**Vlerick Working Papers 2001/8**

# THE STRATEGIC ROLE OF THE PLANT: TESTING FERDOWS' MODEL

ANN VEREECKE
e-mail: ann.vereecke@vlerick.be

ROLAND VAN DIERDONCK
e-mail: ann.vereecke@vlerick.be

**THE STRATEGIC ROLE OF THE PLANT: TESTING FERDOWS' MODEL**

ANN VEREECKE
e-mail: ann.vereecke@vlerick.be

ROLAND VAN DIERDONCK
e-mail: ann.vereecke@vlerick.be

D/2001/6482/08

April 2000; Revised August 2001

Revised for the International Journal of Production and Operations Management

# THE STRATEGIC ROLE OF THE PLANT: TESTING FERDOWS' MODEL

## ABSTRACT

The literature on global manufacturing strategy is still scarce. There are few models that help managers design and manage their global plant network. An interesting model, however, is the one developed by Ferdows, describing the strategic role of plants.

This paper discusses this model and tests it empirically. The data provide strong empirical support for the model and add some new insights.

Whether a multinational company is in search of new opportunities to manufacture abroad, or it faces a rationalization and restructuring of its plant network, some of the key decisions that have to be made are of the same nature. In both cases a manufacturing strategy plan is needed which focuses on the plant configuration. This plan should answer questions such as "How many plants should our company ideally have?", "Where should these plants be located?", "What level of competence should each plant have?", "Which strategic role should be attributed to each plant?", "Which products should be produced in which plant?".

Few models are available in the manufacturing strategy literature that help managers to find the answers to these questions. Interesting is the model developed by Kasra Ferdows, which describes and discusses distinct strategic roles of plants. (Ferdows, 1989) However, this model lacks empirical testing beyond case research. It is the purpose of this paper to develop an operationalization tool for this model, and to test it empirically on a sample of plants.

## LITERATURE REVIEW

### International manufacturing strategy

Already in 1964 Skinner, a pioneer in the field of manufacturing strategy, warned “the time has come when we must begin to sharpen the management of international manufacturing operations”. (Skinner, 1964) As competition is globalizing and the complexity of the environment in which companies operate is increasing, managing an integrated international network has become an increasingly important task for manufacturing managers. (Bartlett & Ghoshal, 1989; Ferdows, 1997a) Decisions need to be taken of both structural and infrastructural nature. (Hayes & Wheelwright, 1984)

The size and location of the plants, the capacity, the type of equipment and degree of automation are just a few of the structural decisions that need to be taken for each of the plants. The skill level of the workforce, the degree of autonomy of the plants, and the organization structure of the plants are important infrastructural decisions. (Hayes et al., 1984) However, a major challenge for multinationals is to leverage the international configuration of manufacturing units for creating sustainable competitive advantage. (Ferdows, 1997a) This requires a holistic perspective on the international plant network.

Despite the importance attached to it by both academics and practitioners, the field of international operations management is still at a relatively early stage of theory development (Roth, Gray, Singhal, & Singhal, 1997) and could be enriched by insights from empirical research. (Chakravarty, Ferdows, & Singhal, 1997) In contrast, there is a broad literature on international business, explaining basically why multinationals exist. See for example (Dunning, 1993). There is also a rich literature on international strategy focusing on the structure and organization of multinationals. Examples are Bartlett and Ghoshal (1989) or Prahalad and Doz (1987). The models and frameworks developed in these fields of research are very helpful for manufacturing strategy research focusing on international operations. Among the recent work that attempts to build this link between manufacturing strategy concepts and insights from international strategy and international business, we find Ferdows (1989; 1997b), Flaherty (1986; 1996), De Toni (1992), Shi (1995), DuBois (1993), Meijboom and Vos (1997), Khurana and Talbot (1999).

Over the past decade, a new paradigm has emerged in the field of international strategy that builds on the idea that the multinational company has to adopt a structure and an organization that allows the company to respond to conflicting demands by its

environment. (Bartlett et al., 1989; Prahalad et al., 1987) The new paradigm pays a lot of attention to the individual manager, which was less the case in the traditional MNE studies. The interaction and communication between managers, the power and skill level of managers, the importance of learning and of sharing know-how are therefore concepts that have received attention in recent research. An important element of this new paradigm is its network approach to the study of the activities of the multinational. (Dunning, 1993) As a consequence, research on the structure and organization of the multinational company has shifted from a focus on the one-to-one headquarters-subsidiaries relationships towards the problem of managing a network of foreign subsidiaries. (Kogut, 1989).

The trend towards depicting the multinational as a network of different units can also be observed in the *manufacturing strategy* literature. Flaherty for example reports how some US companies have evolved from a manufacturing configuration of plants, located in different countries, that were managed fairly independently of each other, towards a coordinated manufacturing network that allowed to benefit from the synergy among the plants. (Flaherty, 1986) She argues that the coordination of international operations in networks can improve cost and delivery performance, and enhances the learning from the experiences of partners in the network. (Flaherty, 1996) The idea of the international manufacturing network is also present in the work of Ferdows, who introduced the concept of the “lead plant”, a plant contributing to the company’s strategy by developing manufacturing capabilities and sharing these capabilities with other plants in the network. (Ferdows, 1989)

**The strategic role of subsidiaries and plants**

The international strategy literature provides several taxonomies describing the strategic role of subsidiaries in multinationals. Bartlett and Ghoshal propose a model that distinguishes between four generic strategic roles of subsidiaries of the MNE: the implementer, the black hole, the contributor and the strategic leader. (Bartlett et al., 1989, p101-103). The generic roles differ on two dimensions: the competence present in the subsidiary (in technology, production, marketing, or another area), and the importance to the company's global strategy of the national environment in which the subsidiary operates. The strategic role of the subsidiary with a global mandate as discussed by Roth and Morrison (1992) can to some extent be compared to the strategic leader. Somewhat different is the model proposed by Jarillo and Martinez. (Jarillo & Martinez, 1990) The first dimension, which they have labeled "the degree of localization", describes the extent to which activities such as R&D, purchasing, manufacturing and marketing are performed in the subsidiary's country. This dimension is thus comparable to the competence dimension studied by Bartlett and Ghoshal. The models differ however on the second dimension. Whereas in the Bartlett and Ghoshal classification the second dimension is externally oriented, in the Jarillo and Martinez classification it is internally oriented. That is, they distinguish on the basis of the degree of integration. This dimension ranges from very autonomous to highly integrated with headquarters. On the basis of these two dimensions, Jarillo and Martinez identify receptive, active and autonomous subsidiaries. Recent research has added a fourth type of subsidiary to this classification, namely the quiescent subsidiary. (Taggart, 1998)

These models provide rich insights into the distinct strategic roles subsidiaries may play in the multinational. However, by taking the subsidiary as the unit of analysis,

these models encompass the entire value chain. Since the focus of our research is limited to manufacturing, a model describing the strategic role of the manufacturing units, the plants, is more appropriate. Ferdows' model can be regarded as such a translation of the strategic classifications of subsidiaries into a manufacturing classification of plants. (Ferdows, 1989) His model compares to the Bartlett and Ghoshal model in the sense that it distinguishes plants on the basis of the level of competence in the plant and the location advantage, which is an element of the environment in which the plant operates.

