this goal seem to have been worthwhile.

Table 3a Performance Measures

Rank Order of Last year's Performance as Compared to Goals*	Rank Order of Relative Performance Change over the past 3 years**
Quality	overall performance
Customer service	quality
Unit production cost	customer service
Overall performance	profit
Profit	return on investment
Inventory	market share
Market share	unit production cost
Return on Investment	inventory

\*The average scoring differences between the different performances are very limited. Only the first two stand out on the basis of a Wilcoxon matched pairs signed rank test

\*\*The average scoring differences between the different performances are very limited. The first four are different from the last four on the basis of a Wilcoxon matched pairs signed rank test

Table 3b Differences between National Groups

Last Year's Performance as Compared to Goals	UK	France	Germany
Quality	2	1	3
Customer service	2	1	3
Relative performance change over the past three years			
Unit production cost	2	1	3
customer service	2	1	3

Though there is a slightly significant difference in the way the different performances have changed over the last three years, the differences are far less than in the comparable North American survey (Miller and Roth, 1987). This could lead us to an interesting hypothesis. Rather than trying to spearhead on one of the performance measures, e.g. return or quality, European manufacturers seem to move towards increased competitiveness by improving on all fronts at the same time. This requires probably more time, but could lead in the end to a more solid competitive position.

France, which has not had a very good image in terms of quality and customer service, has done a particularly good job of improving its relative quality performance (Table 3b). On the basis of an analysis of variance, it appears that they have taken a bigger step in improving their quality and customer service over the last years, than the two other groups. One has, of course, to be careful with these results: they do not say anything about the present absolute level of quality and customer service. It is not because the French respondents have improved more than other European manufacturers' quality performance that they are at the same level as for example the German ones.

The performance results as compared to the goals as well as the improvement over the last three years are not uncorrelated. To determine the underlying performance categories, a principal component analysis was calculated on each of the two groups of variables. Two components can explain 57% of the variance in the data regarding the performance as compared to the goals. The first component is a combination of overall performance, profit, unit production cost, market share and return on investment. They indicate the company wide performance. The second factor combines inventory with quality and customer service and indicates some sort of a total quality performance. For the performance changes over the last three years, we need three factors to explain 65%. The first factor combines overall performance, profit, market share and return on investment. The second factor is a total quality factor combining quality with customer service. The third factor is a production cost efficiency factor, combining inventory with unit production cost.

### *Competitive Priorities*

To understand what type of competitive priorities the respondents consider important to build up a sustainable competitive advantage we offered them nine different competitive abilities. For each they could indicate the perceived degree of importance. We also asked the respondents to indicate which gap they perceived between the current and the desired levels with respect to these abilities. For the degree of importance of each of these abilities the seven point interval scale ranged from not important to very important. For the gaps the scale varied from no gap to a large gap. The results for the total sample are given in Table 4a and 4b.

In comparing with previous surveys, it is seen that the ability to provide consistent and reliable quality, dependable delivery promises and high performance products, remain the top priorities for European industry. Second in importance is the ability to offer fast deliveries and to change the production plan quickly. Next, one finds the ability to change designs and to introduce new products quickly and only in the seventh rank one finds the ability to offer low prices. A broad product line and volume flexibility are least important as competitive priorities.

Table 4a Competitive Priorities

Order of Priority for the European Sample*	Order of Priority for**		
	UK	France	FRGermany
Ability to			
1 offer consistent reliable quality	1	1	1
2 make dependable delivery promises	2	2	4
2 provide high performance products	3	2	2
3 provide fast deliveries	6	6	3
4 change production plan quickly	4	4	6
4 change designs rapidly and introduce products quickly	5	4	5
4 offer low prices	7	8	8
5 offer a broad product line	9	7	7
5 make rapid volume changes	8	9	9

\*The numbers indicate which priorities differ from each other on the basis of a Wilcoxon matched pairs signed ranks test (5% level) \*\* I = highest priority, 9 = lowest priority

Table 4b Perceived Gaps in the Abilities (1 = lowest gap, 9 = highest gap)

