

GLOBAL SUPPLY CHAINS: AN EXPLORATORY SURVEY OF MANAGEMENT PRACTICE AND CHALLENGES ¹

Falling distance and border-crossing costs allow for a wider choice in the design of a product's supply chain. This concerns the mode of supply chain organisation and, in particular, the "geography" of production activities. This paper examines the resulting opportunities and challenges for six Swiss-based companies in the electronics, electro-mechanical, and mechanical industries.

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LITERATURE

¹ The survey is part of preparatory work for applied research on the management of global supply chains.

SUMMARY

Advances in communication technology and the progressive liberalisation of cross-border business transactions allow for a wider choice in the design of a company's production system, or supply chain. This concerns the mode of supply chain organisation (outsourcing) and, in particular, the geographical reach of production activities.

This paper examines the opportunities of global reach and the resulting management challenges in six Swiss-based companies in the electronics, electro-mechanical, and mechanical industries. The main conclusions are as follows:

1. Concerning the importance of global production in these industries, four companies consider the "global reach – performance" link to be a moderate to strong one. For the remaining sample companies, competing mainly on the bases of product and service quality in end-product markets, the contribution of global reach to performance is weak or negative.
2. In exploiting the opportunities of global reach, all companies but one have chosen the option of global sourcing over that of investing in overseas production. Moreover, along with a growing technological competency of suppliers in non-OECD countries, there appears to be a shift in favour of long-term supply alliances with local suppliers at favoured locations.
3. No less than three companies complain about emerging non-OECD competition in their areas of activity. In the electronics and electro-mechanical industries, suppliers from distant countries are in a position to offer medium quality end products at very competitive prices. This is reported by the sample companies to have "eaten into" market shares and margins.
4. For the supply chain manager, global reach lends a strategic dimension to his tasks. In contrast with, say, a traditional supplier selection process, decisions have to be made involving medium to long-term commitments to both the location and the organisation of production. In responding to this challenge, only one company is reported to employ a structured, integrative decision-making process.

1 Background and purpose of survey

In an integrating world economy, the individual company faces a wider choice in the location of its production system or supply chain, that is, the intra and inter-company processes involved in a product's manufacture. At the aggregate level, the efforts of companies in exploiting the opportunities of an extended choice of production location are reflected in the rapid growth in international trade in intermediary products over recent years.² So far, however, relatively little scholarly attention has been paid to the challenges that the production (or the supply chain or purchasing) manager faces in the planning of production on an international scale.

Based on exploratory interviews with production and supply chain managers, this paper examines current management practice in international production planning functions in a sample of Swiss companies in the electronics, electromechanical, and mechanical industries (see Appendix). It focuses on:

- the perceived need for exploiting the opportunities of an extended choice of production location in maintaining or improving company-level performance (or competitiveness)
- the options available in the organisation of production for those opportunities to be effectively exploited
- emerging challenges in terms of to the content and process of international production planning.

The paper is organised as follows. The next section investigates the nature and the sources of an extended choice of production location. In Section 3, the link from global production to company-level performance is explored. The alternative ways of organising production on an international scale in order for locational advantages to be exploited are examined in Sections 4 and 5. Section 6 examines the production planning challenges following an

extended choice in production system location and organisation. In the final section, the findings of the survey are summarised and some tentative conclusions are presented.

² See WTO (1998), p 36, and Hummels *et al* (2001)

2 Choosing location and organisation

The link between the process of worldwide economic integration, or globalisation, and the "extended choice" in the location of a company's production system has several dimensions. At the aggregate level, the process of globalisation is manifested in a rapid growth in international trade and investment in recent years. The drivers of this process are twofold:³

- advances in information and communication technology, reducing the cost of distance, in particular that of coordinating geographically dispersed production activities
- the liberalisation of international trade and investment, reducing the "border-crossing" costs of business transactions.

