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TOWARDS SYSTEM CAPABILITY: IDENTIFYING LOGISTICS AND MANUFACTURING DEMANDS FOR SMALL SUPPLIERS

Inga-Lill Carlsson

PhD student at University of Gävle and University of Linköping, Sweden
Mekanotjänst Industrier AB, Box 34, SE-820 40 Järvsö, Sweden
Tel: +46 (0)651 18917, Fax: +46 (0)651 18910, E-mail: inga-lill.carlsson@mekanotjanst.se

ABSTRACT
Many subcontractors react on global outsourcing and ever stronger demands for price and lead-time reductions by striving to become more of a system supplier. That a larger overall responsibility follows this role is evident, but what does it really mean? Especially for a small or medium-sized subcontractor, with limited resources, this is a relevant question before investing in developing the organization – may it be production technology and equipment, competence, information technology, or management systems. A literature review reveals extensive customer demands from different perspectives on system suppliers, but also some vagueness about what constitutes such a supplier. An exploratory survey, based upon existing customer agreements and demands on a relatively small supplier developing towards system delivery capabilities, gives an incline of how customers and suppliers look at these demands. The results clearly points out some fields that need to be improved as firms develop system delivery capability.

Keywords: system supplier, subcontractors, logistics

INTRODUCTION
Western companies are rapidly sourcing more and more volume production from low cost regions in order to reduce prices and stay competitive. The structural changes and outsourcing brought about mainly by large enterprises also change the prerequisites for many small subcontractors in the Swedish manufacturing industry. The ever-shortening time for planning and the necessity to produce to forecast means great uncertainties for the supplier, often resulting in increasing amounts of capital tied up. One supplier development strategy to meet the strong demands for price reductions and still be able to offer high quality and flexible manufacturing is to take increasingly larger overall responsibility for the delivery, i.e. to become more of a system supplier. This is also in line with the interest of larger companies to reduce the number of first tier suppliers.

A lot of logistics research has been carried out concerning large international companies, but comparatively little covers the situation and the conditions from the perspective of a small supplier (Rota, Thierry & Bel, 2002) in the above described situation. The purpose of this paper is to identify the logistics demands and challenges facing a small supplier when evolving to a system supplier to large international companies. The study is based on an exploratory survey, and forms a basis for further multiple case and large scale survey studies.

The research question is how the logistics demands on a system supplier, with increasing number of subcontractors and overall responsibilities for system deliveries with high value added, differ from those of a manufacturer of components. The result shows that some demands are equally important, while some are clearly pointed out as more important to a system supplier. This paper thus adds to previous logistics studies by focusing small suppliers evolving towards system supplier capability. Furthermore, it complements studies on the effects of partnerships in new product
developments (Swink & Mabert, 2000; Chung & Kim, 2003; Wynstra & ten Pierick, 2000) and on participation of small manufacturing companies in networks (Chaston & Mangles, 2000).

The terminology regarding different types of suppliers is full of nuances, and a literature review examining different views on suppliers, and the demands they are facing in some different contexts, is called for in order to deal with this subject.

DIFFERENT DEMANDS AND SUPPLIER ROLES – LITERATURE REVIEW

There are many different forms of collaboration between supplier and customer, resulting in a wide variety of supplier types. The Japanese manner has influenced and inspired the development and comprehensive research concern the automotive industry and the lean concept (Lamming, 1993; Kamath & Liker, 1994; Ellegaard et al, 2003).

Original Equipment Manufacturers (OEMs) often use so called system suppliers that can manage comprehensive responsibilities, offering more complex parts or modules. Karlsson et al. (1998) propose a framework of the constituents of a system supplier, emanating from a study of suppliers to a European auto manufacturer. They identify four categories of reasons for which a supplier considers itself a system supplier: extent of product range, product development responsibility, just-in-time delivery, and experience in the industry.

The research regarding supplier-buyer relations emphasizes a range of other perspectives: Collaboration (e.g. Kaufman et al, 1996) forms a part of most perspectives in this context. Supplier involvement within product development have been identified as one important issue, often considered from the buyer’s perspective, with the supplier managed by the customer (e.g. Kamath and Liker, 1994; Karlsson et al, 1998; Wynstra & ten Pierick, 2000; Wagner & Bouteiller, 2002; Ellegaard et al, 2003; Mikkola, 2003). A related area – knowledge and know-how contributions from supplier and buyer respectively – have been dealt with by e.g. Möller et al., (2003). Contractual time aspects and duration of the relationship are other key factors for different supplier roles (e.g. Kalwani and Narayandas, 1995; Sobrero and Roberts, 2002).

The various demands emanate from the different perspectives and this is for example illustrated in numerous supplier management portfolios – where some of the most well-known are the model by Kraljic (1983) setting out from the kind of product delivered, and the model by Wynstra and ten Pierick (2000) who mean that supplier involvement is situation specific.