Ferdows defines location advantage as "the strategic reason for establishing and exploiting the plant. He identifies three classes:

1. Access to low cost production input factors

   Exploitation of low cost labor is the most important reason in this respect, followed by the proximity to cheap raw materials and cheap energy. The fourth production input factor, capital, is - according to Ferdows - only of minor importance in the decision to locate manufacturing abroad.

2. Proximity to market

   The exploitation of a plant in a foreign nation allows more rapid and more reliable product delivery, and facilitates the customization of the product according to customer requirements. Reducing financial and trade risks, and avoiding trade barriers are - according to Ferdows - other reasons that can be classified as “market-driven”.

3. Use of local technological resources

   Proximity to universities, research centers, or sophisticated suppliers, customers and competitors, allows the company to tap into local technological know-how.

In his recent publications, Ferdows extends this category, by adding access to skilled employees. (Ferdows, 1993; Ferdows, 1997b) In other words, technological resources are not only defined as being available from outside sources, such as research institutes or partners in the supply chain. Ferdows recognizes here that the skills and capabilities of the employees are an important source of technological transfer in the manufacturing network.

Ferdows mentions two more reasons for exploiting a plant abroad (the control and amortization of technological assets, and pre-emption of competition), but he reports that these factors are less prevalent than the first three factors, and therefore he does not take them into account in his model.

The plant's competence is the second dimension in Ferdows' model. In his earlier work this dimension was described as the extent of technical activities carried out at the site (Ferdows, 1989). In his more recent work it is defined as the extent to which the following competencies are present in the plant: production, process technical maintenance, procurement, local logistics, production planning, product and process development and improvement, development of suppliers, the supply of global markets, and a global hub role for product and process knowledge. (Ferdows, 1997b)

The model is shown in FIGURE 1. Ferdows has identified six types of plants, which he labeled the "off-shore", "source", "server", "contributor", "outpost" and "lead" plant. We refer to Ferdows (1989) for a discussion of these types of plants. The outpost factory, which has as its primary role to collect information, is probably - according to Ferdows - only a theoretical possibility. It is indeed unlikely that a plant would be located in an area rich of know-how, would act as a "window" to access this know-how, and would not exploit this know-how for its own and other plants' benefit.

Insert FIGURE 1 about here

Ferdows makes interesting assertions on the evolution in strategic role that can or should be expected.

Often - according to Ferdows - plants abroad start as off-shore plants or servers. But over the years, if these plants stay in their original (low level) role, which implies that there will be relatively little local competence, the plant may fall behind in productivity as there are few manufacturing managers capable of maintaining a high rate of improvement. Secondly, those plants contribute very little to the company as a whole, or otherwise stated, the company as a whole might be missing an opportunity to benefit from local expertise and market know-how. And thirdly, by treating the plant merely as a supplier of products, the company certainly does not create a challenging environment for the local management team. In the long run, this may de-motivate the local managers, and at the same time make it more difficult to convince talented people to join the plant. This places the plant in a vulnerable position. These observations explain why it is desirable for a company to invest in its plants' competence, in order to allow the plants to fulfill a more substantial strategic role. But even without an explicit top-down decision to develop local competence, some plants seem to follow a natural way upwards in the model. The pressure to reduce time-to-market or to increase customer service for example may stimulate local management to develop the local competence base. Similarly, one may argue that managers will spontaneously seek for the control of a growing amount of competencies and assets, as this improves their status and prestige within the company, and at the same time reduces the vulnerability of the plant.

Other, usually less successful plants may disappear from the “map”, as the company closes down the plant or sells it to another company. Reasons for this can be the

competitive pressure to reduce costs, which may call for a concentration of the production volume in a smaller number of plants, or the appearance of new opportunities. (De Meyer & Vereecke, 1996)

**Comments on Ferdows' model**

Ferdows' model offers an interesting perspective on the international plant configuration. Firstly, the classification of plants has strong face validity. It is very recognizable for executives and is a useful framework for "mapping", analyzing and evaluating the plant configuration. Such a "map" may eventually show unbalances in the set of plants and may highlight opportunities for further development of plants. Another interesting aspect of the model is its dynamic nature. The work of other researchers confirms that the plant's strategic role is a dynamic concept changing over time, and that evolutions in the company's environment may accelerate such a change. See for example Plasschaert and Van Den Bulcke (1991).

On the other hand, some concerns can be formulated on this model. The location advantages are a selection of three categories, out of the five expressed by Ferdows. The selection of the categories has not been empirically verified, except for some descriptive cases. Moreover, the aspect of "control over technological assets" is of another dimension than the other factors mentioned. Whereas the other factors may indeed be the primary driver to establish a foreign plant, the desire to control technological assets rather determines the choice between partnership or ownership, which is a decision that is subordinate to the decision to go abroad.

A second concern deals with the vertical axis of Ferdows' model. As we have described Ferdows has provided two slightly different definitions of this dimension, namely the extent to which technical activities are performed in the plant, and the

presence of competencies in the plant. In his description of the six roles, Ferdows uses a construct that expresses *the importance of the plant for the company's strategy*: The roles evolve from "just supplying products", over "being a focal point for the company", to "a plant that other plants depend upon". This implicit construct is -in our opinion- a more direct expression of the strategic role of the plant. An empirical test of the model requires a clear definition and operationalization of this dimension.

A related concern is that the model suggests that there is some hierarchy or rank order in the competencies in a plant. However, in reality, it is possible for example to give a certain plant the responsibility for product development without decentralizing procurement or logistics.

In what follows we propose a slightly modified model that deals with the above concerns, and we suggest a way to operationalize the model.

## RESEARCH METHODOLOGY

The research reported in this paper is part of a larger research study on the international plant configuration of multinational companies. Since the purpose of the research was to understand the "*how*" and "*why*" of the international plant network, case study research has been preferred over other research methodologies. (Yin, 1984) Great care has been taken to avoid the pitfalls of case research. A common argument against the use of case research stems from the misconception that case research would be based on qualitative data only, and would therefore lack precision and rigor. However, several methodological papers and books are available that help the researcher to design a rigorous, precise and objective research instrument. Examples

are Eisenhardt (1989), Miles (1994) and Yin (1984). To the extent possible and where appropriate, these methodological guidelines have been followed in our research. Without being exhaustive, we mention that a strict research protocol has been designed, a questionnaire with both closed and open ended questions has been developed as guidance for the interviews, and both qualitative and quantitative data have been collected in a rigorous and structured way and have been analyzed in a systematic way. It is also important to note that in order to enhance construct validity multiple raters have been used. This tactic is still fairly uncommon in manufacturing strategy research; Speier and Swink have highlighted this as one of the shortcomings in current operations management research. They argue that research based on a single respondent may be subject to the "lone wolf syndrome", the risk that this single respondent has a biased view on the organization unit being studied, or has limited access to information. (Boyer & Verma, 1996; Speier & Swink, 1995) The reliability of the data obtained from the multiple raters can be assessed through the "Intra-Class Correlation" or ICC method. The ICC index measures the variance of the scores of the raters within a plant or company, relative to the between-plant or between-company variance.