Order of Priority for the European Sample*	Order of Importance of Perceived Gap**		
	UK	France	FRGermany
Ability to			
1 offer a broad product line	1	1	1
2 provide high performance products	2	2	4
2 offer consistent reliable quality	3	2	2
3 provide fast deliveries	6	6	3
4 change production plan quickly	4	4	6
4 change designs rapidly and introduce products quickly	5	4	5
4 offer low prices	7	8	8
5 offer a broad product line	9	7	7
5 make rapid volume changes	8	9	9

In summary, one sees a decrease of emphasis from a total and dependable quality *vis-a-vis* the customer, over a planning flexibility to cost efficiency and volume flexibility. Though this list of priorities is slightly different from the one proposed to the respondents in previous years, the results show a remarkable stability. Quality has been number one priority over the last four years, and flexibility has always been at the bottom. There has been a trend to decrease the importance of low prices and to put more emphasis on the ability to provide fast deliveries.

When one examines the differences between the German, British and French answers, one would be tempted to conclude that the Germans put less emphasis on the dependability of the deliveries and a bit more on the speed of the deliveries. However, under the assumption that the three nationalities have answered the questionnaire in the same way, the hypotheses that the score for any of these competitive priorities would be different for any nationality has to be rejected on the basis of a one way analysis of variance. The three national groups have the same portfolio of competitive priorities.

A discriminant analysis<sup>3</sup> with the nationality as a dependent variable, and the emphasis placed on the different priorities as independent variables suggests a weak discrimination. On the basis of the canonical discriminant functions, 54% of the cases can be classified correctly. The first discriminant function is highly correlated with the ability to provide high performance products, and fast deliveries. The second function is correlated with the ability to provide dependable deliveries and to offer low prices. There is no possibility to distinguish between French and British on the basis of this discriminant analysis. The Germans stand out slightly (but only on a 5% level of confidence) by scoring high compared with the others on the first function.

The list of perceived gaps between current and desired levels of performance with respect to these competitive priorities is somewhat different from the list of priorities. The three top priorities are equally low when it comes to perceived gaps. The lowest gap is the one between the current level and the desired state of the ability to offer a broad product line. The ability to change quickly the design of the products, or to offer low prices, are not high priorities but also aspects where our respondents feel a large gap between what they want and what they realise today. Here however there are some differences between the three national groups. On the basis of an analysis of variance, and a Tukey range test, it appears that the German respondents perceive less of a gap than their colleagues in the two other countries with respect to their ability to provide consistent and reliable quality and to offer a broad product line. In particular the British respondents see a far larger gap with respect to consistent and reliable quality.

This is, moreover, confirmed by a discriminant analysis with the nationality as a dependent variable and the gap scores as independent variables. More than 58% of the cases can be correctly classified on the basis of the discriminant functions. The first canonical discriminant function (75% of the variance explained) contrasts the gap in the ability to provide consistent and reliable quality and to offer a broad product line with the ability to change the product design quickly. The second canonical discriminant function is highly correlated with the gap concerning the ability to provide dependable delivery promises. Though the separation between the French and the British groups is not significant, the German groups stands out in significant way, by scoring high on the first function and being neutral on the second one. In this way they imply that they perceive less of a gap than the others on the issues positively correlated with the first discriminant function.

As a conclusion one can say that Germans, British and French have a similar portfolio of priorities, with the Germans emphasizing slightly more the ability to provide high performing products and to deliver rapidly. They perceive a smaller gap between current and desired levels with respect to their ability to offer consistent and reliable quality and to offer a broad product line but might have somewhat more problems with changing the product design quickly.