In many industries, reductions in distance and border-crossing costs, followed by intensified competition, have contributed to the geographical separation of a product's manufacture from its sale and end-use. An example is the changing role of international production in the strategies of US automotive firms over the past decades.⁴ In the 1960s and early 1970s, foreign production was aimed at accessing national or regional markets. Today, it is driven mainly by the need to cut the cost of production in order to remain competitive. Thus, for a car, manufactured by one of the large US automotive firms, no less than nine countries are reported to be involved in some aspect of production, marketing and selling.⁵

As to the optimising strategies of individual companies, a larger number of accessible production locations amounts to a greater diversity among those to choose from. This does not only refer to the "cost" of production at a company's current locations, as compared with new locations in non-OECD countries. Among the latter countries, there are also considerable differences along various dimensions of "capability" such as the availability of

³ See Venables (1998).

⁴ See Lynch (1998).

⁵ See WTO (1998).

specialised skills and various kinds of infrastructure, ranging from roads and electricity supplies to science and technology (S&T) facilities. These differences originate in the pattern of industrial development and learning and, not least, in the nature of government intervention.⁶

An extended choice of location entails, moreover, a wider range "cost-and-capability" combinations in the choice of partners and suppliers. In international supply chains, companies from non-OECD countries are, in most cases, suppliers of intermediary goods and services such as components and assembly services.⁷ However, with growing technological capabilities, they often assume a wider range of functions or position themselves as private-label suppliers of end products. Finally, when companies from these countries establish themselves as suppliers of end-products sold under their own brandname in international markets, a situation arises in which an extended choice of location leads to a greater diversity among supply chains.⁸

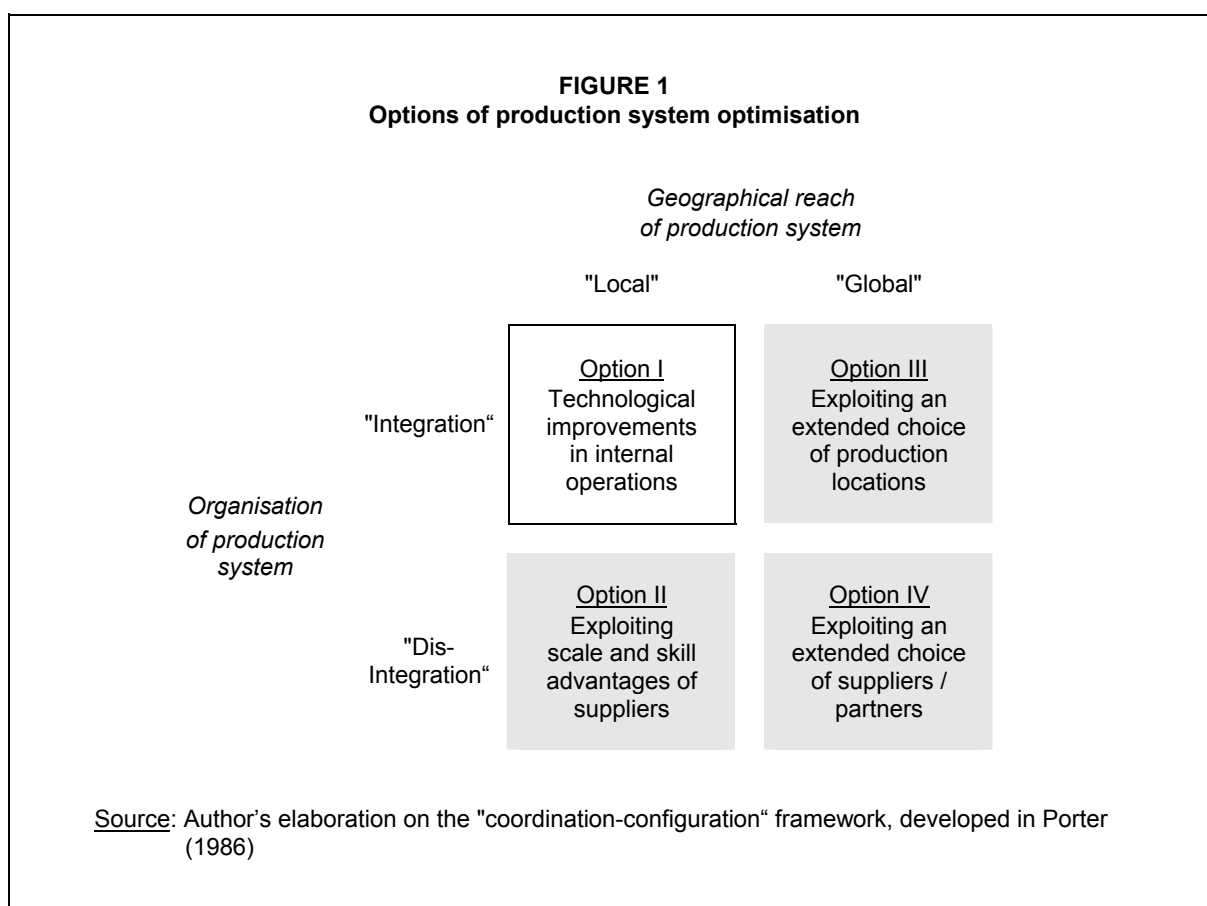
⁶ See Lall (1998).