The case research has been carried out in eight manufacturing companies headquartered in Western Europe, in different industries: food products (2 companies), textile goods, plastic products, leather products, primary metal, fabricated metal and electrical goods. The companies had between 4 and 10 manufacturing plants. The primary selection criterion for the cases has been diversity, at the level of the company as well as the plant. At the company level it is important to have diversity in terms of the international environment in which the company operates, since one of the research objectives was to explore the link between the characteristics

of the company's international environment and the plant configuration in the company. That is, the cases had to be distributed over the global, transnational and multinational environments, as described by Bartlett and Ghoshal (1989). Diversity at the plant level has been obtained by selecting companies with a minimum of 4 plants, spread over a broad geographical region. The rationale being that with three plants or less, companies have few opportunities for differentiating the role and focus of their plants. A geographical spread of the plants (Pan-European, or even global) was expected to result in a broad range of drivers for establishing the plant, and therefore also in a broad range of plant roles.

Secondly, the sample was limited to companies with their headquarters in Western Europe, to avoid major cultural differences between the distinct cases.

Data has been gathered at two levels of analysis: the plant and the company.

- Interviews have been conducted with the general manager and with manufacturing managers at headquarters. In total data has been collected on 59 manufacturing plants, through 37 interviews (with a total duration of appr. 120 hours). The number of interviews varied between 2 and 6 per case. A highly structured questionnaire with closed and open-ended questions has been used as a guide through the interviews. The purpose of these interviews has been to measure the strategic role of each of the plants as well as its evolution, as the managers in headquarters perceive it.
- A (different) questionnaire has been sent to the plant managers and/or the manufacturing managers in the distinct production plants. The purpose of these questionnaires has been to measure the strategic role of the plant as well as its evolution, as the managers in the plant perceive it. A total of 144 questionnaires

have been sent to 54 out of the 59 plants[1]. 83% of the questionnaires have been returned, from 50 plants. This implies that in total we have received data from the plant managers on 50 out of the 59 plants (85%). The number of questionnaires returned from the plants varied between 1 and 5 per plant.

Fourty-five plants are located in Europe. The other 15 plants are located in the Far and Middle East, the USA and Canada, South Africa and Australia. The number of years the plant had been part of the company ranges between 0 and 50 years, with an average of 17 years. The number of employees in the plants ranges between 77 and 1.100, with an average of 340.

**Operationalization of the constructs**

***The vertical axis: the level of strategic role of the plant.*** The operationalization of the vertical axis of Ferdows' model can be done in multiple ways. The extent to which technical activities are performed at the plant (which is the definition of the vertical dimension Ferdows used in his first publication in 1989) is one possibility; the number of staff people in the plant can serve as a proxy for this variable. The level of competence at the plant (which is the definition of the vertical dimension Ferdows used in his publication in 1997) is another possibility. However, these possible operationalizations offer indirect measures of the construct, since they imply assumptions on the degree of autonomy, the absence of slack resources and the diffusion of know-how in the plant network. As argued earlier, Ferdows' description of the six different strategic roles brings forward a construct that expresses *the extent to which the plant contributes to the competitive strategy of the company.* The roles evolve from “just supplying products”, over “being a focal point for the company”, to

[1] For five of the plants, headquarters asked us not to send a questionnaire to the plant managers.

"a plant that other plants depend upon". We have developed a Likert-scale to measure this construct directly. Descriptions have been attached to the scale, in order to guide the choice of a score for the plants. These descriptions were extracted from the typology description that was given by Ferdows. They are listed in TABLE 1. It is important to note that the strategic role, defined in this way, is a *matter of degree*, rather than a typology. We will therefore, in our empirical discussion, analyze the *level* of strategic role played by the plant, rather than the *type* of strategic role.

Insert TABLE 1 about here

We have asked managers at headquarters, during the in-depth interviews, to rate all plants on a 1-to-9 scale. The current strategic role of the plants at the moment of the interview has been measured (variable "ROLE today"), as well as the level of strategic role of the plant five years before (variable "ROLE -5y") and the expected level five years ahead (variable "ROLE +5y"). The same question has been asked to plant management for their particular plant, through a mail questionnaire. The questionnaire item is reproduced in APPENDIX A. The level of strategic role of the plant has been determined as the average score that has been given for that plant by the respondents.

Since this data is highly perceptual tests have been carried out to guarantee the construct validity of the measure. As explained earlier, Ferdows suggested to use the number of people in technical activities as a proxy for the level of strategic role played by the plant. Comparing the level of strategic role with the number of people in the manufacturing staff in the plant could therefore provide an estimate of the construct validity of our measure. The Pearson correlation between our measure of the

strategic role as perceived in headquarters and the number of manufacturing staff[2] people in the plant is 0,55. Comparing to the level of strategic role as perceived by the plant managers gives an $R^2$ of 0,40 (both significantly different from 0 at $p<5\%$) The correlation is indeed fairly high, thus strengthening our confidence in the measures.

Although we don't expect a perfect fit between the perception of the strategic role by the headquarters and the plant managers, there should be some correspondence. The correlation between these 2 measures was 0,62 (significantly different from 0 at $p<5\%$).

The reliability of the measure is evaluated through the ICC-index. TABLE 2 shows the inter-rater reliability of the three variables, measured at headquarters and at plant level. The ICC exceeds the cut-off rule of 0,70 recommended by Futrell for all three variables. Consequently, a fortiori, the ICC satisfies the 0,60 cut-off point recommended by Boyer. (Boyer & Verma, 2000; Futrell, 1995)

Insert TABLE 2 about here

***The horizontal axis: Primary drivers for establishing and exploiting a plant.*** The horizontal axis of Ferdows' model describes the primary driver for establishing or acquiring the plant. This ties in with the vast literature on location selection. Several authors have described the location selection as a *multi-stage problem*, in which each stage involves another kind of decisions. Among these authors we find Schmenner (1979; 1982), Dunning (1993), Haigh (1990), and MacCormack et al (1994).

[2] Manufacturing staff comprises planning and inventory management, purchasing, product and process design & development, maintenance and quality control & quality management.

We should note that there is no uniform definition of these stages. Also, the stages are not always strictly sequential. Yet, the following set of stages seems to emerge:

- First, there is the *decision to produce abroad*. This is a strategic decision that may be triggered by the observation that a capacity expansion is necessary, that labor cost advantages may be gained by producing in foreign countries, or that market opportunities are present. (Ernst & Young, 1992; Haigh, 1990; Schmenner, 1979)

  The major question that needs to be answered by top management is how the foreign plant will fit in the existing plant network, and how the plant will contribute to the company's strategy.
- The next decision concerns the *region or country* in which the new facility will be located. Tools are available that are helpful in screening different countries or areas. An example of such a tool is provided in Leontiades (1985)

  Often this decision is linked to the first decision. For example, if a new market opportunity is the driver for the foreign plant, the selection of the region is dictated by this market location. Research has also shown that managers often have a preference for some region, before the evaluation of regions has even been started. (Haigh, 1990; Hood & Truijens, 1993)
- A third stage involves the *site selection*. Important factors in this decision are for example the cost of land, the access to roads and ports, the quality of the schools. (Schmenner, Huber, & Cook, 1987)

The focus of our research has been primarily on the decision to establish (or acquire) a production unit, rather than the criteria for country or site selection. We have composed a list of potential drivers for the establishment of a plant on the basis of some theoretical and empirical publications of location studies, most of which have in turn been based on extensive literature reviews. (Artikis, 1991; Badri, Davis, & Davis,

1995; Dunning, 1993; Ferdows, 1993; Porter, 1990) We also allowed the interviewees to add items to the list if they thought some important drivers were missing. The resulting list is provided in APPENDIX B. The drivers have been grouped into 9 categories, according to their theoretical coherence. The interviewees were asked to select a maximum of three drivers explaining the *initial* reason for establishing/acquiring the plant, as well as a maximum of three major advantages the plant's location provides *today*.