### *Action Plans*

As in previous years the respondents were offered a list of 37 action plans for which they could indicate on a seven point scale which degree of emphasis they had placed on them during the last year and which degree they intend to place on these action plans during the next two years. In table 5 the list of action plans is given in order of degree of emphasis. It is striking to see the number of top action plans related to (1) quality management (zero defects, vendor quality, just-in-time and statistical quality control); (2) increasing the responsiveness to the customers' needs (improving the capability for introducing new products, developing new processes for new processes and manufacturing lead-time reduction) and (3) the integration of information systems in manufacturing as well as across functions. With exception of the issue of worker safety, the top ten list of past and future actions



remains fairly stable. Comparing past with future action plans, big upward movers in this list of action plans seem to be computer aided manufacturing, the integration of information systems, and just-in-time. This could be an indication of the fact that European manufacturers intend to deploy more technology to meet some of their upward moving competitive priorities, e.g. faster deliveries and quicker changes of the production plans. When it comes to differences between the three national groups, quite a few past and future action plans get a different degree of emphasis. In Table 6 those action plans for which there is a different attitude are given as well as the comparative ranking for the three groups. Past as well as future action plans give the same indication: French respondents emphasize strongly quality-related action programmes, British respondents emphasize more than the others the change of the relationships between management and labour, and German respondents put a higher emphasis on technology related action plans, in particular computer-aided manufacturing, flexible manufacturing systems and the development of new processes.

Table 5. Order of Importance of Past and Future Action Plans

Past Action Plans	Future Action Plans
worker safety	zero defects
manufacture lead-time reduction	improve capab. for new product intro
production/inventory control systems	production/inventory control systems
zero defects	vendor quality
supervisor training	integrating mfg information systems
manufacturing reorganisation	direct labour motivation
develop new processes for new products	integr. info systems across functions
vendor quality	manufacture lead-time reduction
improve capab. for new product intro	develop new process for new products
direct labour motivation	supervisor training
integrating mfg information systems	just-in-time
define a manufacturing strategy	statistical quality control
statistical quality control	define a manufacturing strategy
preventive maintenance	worker safety
integr. info systems across functions	computer aided manufacturing
change management/labour relations	capacity expansion
reduce the size of the workforce	manufacturing reorganisation
reduce setup time	preventive maintenance
vendor lead-time reduction	automating jobs
develop new processes for old products	vendor lead-time reduction
automating jobs	reduce the size of the workforce
just-in-time	computer aided design
give workers a broader range of tasks	give workers a broader range of tasks
computer aided manufacturing	value analysis/product redesign
capacity expansion	changing management/labour relations
group technology	develop new process for old products
computer aided design	quality circles
quality circles	flexible manufacturing systems
value analysis/product redesign	narrow product lines/standardisation
recondition physical plants	group technology
narrow product lines/standardisation	give workers more planning responsibility
give workers more planning responsibility	reconditioning physical plants
flexible manufacturing systems	capacity expansion
introducing robots	introducing robots
reduce size of the manufact. units	reduce size of the manufact. units
plant relocation	plant relocation
closing plants	closing plants

Table 6 Differences in Action Plans\*

Past Action Plan	UK	France	FRGermany
Give workers a broader range of tasks	2	1	3
Change management/labour relations	1	2	3
Zero defects	2	1	3
Manufacture lead time reduction	3	2	1
Computer aided manufacturing	2	3	1
Reduce setup times	3	2	1
Value analysis/product redesign	2	3	1
Group technology	3	2	1
Develop new processes for old products	3	2	1
Develop new processes for new products	3	2	1
Narrow product lines/standardisation	3	2	1
Flexible manufacturing systems	2	3	1
Automating jobs	3	2	1
Future Action Plan			
Change management/labour relations	1	2	3
Zero defects	2	1	3
Computer aided manufacturing	2	3	1
Value analysis/product redesign	2	3	1
Develop new processes for old products	3	1	2
Develop new processes for new products	3	2	1
Flexible manufacturing systems	3	2	1
Quality circles	3	1	2
Automating jobs	3	2	1

\*The numbers indicate the comparative ranking, 1 = highest emphasis, 3= lowest emphasis; the differences were tested with a Tukey range test

These action plans are, of course, not uncorrelated. We decided to apply a principal component analysis to reduce the 37 action plans to a limited number of underlying categories of action strategies (see De Meyer and Ferdows (1987) for a more detailed analysis). The action programmes could be factored into seven components, explaining 54% of the variance. We have labelled each of these categories in the following way:

(1) *new product introduction*: the combination of value analysis and product redesign, group technology, development of new processes for new products, integration of information systems in manufacturing and across functions, defining a manufacturing strategy, production and inventory control systems, vendor quality and improvement of the capability to introduce new products.