⁷ See Yeats (1998), and Ng *et al* (1999).

⁸ An example is the software industry, in which there is an emerging competition in international markets between Indian firms on the one hand, and large US-based ones with production in India on the other (Far Eastern Economic Review, 14.11.2002).

3 Global reach and performance

From the point of view of the OECD-based Original Equipment Manufacturer (OEM), the link from global reach to improved company-level performance (or competitiveness) is not a straightforward one. As FIGURE 1 suggests, the opportunities of global reach (Options III and IV) have to be weighed against those of improving production system performance at current locations (Options I and II), including improvements in the technology of production at the machine and plant levels. The choice of the option for a company to pursue in improving production system performance is, in turn, affected by its choice of competitive strategy, defining the bases on which to compete in final product markets.



As expected, companies competing on price attach more weight than others to the options available in the location of their production systems. In the case of ELECTRO B, a large share of total industry production has, over the last decade, migrated to low-cost locations.

In anticipating this trend, ELECTRO B set up assembly operations in Southeast Asia as early as ten years ago. In retrospective, this move has been crucial, not only in securing the company's survival, but also in maintaining its above-industry performance in recent years. Confronted by a similar development in its own line of activity, EL-MECH B has only recently started to examine, in a more systematic manner, the opportunities of global sourcing.

In contrast, the companies competing mainly on quality and flexibility view international production as placing a constraint on their ability to effectively compete in end product markets. EL-MECH A supplies a specialised device of vital importance to its customers' end products, but one that represents only a tiny fraction of their total cost. Therefore, the potential cost savings from global production are not considered large enough to offset the additional risk of product liability claims. Likewise, MECHANO A fears the risk of losing the flexibility in production needed to be able to compete in the market for highly customised textile machinery solutions.

Besides the opportunities of locational change, no less than half of the sample companies emphasise the importance of fully exploiting those of innovation and technological change at the machine, plant and the production system levels at their current production locations. In this regard, EL-MECH A and MECHANO A point to the cost reductions that are often made possible by the automation of production processes with a high degree of standardisation. In addition to automation, ELECTRO B has recently introduced just-in-time production methods, yielding both cost reductions and an increased flexibility in production.

MECHANO B offers yet another example of measures reducing the need for international production. In order to better capitalise on the advantage of being the only supplier in its line of activity with a global distribution network, the company recently decided to focus on a narrow segment of international customers with an above-average demand for product quality and customer service. This shift in strategy reduced the importance of cost

considerations in production. For this reason, the company's production operations in Poland were terminated, even though MECHANO B appeared to have one of the most labour-intensive production processes among the companies surveyed.

In summary, the question of whether to exploit the opportunities of global reach amounts to that of weighing the opportunities of an improved performance at a company's "old" locations against those of shifting production to "new" ones. For most sample companies, the outcome was a combination of both. From observed practice, old locations offer considerable potential for performance improvement, not only in terms of production system cost and flexibility but also at the level of strategic re-positioning. By comparison, the reasons for exploiting the opportunities of global reach are considerably stronger in industry segments in which product price matters.