Subsequently, for each of the plants, a summary was made of all the drivers that had been mentioned by the interviewees. We then went back to one of our interviewees in each of the cases, and asked him to select the primary driver among the drivers that had been mentioned by himself and his colleagues. This procedure of asking multiple respondents to indicate the three main drivers, summarizing the responses, and discussing the results with one of the respondents, has ensured the reliability of the measure. TABLE 3 shows the number of times each of the drivers has been ranked as the most important driver for establishing the plant *initially*, and for exploiting the plant *today*.

Insert TABLE 3 about here

It is clear from TABLE 3 that the primary drivers for the initial decision to establish or acquire a plant are diverse. In total 15 drivers have been indicated as primary *initial* driver, taken from six of the categories listed in the appendix. On the other hand, only 8 drivers have been indicated as the primary advantage of exploiting the plant *today*. These 8 drivers are taken from three categories only: availability of labor, availability of skills & know-how and proximity to the market. This observation suggests that

when assessing an existing plant configuration, managers take into account a smaller number of factors than when thinking about an enlargement of the plant configuration. Secondly, it suggests that, although there is a diversity of reasons for establishing/acquiring a plant, some of these reasons tend to fade over time. This becomes clear when we group the drivers mentioned in TABLE 3 into the theoretical categories. The evolution between the initial primary driver and today's primary driver is shown in FIGURE 2

Insert FIGURE 2 about here

The figure shows that *market proximity* is by far the most stable location driver. Almost all the plants that have been established in order to be close to a market, still have their market proximity as their main advantage.

*Labor and skills* appear to be less stable location drivers. For some plants (6 out of 11), it is still the major advantage, but other plants seem to have found other advantages that replaced the labor advantage.

The *socio-political drivers* appear to be highly unstable. None of the plants in our sample that have been established for socio-political reasons, have these socio-political reasons still as the major advantage today. The most unstable location drivers are those drivers that have a "once-only" character. *Tax breaks or financial incentives* are typically provided at the moment of the acquisition, or on a temporary basis. These drivers therefore influence the initial decision, but don't provide a lasting major advantage. *Overcoming trade barriers* has been an important driver for the establishment/acquisition of plants: It has been mentioned as the primary initial driver for six plants in total. As of today, it is not mentioned as the primary advantage of exploiting any of the plants, which can be explained by the decline in tariffs as a

consequence of agreements such as the European unification and NAFTA.

The same remark holds for the acquisition of plants in order to *prevent competition* from acquiring the plant or in order to capture the market supplied by the plant. Once the plant is part of the network, the threat of competition entering the market has diminished. As soon as the customer base of the plant is internalized, the company may probably consider supplying these customers from one of its other plants, if this proves more appropriate for cost or other reasons. The one-to-one relationship plant-customer thus becomes more vague.

## THE MODEL OF FERDOWS: EMPIRICAL VERIFICATION

We can now compare the conceptual model developed by Ferdows, with the empirical results obtained in our case research. The scatterplot in FIGURE 3 reflects the position of the 59 plants in our sample in Ferdows' model. The empirical results support the model proposed by Ferdows in some aspects, and modify it in others.

Insert FIGURE 3 about here

### Conclusion 1

Ferdows recognized that there is diversity in the drivers for establishing and exploiting a plant; he distinguished five categories of drivers. However, he claimed that the three categories represented in his model (low-cost production factors, skills & technological know-how and market proximity) encompass the vast majority of plants. (Ferdows, 1989) This is confirmed in our research TABLE 3 shows that we observed no plants for which today's primary advantage of exploiting it fell outside

these three categories. Moreover, Ferdows claims that among the low-cost production factors labor is the most important factor. This is confirmed in our research.

**Conclusion 2**

We did, however, observe four plants for which the respondents failed to identify a clear advantage of exploiting them. The only reason why these plants are still exploited is the cost (the financial and social cost) of closing the plant.

**Conclusion 3**

Ferdows' model implies that the degree of contribution of the plant to the company's network differs according to the primary reason for exploiting the plant. It is suggested graphically that plants with low-cost production as the primary driver tend to play a lower level strategic role than plants with market proximity as the primary driver. If we exclude the theoretical outpost factories from the chart, we see that there is also the implicit suggestion that plants with skills and know-how as the primary driver play a higher level strategic role than plants with market proximity as the primary driver. (See FIGURE 1)

The median and mean level of strategic role follows indeed the hypothesized pattern. (See TABLE 4)

Insert TABLE 4 about here

The non-parametric Mann-Whitney U Test shows that the plants which have market proximity or access to skills and know-how as the primary driver for their exploitation do indeed have in general a significantly higher level strategic role than plants which have low-cost labor as the primary driver ($p<5\%$). The difference in strategic role

between plants with skills and know-how as primary driver, and plants with market proximity as primary driver is not significant. The four plants for which no clear location advantage could be identified have a strategic role that is significantly lower than the role of plants which have a market ($p<10\%$) or skills and know-how advantage ($p<5\%$).

**Conclusion 4**

Closely related to this is the hypothesis that there are no plants in the upper left and right hand corner of Ferdows' model. That is, the plants with the highest level of strategic role are by definition plants that have skills and/or know-how as their primary advantage. At least, this is suggested by the graph in FIGURE 1.

Our data contradicts this hypothesis. One of the plants with a high-level strategic role falls in the labor category for its primary driver. Twelve plants have a high level strategic role and have market proximity as the primary driver. We conclude that there is evidence of plants which do not have skills or know-how as their primary driver, and yet are regarded as centers of excellence that play a strategically important role in the company's plant configuration.

**Conclusion 5**

The hypothesis of an upward evolution of plants in the framework is supported by the data. The (non-parametric) Wilcoxon Matched Pairs Test indicates that there has indeed been a significant increase in the median strategic role in the five years prior to the research study (significance level $p <1\%$). However, the increase was not expected to continue in the 5 years following the research study.

We should note that this test reflects the evolution in strategic role only for the

subsample of plants that had been part of the network for at least five years (N=49). We will refer to this group of plants as the “senior plants”. Comparing these "senior plants" to the "newcomers", the plants that had joined the company recently (that is, in the five years prior to the study) adds extra insights. The average level of strategic role of these “newcomers” is 2,83 which is lower than the average level of strategic role of the “senior plants” (avg. strategic role 4,97). The (non-parametric) Mann-Whitney U Test comparing these two independent groups of plants indicates that the difference in strategic role between the “seniors” and the “newcomers” is significant at the 5% level.

We conclude from the statistical analyses that the plants that have been with the company for at least five years have experienced, on average, a moderate but significant increase in strategic role. Newcomers have a low level of strategic role, compared to the “seniors” in the plant configurations.

**Conclusion 6**

Ferdows describes that some plants combine two or more roles. (Ferdows, 1997b) He gives the example of a plant that is a server for a specific region, and at the same time an offshore supplier of specific components. Although our data has not been designed to test this statement, it provides some evidence for such “secondary roles". For 53 of the 59 plants, more than one location driver was mentioned as being important. Up to eight drivers have been mentioned for one plant.