(2) *changed role of the workforce*: the combination of giving the workers a broader range of tasks, give them more planning responsibility, change the management/labour relations, worker safety, supervisor training, preventive maintenance, zero defects, just-in-time and direct labour motivation

(3) *investment in new manufacturing technologies*: combines computer aided design, computer-aided manufacture, the introduction of robots and flexible manufacturing systems, automating jobs and the reduction of setup times

(4) *reorganisation of the existing assets*: combines the change of the management/labour relations, manufacturing reorganisation, the reduction of the size of the manufacturing units and the workforce, plant relocation, closing plants and reconditioning of the plants.

(5) *action flexibility*: combines reduction of manufacturing lead-time and vendor lead-times, computer-aided design, reduction of the setup times and vendor quality which are all aimed at a faster response to the customers' requests.

(6) *quality management of the existing product line*: combines direct labour motivation, statistical quality control, narrowing the product lines/standardisation and quality circles.

(7) *development of new processes*: combines group technology, capacity expansion, and the development of new processes for old as well as new products.

In previous papers (De Meyer and Ferdows, 1987; Roth, 1987), it was argued that these components can be interpreted as the decision categories used by senior manufacturing managers in determining their manufacturing strategy. These decision categories suggest the questions on which senior manufacturing managers work to determine their response to the global competitive challenges.

To examine whether the three national groups that we have singled out pursue different manufacturing strategies, as reflected in their action plans, a discriminant analysis was carried out. The dependent variable was again the national group and as independent variables, the factor scores of each observation on the seven components was used. The two canonical discriminant functions can correctly predict 60% of the cases. The first canonical discriminant function (which explains 85% of the variance explained by the discriminant analysis) is correlated with the second, the third and the seventh component. The second function is correlated with the sixth and first component and negatively correlated with the fourth. The separation between the British and French group is not very good, but the German group stands out again. They score indeed very positive on the first function, and are neutral with respect to the second. One can argue that the German respondents differentiate themselves from the rest in their past strategy by having emphasized less the changed role of the workforce and by having emphasised more the investments in new manufacturing technologies and the development of new processes. The weak differentiation between British and French is reflected in a stronger emphasis by the French on quality management and a stronger emphasis by the British on re-organisation of the existing assets.

A similar analysis can be carried out for the future actions. Again we limited the number of factors to seven, explaining 53% of the variance. The seven factors are, with the exception of some minor variations, exactly the same (though they are produced in a different order):

- (1) Action flexibility
- (2) Total quality management
- (3) Re-organisation of the existing assets
- (4) New product introduction
- (5) Investment in new manufacturing technologies
- (6) Changed role of the workforce
- (7) Development of new processes

The discriminant functions allow to correctly classify 59% of the cases. Germans are separated from French and British on less than a 1% level. French and British can only be separated on less than a 10% level. The first discriminant function explains 70% of the variance explained by the discriminant analysis and is correlated positively with the fifth and negatively with the sixth factor. The second function is negatively correlated the second factor.

The German group scores high and positive on the first function, while they remain neutral *uis-li-vis* the second function. The British and the French score the same on the first function, but oppose each other on the second one. Concluding, one can say that the German group of respondents will emphasize in the next two years the investment in new technologies, and deemphasize the changed role of the workforce. The French stand out by emphasizing more strongly than the others the action plans related to the improvement of the total quality, and this in contrast to the British.