4 The organisation of global production

From the OEM perspective, the alternative ways of organising global production can be categorised as "buy", "cooperate", and "make". In theory, this choice depends on the relative size, composition, and distribution over time of the governance-related costs involved:

- In the case of "buy", costs are incurred in the search, negotiation and monitoring processes that are needed for individual transactions to take place.
- In the case of "cooperate", investments are made in the development and sustaining of a supplier relationship beyond single transactions (viz. a "continuous handshake").
- In the case of "make", the cost and risk of managing production operations at foreign, distant locations are to be considered.

The internationalisation of purchasing is the most frequently mentioned way for the sample companies to exploit locational advantage. The reason lies in the relatively short-term resource commitments of this option, as compared with "cooperate" and "make". However, according to ELECTRO B's head of global sourcing, this option is confined, by and large, to production processes with *"... relatively large series of intermediary products based on commonly accepted product standards"*. This characterisation of the production processes amenable to "buy" highlights the importance of standards as a determinant of production system organisation. It also offers an explanation for the greater role of global sourcing in electronics than in mechanical industries.

As compared with electronics, mechanical industries use relatively fragmented production processes. This contributes to higher unit sourcing costs in two important ways: First, individual intermediary products are purchased in smaller lot sizes. Second, there is more often a lack of established standards against which to monitor quality. Following recent efforts in overcoming these obstacles, a production manager of MECHANO A claims that,

"... for us, globalisation is just beginning". Whilst three quarters of its purchases are today made in Switzerland, the company is now extending its sourcing activities to Asia and Eastern Europe. A recent project involving the sourcing of foundry products in Romania is reported to have yielded cost savings of up to 50 percent.

None of the companies reports to have explicitly addressed the choice between "buy" and "cooperate" in exploiting locational advantage. This suggests that cooperative ventures on a global scale are more often the result of mutual learning processes, in particular the development of personal trust, than strategic decisions. At the time of the interviews, the sample companies did not seem to possess much experience of long-term cooperative supply arrangements. However, judging from their reflections on the opportunities involved, such arrangements are believed to be crucial for the international outsourcing of non-standardised components and production processes, requiring significant partner and relation-specific investments.