**Conclusion 7**

FIGURE 4 contrasts the perception of the managers at headquarters with the perception of the managers in the plants, by comparing the level of strategic role of

the plants as measured in the interviews at headquarters, with the level of strategic role reported in the plant questionnaires. We recall here that plant perception data stems from the 120 questionnaires returned from 50 plants.

Insert FIGURE 4 about here

Some observations can be made from FIGURE 4:

- The management teams in about half of the plants have a very good notion of the level of strategic role played by their plant. For 50% of the plants, the plant respondents classified the plant in the same category (low, medium or high) as did the headquarters interviewees.
- A small group of plants (10%) overestimates its level of strategic role: 5 of the plants have been classified higher by the plant respondents than by the headquarters interviewees. However, no plants have been observed in the lower right hand class, which would be the class of plants that strongly overestimate the level of strategic role they play in the company.
- A fairly large group of plants underestimates the level of strategic role they play in the company: 39% of the plants have been classified lower by the plant respondents than by the headquarters managers. For 10% of the plants, the gap between headquarters and plants perception was even 2 categories. These are the plants in the upper left-hand cell in FIGURE 4.

When comparing the performance of the plants, we come to an intriguing result: The plants in the upper left hand corner, that is those plants that strongly underestimate their strategic role, on average, outperform their cost and quality performance target more than the other plants in the sample. The explanation may be that, because these plants perform remarkably better on cost and quality than targeted, the managers at headquarters have raised their expectations in terms of the level of contribution that

the plants might deliver to the company. Plant management, on the contrary, is not (yet) aware of the plant's capabilities to act as a network player contributing to the other plants, and therefore underestimates the strategic role played by the plant.

We conclude that the overall picture that emerges from FIGURE 4 is thus a picture of "*modesty*" of plant management. Very few managers overestimate the level of strategic role played by their plant. Rather, many underestimate the level of strategic role played by the plant. Especially those whose performance exceeds (more than for the average plant) the cost/quality target set for them still have a modest perception of the level of strategic role they play in the company.

## LIMITATIONS AND FUTURE RESEARCH

As mentioned in the Methodology section, this paper is based on case research. While one of the major advantages of case research is the depth of the information that can be collected, its major disadvantage is the limitation in external validity. The extent to which the conclusions can be generalized may be questioned. However, we are convinced that the careful selection of the cases from a diversity of industries improves the external validity of the work.

As explained earlier, the cases have been limited to companies headquartered in Western Europe, to avoid cultural differences between the cases. Whether the conclusions still hold in multinationals headquartered in other continents is unexplored, and can be subject to future research.

Our research describes the strategic role played by plants in international plant networks. It identifies those plants that develop know-how and capabilities, and transfer this know-how to the other plants in the network. The research doesn't explain

how this know-how is developed, nor does it describe the mechanisms used for the diffusion of this know-how and their effectiveness. This is also an area of future research.

Finally, the model has been developed for manufacturing sectors and the implicit assumption is that the production can be separated from the distribution of the products. Therefore the model appears to be valid in the manufacturing industries only. However, service firms are becoming more and more international and as we pointed out elsewhere are confronted much earlier with setting up an international network of operating units. (Van Looy, Van Dierdonck, & Gemmel, 1998) The issue of the strategic role these operating units play in the network is an important one. For service firms the primary reason for establishing a unit is overwhelmingly market proximity. Although we have not done explicit research, it is our belief that some sites might play a different strategic role. This can be explained by referring to the concept of the service triangle. (Van Looy et al., 1998) Service organizations that are classified at the top of the triangle (as McDonald's and Wal-Mart) will probably have one outspoken headquarters unit with the other sites typically in the position of a server plant. In service organizations at the bottom of the triangle, more specifically at the right hand side (e.g. professional service firms like consulting), we expect to find a more balanced situation with various units having a higher level strategic role, i.e. contributors and lead plants. However, companies within the same sector may follow a different strategy. For instance Toys 'R' Us, which is a distribution company as is Wal-Mart, is much more sensitive to local needs. Therefore we expect a higher level strategic role of the units at Toys 'R' Us than for instance at Wal-Mart Operating units at Toys 'R' Us are definitely at a higher position in the model than the server plants.

Moreover, by splitting front office and back office activities, companies find opportunities for improving productivity by locating the back office in low-cost labor countries, thus adding off-shore units to their network. In some case, the technological evolution reduces the need for market proximity, even for the front office. The location of call centers in low-cost labor countries illustrates this point. However, this anecdotal evidence linking service companies to Ferdows' model should be subject to further research.

## CONCLUSION

In this paper, we have discussed the international manufacturing model proposed by Ferdows. The paper suggests a tool for operationalizing the model, and tests the model empirically on a sample of plants spread globally. We conclude that the empirical data supports Ferdows' model in most of its elements. However, the typology appears to be too limited to encompass the strategic role that was initially, that is at the moment of establishing or acquiring the plant, played by the plant. This suggests that, although the model provides a useful tool for describing and assessing the strategic role played by the plants in today's manufacturing networks, it doesn't provide enough variety to describe the plants that may be added to the network.

Another remarkable difference between the model and the empirical data is the presence of centers of excellence with market proximity, rather than the proximity of skills or know-how as their primary advantage.

Finally, the research shows the modesty of plant management. Very few managers have overestimated the level of strategic role played by their plant; on the contrary, many managers have underestimated the level of strategic role played by their plant.

This was especially the case in plants performing better than the target set for them. This suggests that the evolution in the strategic role of the plant is a combination of top-down and bottom-up pressures. Future research should bring more insights into this dynamic.

FIGURE 1

A typology of plants (Ferdows, 1997)

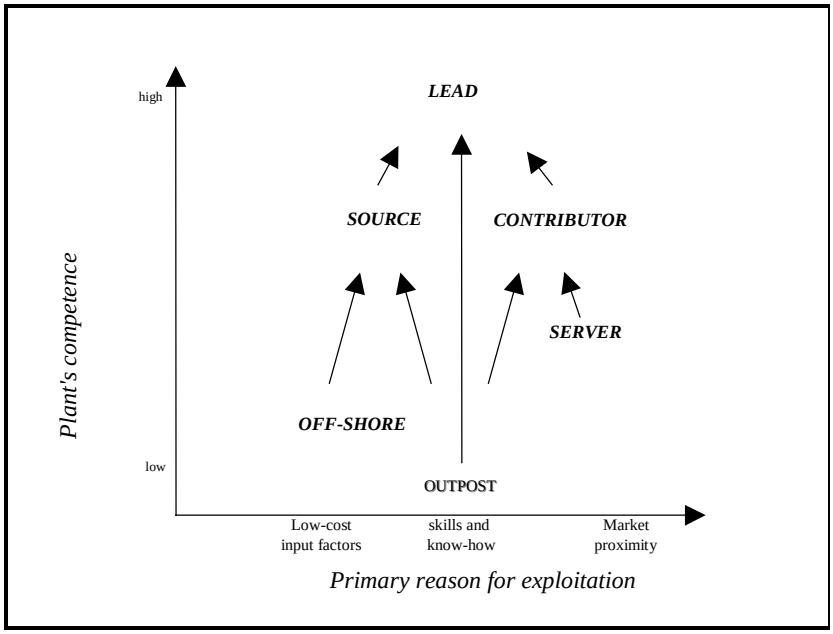


TABLE 1

Description of distinct levels of strategic role

| | | |
|---|---|---|
| **low level strategic role** | 1 | The main goal of the plant is "to get the products produced". Managerial investment in the plant is focused on running the plant efficiently. |
| | 3 | The plant has sufficient internal capabilities to develop and improve its own components, products and production processes |
| | 5 | The plant is a focal point in the company for the development of specific important components, products or production processes |
| | 7 | The plant develops and contributes know-how for the company |
| **high level strategic role** | 9 | The plant is a "center of excellence", and serves as a partner of headquarters in building strategic capabilities in the manufacturing function |