### *Relation between Performance and Action Plans*

One can hypothesize that a higher investment over the last year should be reflected in the changes in performance. One will remember from section 3.1 that the changes in performance over the last three years can be summarised in three categories: companywide performance, quality performance and cost efficiency. To test this hypothesis a stepwise regression analysis was calculated between the factor scores for these three factors and the factor scores for the action programmes. The squared multiple correlation coefficient was resp. 14%, 19%, and 6%. In the first case the company-wide performance was dependent on two significant factors: the changed role of the workforce (positive contribution) and the investments in new manufacturing technologies (negative contribution). The performance change in quality performance is significantly influenced in a positive way by actions on the workforce, and by increasing the action flexibility. It is negatively influenced by the investments in new manufacturing technologies. The third regression analysis is too insignificant to draw any conclusions. The pattern (if there is any) seems to be that the investments in a different way of managing the workforce have paid off in an improved overall performance, that attention paid to faster reaction times has contributed to a better quality, and that the investments in new manufacturing technologies will need some more time to show a return, and have required up until now only the investment of resources.

### **Conclusion**

European companies seem to have a very stable portfolio of competitive priorities. They emphasize as a competitive manufacturing weapon the ability to provide total quality, followed by the aptitude to react fast and to change production plans quickly, followed by the capability to offer low prices, and finally at the bottom of their list of priorities one finds the willingness to compete on design and volume flexibility. Moving up in the stack of competitive priorities is the willingness to deliver faster and to change the production plan if needed.

The greatest gaps in abilities are felt in the area of being able to offer a broad product line, which does not seem to be a priority, and the ability to offer the right quality. Looking at the action plans in the past and in the future, it seems that this willingness to invest in delivery and planning flexibility is backed up by an intent to invest more in technology. All technology action plans move upwards. Integration of information systems across functions as well as in manufacturing remain high on the list of priorities of the Europeans.

In the framework of cost efficient flexibility which we sketched in the introduction, it seems that European manufacturers have chosen in the first place to invest in one corner of that flexibility: neither volume nor design flexibility seem to be important, but changeover and mix flexibility (according to the definitions of Gerwin, 1987) come to the fore. The way to attain this flexibility is by an ever-increasing investment in technology.

What can one conclude from all this for the three national groups we have studied? The conclusions we will forward here have to be interpreted as hypotheses, since we do not pretend that our sample can be representative of the British, German or French industry.

First of all, British companies seem to have emphasized in the recent past the re-organisation of their assets, and have done this with positive results. The profits have gone up. They still seem to perceive a larger gap than the others with respect to quality. One could argue that the re-organisation has not left them the time until now to invest in the development of an externally supportive manufacturing strategy. The only issue where they stand out very clearly is their willingness to keep working on the improvement of the relationships between workers and management. In the context of the cost efficient flexibility challenge which was mentioned in the introduction, they do not seem to invest as much as other countries in flexible technology. If the improvement of the relations between workers and management leads to a more flexible workforce, this could be a major asset to prepare a flexible manufacturing strategy.

The French participants in the survey emphasize more than anything else the quality issue. They have invested more than the other groups in the improvement of product and process quality, and seem to have achieved some results. This does not imply that they have necessarily reached the level of quality as reached by other countries, and one can see in the results that they continue investing in action plans aimed at improving the total quality of their operations.

While the differences between the French and British participants exist but seem to be marginal, the German participants stand out clearly. They emphasize more the need for high performance products and the need to deliver faster, have less problems with providing a consistent and reliable quality and with the ability to offer a broad product line. They would, however, like to improve on their ability to change products more quickly. To achieve this, they have, in the recent past, invested in the development of new process technology, the implementation of new manufacturing technologies, and have put less emphasis than their colleagues in France or Great Britain on the need to change the way they manage their workforce. They intend to continue this strategy in the future. It appears to us that this indicates that there is a clear technology-based strategy to become more flexible with respect to product modification and delivery.

It is not possible for us to determine whether they have taken a different approach to increasing flexibility as, for example, the British, or whether they are simply further down the road on their way to flexible manufacturing.

## Notes

1. This-paper is part of a larger research project, the “Manufacturing Futures Project”, initiated by Prof. J.G. Miller of Boston University and carried out by research teams at Insead, Fontainebleau, France; Boston University, Boston, USA; and Waseda University, Tokyo, Japan.
2. The numbers between brackets indicate the standard deviation.
3. The formal and quantitative results of this and following discriminant analysis are not included in the text but are available on request from the author.

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