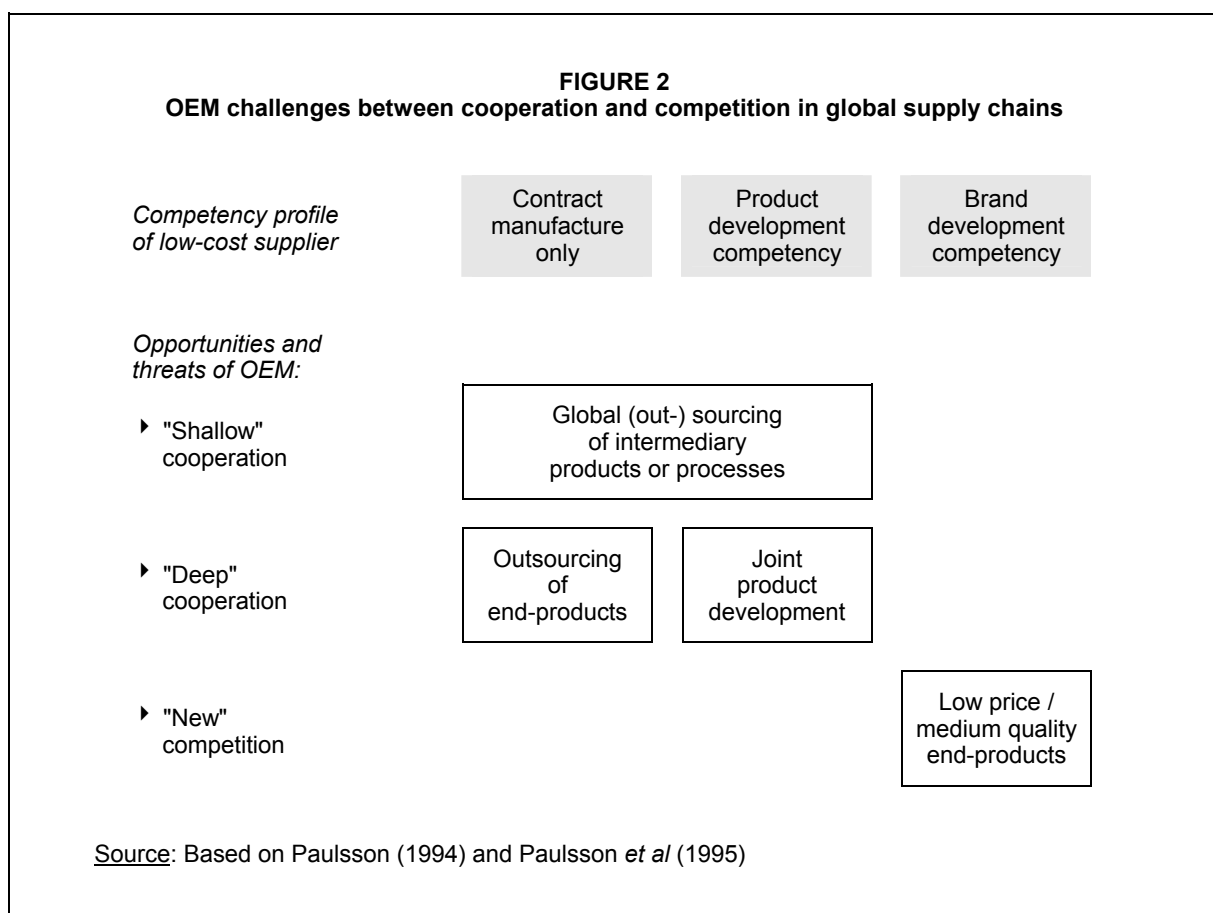
ELECTRO A is the only sample company to have invested in production facilities at low-cost locations. The initial investment decision was based on wage cost considerations in the assembly operation alone. More recently, direct management control has come to play an important role in achieving a higher degree of integration of purchasing and production functions. This has allowed the venture to assume more responsibility for local procurement. At the corporate level, however, the senior purchasing manager reports that "*... considerable management effort is now needed to ensure that our development, procurement and production processes are effectively coordinated*".

Taken together, the observed practices of the sample firms reveal a strong bias in favour of organisational modes with relatively short-term resource commitments. In part, this reflects the current operational bias in production or supply chain management functions, which in turn appears to confine international production operations to commodity-type products and components. By comparison, the effective exploitation of locational advantages for non-

standardised intermediary products and processes requires a longer-term perspective with resources being committed on the basis of a structured planning process rather than *ad hoc* decisions.

5 OEM opportunities and threats

In addition to OEM effort, a supply chain's configuration and organisation also depends on the capabilities and strategies of upstream suppliers and partners (FIGURE 2). One example are the efforts of non-OECD-based suppliers to integrate forward into "higher value" development and marketing activities.⁹ Another is the recent proliferation of globally operating Electronics Manufacturing Service (EMS) providers, specialising in the contract manufacture of end-products. From the OEM perspective, these developments offer new opportunities of "deep", as compared with "shallow", cooperation. However, new supply chains with a global reach also pose the threat of intensified competition in end-use markets.



⁹ For a simple model of organisational choice and dynamics, see Paulsson (2001a).

Among the sample firms, ELECTRO A has gone furthest in exploring the opportunities of new divisions of responsibility with partners in the production process. As one example, it has been engaged in "... *several successful development projects with Asian partners*". The main benefits from such projects have most often been of an indirect kind: If a supplier of non-standardised components and systems participates in the development process, he is better placed to exploit the opportunities of upstream sourcing in his home country. In terms of supply chain performance, this contributes not only to reduced costs but also to an increased flexibility.