TABLE 2

Inter-rater reliability of strategic role variable

| | **headquarters perception** | | **plant perception** | |
|---|---|---|---|---|
| | **p-level** | **ICC** | **p-level** | **ICC** |
| **ROLE today** | *** p<.001 | **0,82** | *** p<.001 | **0,82** |
| **ROLE -5y** | *** p<.001 | **0,85** | *** p<.001 | **0,80** |
| **ROLE +5y** | *** p<.001 | **0,83** | *** p<.001 | **0,70** |

TABLE 3

Primary reasons for establishing/exploiting the plant

| | **frequency[3] with which the driver is mentioned as the main reason for establishing/acquiring the plant** | | |
|---|---|---|---|
| | **category** | **primary driver *initially*** | **main advantage *today*** |
| rapid/reliable delivery to customers | MAR | 17 | 24 |
| adapt products to local taste/cooperation with customers | MAR | 12 | 15 |
| overcome trade barriers | SO-POL | 6 | |
| take advantage of low-cost labor | LAB | 5 | 9 |
| the place of residence of the owner | OTH | 5 | |
| capture/maintain market share | COMP | 4 | |
| tax breaks and/or investment incentives | SO-POL | 3 | |
| fast service or technical support to customers | MAR | 3 | 7 |
| availability of workers | SKILL | 3 | |
| highly qualified workers | SKILL | 2 | 6 |
| seize a provided opportunity | OTH | 2 | |
| skilled engineers | SKILL | 1 | 2 |
| close to source of technological know-how | SKILL | 1 | 1 |
| prevent major competitors | COMP | 1 | |
| close to major competitors | COMP | 1 | |
| managerial/organizational skills | SKILL | | 2 |

[3] In total, 66 primary drivers have been indicated. This is more then the number of plants (59), since for some plants two drivers were indicated as being equally important in the decision to establish or exploit the plant.