As another example, ELECTRO A explored at the time of the interview the "pros" and the "cons" of outsourcing the entire production and logistics process of a recently developed end product to an Hong Kong-based EMS provider. Through such an alliance, ELECTRO A would benefit considerably from the partner's superior scale and purchasing economies as well as from the truly global configuration of its production operations. As the biggest drawback, it would face the risk that the partner's interaction with its customer base results in a leakage of market information, allowing the partner to develop and launch a competing product offer.

Compared with the limited evidence of "deep" cooperation, no less than half of the sample companies report an intensified competition from new suppliers in low-cost countries in their fields of activity. Marketing a range of low-tech products on the basis of a well-established quality reputation, EL-MECH A admits to suffer from growing competition by low-cost Asian suppliers. This competition, involving counterfeit products using the company's designs and being sold at a low price, has not only resulted in lost sales. It has also damaged its quality reputation, for which "... *the uncertain outcomes of costly litigation hardly offer an effective remedy*".

In the case of ELECTRO A, the growing tendency among its customers to turn to low-priced products of Asian suppliers for large-volume orders has forced the company to abandon the

volume segment of its market and to focus instead on selected niches. Like-wise, EL-MECH B attributes the downward pressure on the price premium commanded by its brandname to the growing ability of low-cost suppliers to *"... offer acceptable products with an attractive price tag"*. Realising that their technical capabilities increasingly spill over into a greater ability to exploit local sourcing opportunities, a senior production manager suggests that, *"... our global sourcing people must behave more like the Chinese do"*.

In summary, more than half of the sample companies are affected by the moves by upstream suppliers or partners aimed at achieving a "new" position in the production systems of which they are part. This is especially the case in industries moving towards globalised production. As compared with the efforts of OEMs in exploiting the opportunities of global reach, those of upstream suppliers and partners are focused on achieving a higher level of production system integration. In the case of all but one of the sample companies, ELECTRO B, these moves have been poorly anticipated. This reflects a lack of understanding of medium-term supply trends in their areas of activity and, hence, a lack of monitoring effort.

6 The production planning challenge

With a growing number of options of production system location and organisation, greater demands are placed on the ability of companies to plan the configuration and the organisation of production on a global scale.¹⁰ Indeed, facing intensified competition in final product markets, most sample companies acknowledge the increased need for achieving the "right fit" between the characteristics of the production process on the one hand, and the location and the organisation of production on the other. This requires a structured production planning process, allowing for scarce management and information resources to be efficiently used.

For many companies, the recent growth in the number of options of production system location and organisation has outstripped their production planning capacity. From comparisons between what appears to be good and bad practice, the latter comprises: a poor understanding of industry-level trends in production location; a limited ability to translate new opportunities in the location and organisation of production into options for management action; and the omission of, or the assignment of "wrong" values to key decision variables. As a measure of the resulting uncertainties, the allowances being made for the risk of "location project" failure often exceed 25 percent of the project value.

The company sample also offers some examples of what good management practice is likely to comprise, namely:

- recurrent reviews of suppliers and partners, contributing to an in-depth understanding of industry-level trends in the location and the organisation of production
- the identification and assessment of the available production system options at an early stage in a product's development

¹⁰ For an assessment of the management demands associated with supply chain configuration, see Hieber *et al* (2000), p 13.

- addressing the strategic choices of production system design prior to the selection of partners or suppliers
- the application of a comprehensive set of criteria to the selection of partners or suppliers, accounting both for the diversity of potential partners and the dynamics of the partner relationship.

In ensuring a structured approach to international production planning, planning tools such as guidelines and checklists play an increasingly important role. Likewise, software-based decision tools are needed in order for a greater number of both hard and soft decision variables to be considered in the assessment, or the simulation, of alternative production system strategies. In this regard, ELECTRO B has benefited from its mother company, a major German multinational company, which "*... currently runs a double-digit-million (DM) program*" aimed at developing a tool-kit for strategic planning in supply chain management functions.

Effective production planning also depends on access to information with an increased depth as well as breadth. Following an extended choice of location, it becomes necessary to consider a wider range of production system alternatives. This translates into a greater need for comparable information, encompassing not only the cost but also the competency dimensions of individual production locations. Commenting on the futility of planning without access to relevant information, a senior production manager of EL-MECH B suggests that "*... while speculating about new sourcing opportunities in Estonia and Lithuania, we could as well consider Ukraine*".