FIGURE 2

Location drivers: evolution between initial driver and today's advantage

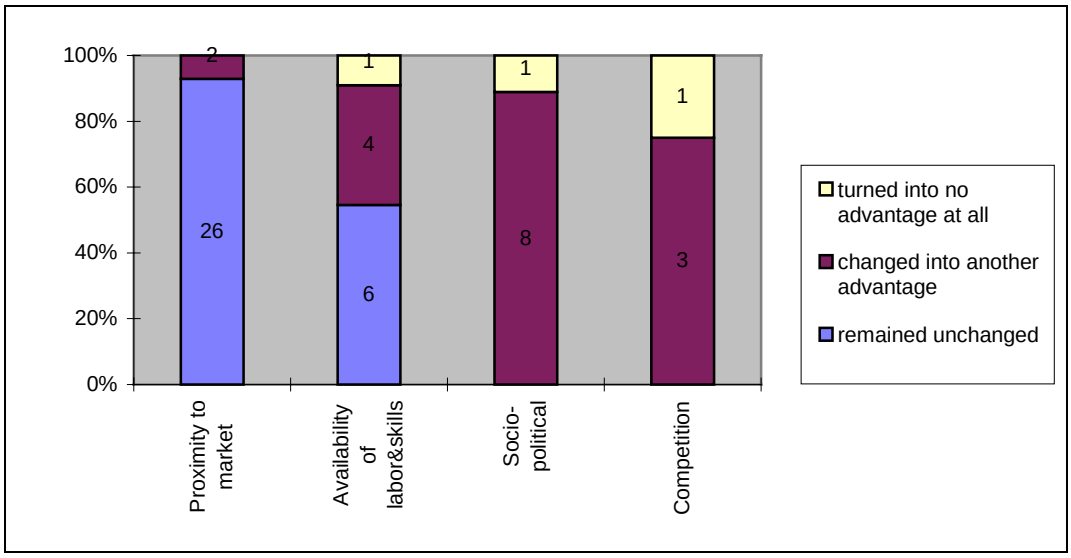


FIGURE 3

Empirical verification of the plant typology based on Ferdows' model

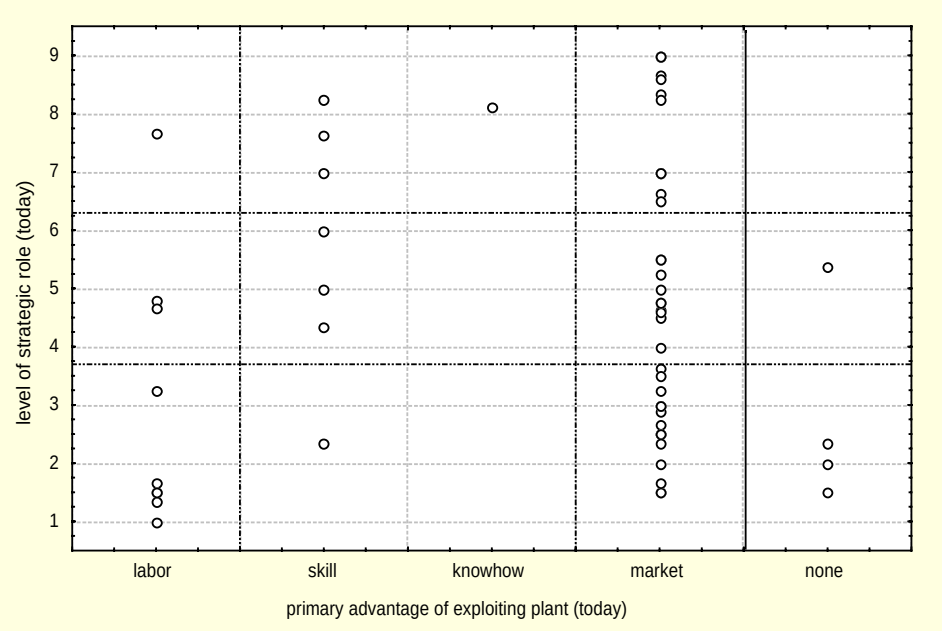


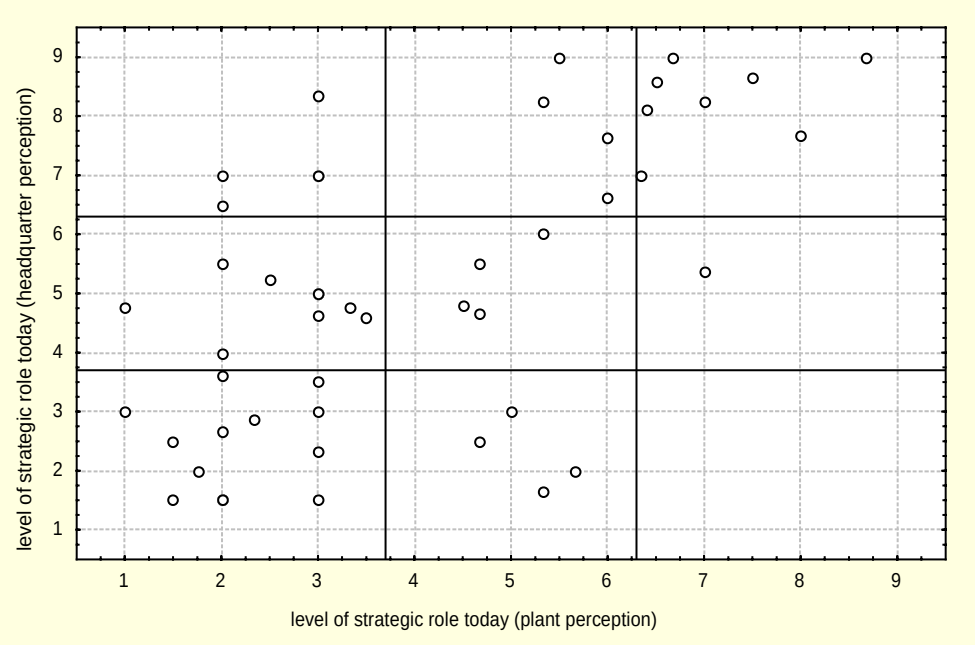
TABLE 4

Descriptive statistics of strategic role (classified according to primary driver)

| **primary driver** | **Valid N** | **Mean** | **Median** |
|---|---|---|---|
| **market** | 38 | 4,86 | 4,60 |
| **labor** | 9 | 3,04 | 1,67 |
| **skills & know-how** | 8 | 6,08 | 6,50 |
| **none** | 4 | 2,80 | 2,17 |

FIGURE 4

HQ vs plant perception of the strategic role of the plant



APPENDIX A Level of strategic role

***Questionnaire item for interviews in headquarters***

Typically, the plants in a company may have different roles. Some plants, for example, have a clear focus on the production function only; other plants may be the development and production center for specific product groups or components, or may be the specialized plant for specific processes; other plants have become a partner of headquarters for certain manufacturing capabilities that are important for the whole company.

This "role" of the plants is described below on a 1 to 9 scale. On this scale, indicate for each of the plants what role it plays in your company *today*.

Be careful to describe in this scale what the plant actually <u>*does*</u> in your company, which is not necessarily what it *should* do.

| | The main goal of the plant is "to *get the products produced*". Managerial investment in the plant is focused on running the plant *efficiently*. | | The plant has sufficient internal *capabilities to develop and improve* its own components, products and production processes | | The plant is a *focal point* in the company for the development of *specific important components, products or production processes* | | The plant *develops and contributes knowhow* for the company | | The plant is a "center of excellence", and serves as a *partner of headquarters in building strategic capabilities* in the manufacturing function |
|---|---|---|---|---|---|---|---|---|---|
| **plant 1** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **plant 2** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **…..** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

What changes do you expect in the near future (coming 5 years) ? Indicate in the previous table where each of the plants should be positioned, according to you, 5 years from now.

Some of the plants may have had the same strategic role ever since the plant became part of your company. Other plants however, may have evolved over time, in terms of their strategic roles. For these plants, please describe in the following table what their strategic role was 5 years ago.

Can you give us some typical facts about each of the plants, that you thought of while you were filling in the previous table ?

## APPENDIX B Potential drivers for establishing/exploiting a plant

***Questionnaire item for interviews in headquarters***

In the following list, some reasons for establishing manufacturing facilities have been identified.

Please indicate, for each plant, which reasons are critical in explaining why the plant has become part of your company. Choose maximum 3 reasons.

Similarly, we ask you to identify the (maximum) three main advantages that the plant's location provides today.

*Proximity to suppliers*

- to benefit from rapid/reliable delivery from suppliers and/or low transport costs
- to be close to low cost suppliers
- to facilitate cooperation with suppliers in product design, planning, etc.
- to have access to source of raw materials

*Availability of labor*

- to take advantage of low-cost labor
- to take advantage of the availability of workers
- to take advantage of favorable social climate (high productivity, low absenteeism rate, weak unionization, etc.)

*Availability of skills and know-how*

- to take advantage of highly qualified workers
- to take advantage of skilled engineers
- to take advantage of managerial/organizational skills
- to be close to the source of technological know-how (university, research institute, etc.)

*Proximity to market*

- to provide rapid/reliable delivery to customers, at low transport costs
- to adapt products to local taste and/or to facilitate co-operation with customers in product design, planning, etc.
- to provide fast service or technical support to customers

*Socio-Political*

- to benefit from tax breaks and/or investment incentives
- to overcome trade barriers
- to benefit from favorable or less stringent environmental regulations
- to reduce the impact of exchange rate fluctuations

*Competition*

- to be close to major competitors
- to prevent major competitors from establishing a manufacturing facility in the area
- to capture/maintain market share

*Energy*

- to take advantage of low-cost energy

*Other*

- to take advantage of highly qualitative environment (air, water, noise, climate)
- to create a high quality of life for employees
- the place of residence of the owner
- to seize a provided opportunity

## REFERENCES


Artikis, G. P. 1991. Plant location decisions in the Greek food industry. International Journal of Operations and Production Management, 11(5): 58-71.

Badri, M. A., Davis, D. L., & Davis, D. 1995. Decision support models for the location of firms in industrial sites. International Journal of Operations and Production Management, 15(1): 50-62.

Bartlett, C. A. & Ghoshal, S. 1989. Managing across borders: The transnational solution: Hutchinson Business Books.

Boyer, K. K. & Verma, R. 1996. A note on the use of multiple raters in survey-based operations strategy research. Paper presented at the Decision Sciences Annual Meeting, Orlando.

Boyer, K. K. & Verma, R. 2000. Multiple raters in survey-based operations strategy research: A review and tutorial. Production and Operations Management, 9(2): 128-140.

Chakravarty, A., Ferdows, K., & Singhal, K. 1997. Managing International Operations versus Internationalizing Operations Management. Production and Operations Management, 6(2): 100-101.

De Meyer, A. & Vereecke, A. 1996. International Operations. In M. Werner (Ed.), International Encyclopedia of Business and Management: Routledge.

De Toni, A., Filippini, R., & Forza, C. 1992. Manufacturing strategy in global markets: An operations management model. International Journal of Operations and Production Management, 12(4): 7-18.

DuBois, F. L., Toyne, B., & Oliff, M. D. 1993. International manufacturing strategies of U.S. multinationals: A conceptual framework based on a four-industry study. Journal of International Business Studies(Second Quarter): 307-333.

Dunning, J. H. 1993. Multinational enterprises and the global economy. Reading: Addison-Wesley.

Eisenhardt, K. M. 1989. Building theories from case study research. Academy of Management Review, 14(4): 532-550.

Ernst & Young. 1992. Regions of the new Europe: A comparative assessment of key factors in choosing your location: Corporate Location.

Ferdows, K. 1989. Mapping international factory networks. In K. Ferdows (Ed.), Managing International Manufacturing: 3-21. Amsterdam: Elsevier Science Publishers.

Ferdows, K. 1993. Why manufacture abroad: Moving beyond the production benefits: working paper Georgetown University, School of Business Administration.

Ferdows, K. 1997a. Made in the world: The global spread of production. Production and Operations Management, 6(2): 102-109.

Ferdows, K. 1997b. Making the most of foreign factories. Harvard Business Review(March-April): 73-88.

Flaherty, M. T. 1986. Coordinating international manufacturing and technology. In M. C. Porter (Ed.), Competition in Global Industries: 83-109. Cambridge, Massachussets: Harvard Business School Press.

Flaherty, M. T. 1996. Global Operations Management: McGraw Hill.

Futrell, D. 1995. When quality is a matter of taste, use reliability indexes. Quality Progress, 28(May): 81-86.

Haigh, R. 1990. Selecting a US plant location: The management decision process in foreign companies. Columbia Journal of World Business(Fall): 22-31.

Hayes, R. H. & Wheelwright, S. C. 1984. Restoring our competitive edge: Competing through manufacturing. John Wiley and Sons.

Hood, N. & Truijens, T. 1993. European location decisions of Japanese manufacturers: Survey evidence on the case of the UK. International Business Review, 2(1): 39-63.

Jarillo, J. C. & Martinez, J. I. 1990. Different roles for subsidiaries: The case of multinational corporations in Spain. Strategic Management Journal, 11: 501-512.

Khurana, A. & Talbot, B. 1999. Plant missions in global manufacturing networks: A resource-based perspective with evidence from the global color picture tube industry: 48: unpublished paper Boston University School of Management.

Kogut, B. 1989. Research notes and communications: A note on global strategies. Strategic Management Journal, 10: 383-389.

Leontiades, J. C. 1985. Multinational corporate strategy. Massachusetts, Toronto: Lexington Books.

MacCormack, A. D., Newman, L. J. I., & Rosenfield, D. B. 1994. The new dynamics of global manufacturing site location. Sloan Management Review(Summer): 69-80.

Meijboom, B. & Vos, B. 1997. International manufacturing and location decisions: Balancing configuration and co-ordination aspects. International Journal of Operations and Production Management, 17(8): 790-805.

Miles, M. B. & Huberman, A. M. 1994. Qualitative Data Analysis (2nd edition ed.): SAGE Publications.

Plasschaert, S. & Van Den Bulcke, D. 1991. An analysis of the globalisation and collaborative developments of multinational enterprises: discussion paper CIMDA (University of Antwerp).

Porter, M. E. 1990. The competitive advantage of nations. London: MacMillan Press.

Prahalad, C. K. & Doz, Y. L. 1987. The multinational mission: Balancing local demands and global vision. New York: The Free Press.

Roth, K. & Morrison, A. J. 1992. Implementing global strategy: Characteristics of global subsidiary mandates. Journal of International Business Studies, 23(4): 715-735.

Roth, A., Gray, A. E., Singhal, J., & Singhal, K. 1997. International technology and operations management: Resource toolkit for research and teaching. Production and Operations Management, 6(2): 167-187.

Schmenner, R. W. 1979. Look beyond the obvious in plant location. Harvard Business Review(January-February): 126-132.

Schmenner, R. W. 1982. Making Business Location Decisions. Englewood Cliffs, New Jersey: Prentice Hall.

Schmenner, R. W., Huber, J., & Cook, R. 1987. Geographic differences and the location of new manufacturing facilities. Journal of Urban Economics, 21(January): 83-104.

Shi, Y. & Gregory, M. J. 1995. International manufacturing configurations. Paper presented at the EurOMA Conference, Twente.

Skinner, W. C. 1964. Management of international production. Harvard Business Review(September-October): 125-136.

Speier, C. & Swink, M. 1995. Manufacturing strategy research: An examination of research methods and analytical techniques: University of Oklahoma, College of Business Administration.

Taggart, J. H. 1998. Strategy shifts in MNC subsidiaries. Strategic Management Journal, 19: 663-681.

Van Looy, B., Van Dierdonck, R., & Gemmel, P. (Eds.). 1998. Services Management: an integrated approach (first ed.). London: Financial Times Management.

Yin, R. K. 1984. Case study research: Design and methods. Beverly Hills: Sage Publications.

**Professor Roland VAN DIERDONCK**

Civil and Industrial Engineer (Ghent University) and Doctor in Business Administration, Harvard University (USA). He is partner of and professor at Vlerick Leuven Gent Management School and at Ghent University. He is currently dean of Vlerick Leuven Gent Management School. His main research interests are supply chain management, manufacturing strategy and service operations management.

**Professor Ann VEREECKE**

Civil Engineer and Doctor in Management (Ghent University). Followed a doctoral programme at INSEAD (France). She lectures at the Faculty of Economics and Business Administration (Ghent University) and at Vlerick Leuven Gent Management School, where she is also the Programme Director of the Master in General Management and head of the Operations and Technology Management Center. Her main interests are production planning, stock management systems and production strategy. She is specialised in global manufacturing strategy.

**Vlerick Leuven Gent Management School**

## WORKING PAPER SERIES

2001/1 VERWEIRE, K., and L. VAN DEN BERGHE, The performance consequences of diversification in the financial services industry: the case of financial conglomeration in Belgium and the Netherlands. (48 pp.)

2001/2 BUYENS, D., and A. DE VOS, Adding value through integration and involvement: a qualitative study about management 's perception of the added value of the HR function. (46 pp.)

2001/3 VEREECKE, A., R. VAN DIERDONCK, and A. DE MEYER, A network typology of plants in global manufacturing networks. (33 pp.)

2001/4 VAN POUCKE, D., and M. BUELENS, Predicting the negotiated outcome: the role of the structural reference points and negotiator's 'offer zone'. (27 pp.)

2001/5 BUELENS, M., and D. VAN POUCKE, Determinants of negiotatiors's initial offer. (27 pp.)

2001/6 OOGHE, H., and V. DE VUYST, The Anglo-Saxon versus the Continental European governance model: empirical evidence of board composition in Belgium. (42 pp.)

2001/7 SLEUWAEGEN, L., and I. DE VOLDERE, Globalisation and the definition of the relevant geographic market in antitrust practice. (38 pp.)

2001/8 VEREECKE, A., and R. VAN DIERDONCK, The strategic role of the plant: testing Ferdows' model. (44 pp.)

2001/9 OOGHE, H., J. CAMERLYNCK and S. BALCAEN, The Ooghe-Joos-De Vos failure prediction models: a cross-industry validation. (61 pp.)

2001/10 OOGHE, H., and J. CAMERLYNCK, Pre-acquisition profile of privately held companies involved in takeovers: an empirical study (57 pp.)

2002/1 MANIGART, S., M. A. KORSGAARD, R. FOLGER, H. J. SAPIENZA and K. BAEYENS, The impact of trust on private equity contracts. (21 pp.)

2002/2 DE WULF, K., G. ODEKERKEN-SCHRÖDER, M.H. DE CANNIÈRE and C. VAN OPPEN, What drives consumer participation to loyalty programs? A conjoint analytical approach. (25 pp.)

Contact:
Vlerick Leuven Gent Management School
Bellevue 6
B-9050 Ghent
++32 9 210 97 27 (T) ● ++32 9 210 97 47 (F) ● www.vlerick.be ● library@vlerick.be