ELECTRO B's International Procurement Office (IPO) in Singapore played a central role in the initial development of the company's sourcing operations in Southeast Asia, mainly in providing valuable information on new opportunities of low-cost supply. However, along with an increased choice in the location and organisation of production, ELECTRO B's IPO

network is no longer in the position to offer the breadth of information required by the company's global sourcing unit. For example, despite the company's Southeast Asian IPO, the staff of this unit possesses only rudimentary knowledge of the opportunities of supply in increasingly important countries such as India.

In summary, the increased importance of global reach (Options III and IV in FIGURE 1) as a determinant of production system performance lends a strategic dimension to production planning tasks. In industries moving towards global production, OECD-based OEMs are increasingly confronted by decisions involving long-term resource commitments to both the location and the organisation of production. As compared with tasks of an operational kind, for example the choice of local or regional suppliers (Option II), such decisions depend to a greater extent on a structured planning approach, being supported by relevant management tools and information.

7 Summary and concluding remarks

Along with a greater choice in the location of production, the geographical configuration of a company's supply chain gains in importance as a determinant of its performance.¹¹ This places greater demands on a company's ability to manage its supply chain, or production system, on a global basis. These demands do not only involve a shift from a short-term to a medium to long-term planning horizon. It also becomes necessary to address the choices in the location and organisation of production in an integrated manner. Due to the resulting complexity, the identification and assessment of alternative production strategies require an integrative planning process that makes efficient use of scarce management and information resources.

This account of the demands on international production planning emphasises the need for increased research efforts in providing the necessary models, methods and tools. First, a geographical dimension needs to be added to existing models and frameworks in the production engineering field,¹² Specifically, models are needed in which production system performance is related not only to the technology employed, but also to the configuration and the organisation of geographically dispersed production activities. This requires an interdisciplinary approach in which production engineering concepts are supplemented by those of the management and economics disciplines.

Second, empirical investigation of decision-making processes, mainly at the production system and re-location project levels, is needed in order for theory to be translated into the methods and tools demanded by practitioners. In addition, an improved understanding of the micro-economic criteria of locational choice has important side-effects: It offers valuable guidance to trade and investment promotion activities in importing as well as exporting countries. It may also contribute to the development of "deeper" markets in the kind of

¹¹ See Dunning (1998), p 60.

¹² Examples are SCOR and GERAM.

information needed to monitor, identify and to assess opportunities of international production.

Appendix: Survey method and data

The company sample was selected with the aim of obtaining a cross section of industries, for which (i) the geographical reach of production activities is likely to have a non-trivial impact on production network performance (in terms of end-product cost, quality, and flexibility), but which (ii) differ with respect to production technology and process characteristics.

The interviews, conducted with senior managers in supply chain functions, focused on the challenges originating in the internationalisation of production, including the content and the process of international production planning.

The information obtained from the sample companies is summarised in the table below:

<i>Company acronym</i>	<i>OEM activity</i>	<i>Competitive priorities</i>	<i>"Global reach – performance" link</i>	<i>Organisation of global production</i>	<i>Opportunities [Threats]</i>	<i>SCM planning process</i>
ELECTRO A	Protective devices for the computer industry	Price, quality	Strong	"Make"	[New competition]	Un-structured
ELECTRO B	Sensing equipment for building control functions	Quality, price	Moderate	"Buy", "cooperate"	Deep cooperation	Structured
EL-MECH A	Power switches for the machinery industry	Quality	Weak	"Buy"	[New competition]	Un-structured
EL-MECH B	Handheld powertools for professional and private use	Price, brandname	Strong	"Buy", "cooperate"	[New competition]	Un-structured
MECHANO A	General machinery for textile production	Quality, flexibility	Moderate	"Buy", ("cooperate")		Semi-structured
MECHANO B	Specialised equipment for chemical production	Quality, services	(Negative)			

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