Supplier roles

Halley and Nollet, (2002) made a differentiation of supplier relationships from five characteristics: nature of the agreement, type of subcontracting, supplier’s expertise, order-giver’s objectives and supplier development and motivation. This resulted in a general and rather wide identification of three different types of suppliers, a subdivision that could also be seen as a description of the requirements on a subcontractor, developing from very price-focused production to be a more “complete” supplier.

1. **The regular supplier**, a capacity subcontractor characterized by short-term agreements and where the order-giver’s objectives are lowest price / meet specifications.

2. **The tactical partner** (or specialized supplier) characterized by medium-term agreements where the order-giver’s objectives are development of a joint quality system, constant price reductions, increased delivery frequency and smaller lot sizes.

3. **The strategic partner** (or preferred supplier) with long-term agreements with its customers, based on continuous improvement, flexibility, added value, and profit. The type of subcontracting is intelligence, where the customer generally has no more than two suppliers per part or module. The supplier master techniques like JIT, TQM and flow management as well as process and systems design, and has high control over cycles and time. Order-giver’s objectives are constant cost and lead-time reductions, increased delivery frequency and smaller lot sizes, together with tight order follow-up monitored in real time.

The supplier role entailing the least complex customer demands is described with a range of different names – regular supplier as above by Halley and Nollet, (2002), commodity supplier
(Kaufman et al., 1996), contractual supplier (Kamath and Liker, 1994; Karlsson et al., 1998), supplier of detail-controlled parts (Clark, 1989; Mikkola, 2003), standard or capacity supplier (Möller et al., 2003). The different perspectives obviously emphasize different demands but to summarize they imply a supplier characterized by low collaboration and low technology levels, which supplies standard parts or parts developed by the customer and built by the supplier to the exact specification.

As Karlsson et al. (1998) emphasize the meaning of the term “system supplier” is somewhat more nuanced. There are a lot of names for suppliers in this kind of more collaborative role towards the customer: besides strategic partner or preferred supplier as used by Halley and Nollet, (2002), other examples are problem-solving supplier or Black Box supplier (Kaufman et al., 1996), mature and partner (Kamath and Liker, 1994; Karlsson et al., 1998), Black Box parts supplier (Clark, 1989; Mikkola, 2003), technology supplier (Möller et al., 2003). These names include wider, more complex roles but some common features indicate a supplier characterized by high collaboration and technology levels, actively cooperating in and sharing some risks of product development with the customer in a long-term relationship. A supplier of this calibre actively works with continuous improvements within different areas – product technology, logistics, competence management etc.

Demands on suppliers
As can be concluded by the above classifications of suppliers the demands on some types of suppliers are substantial, and increasing. Some basic demands are commonly accepted in order to be approved as a “preferred supplier”:

- Certificates of quality and environmental management systems (e.g. standards ISO 9001:2000, ISO 14001:2004)
- Enough financial resources and satisfactory economic growth
- Sufficient production capacity
- Adequate information systems. Open and mutual information exchange about such things as orders and stocks (Rota et al., 2002) is essential to manage shorter lead-times and cost reductions.
- Sufficient technological development. Kaufman et al., (1996) concentrate on strategies for small and medium suppliers’ to collaborate with their customers and manage appropriate technologies. High collaboration and technology levels characterize a problem-solving supplier or Black Box supplier.
- Efficiency. In the study of Stjernström & Bengtsson (2004) all suppliers claim they provide “efficient manufacturing and delivering processes”. This, for manufacturing suppliers, could be regarded as an order-qualifying criterion.

Product development is clearly pointed out as one distinguishing area. Kamath and Liker (1994) identify some critical dimensions: design responsibility, product complexity, specifications provided and supplier’s influence on specifications and stage of involvement, component-testing responsibility and supplier’s technological capabilities. Emanating from these they identify different supplier roles in product development, among others the mature supplier, who waits for critical specifications from the OEM and may have to provide customisation for all subsequent carry-overs, and the partner, who works on a single function, collaborates with the customer and is responsible for the product development. Karlsson et al. (1998) also refer to these roles and use the term system supplier for this latter supplier role. Clark (1989) speaks of Black-box parts, characterized by shared development, where functional specification is done by the assemblers while detailed engineering is carried out by parts suppliers (co-developed parts). But as Blomgren (1997) observe, developmental capability may also be about manufacturing, for example producing prototypes. The significance for manufacturers to take such a role in their customers’ product design process is recognised.

High supplier development responsibility necessitates flexible communication solutions in order to minimize management capacity (time and resources) and still optimize the use of the suppliers’ expertise. According to Wynstra and ten Pierick (2000) different supplier development responsibilities demand different sorts of communication between supplier and manufacturer.
Competence is another prerequisite. Möller et al., (2003) relates to Kraljic’s (1983) portfolio model for resource allocation among different types of suppliers, which the authors claim “advocates a departure from a purchasing and operations perspective towards supply management with a strategic perspective”. They describe know-how and knowledge contribution from supplier and buyer respectively as types of inter-organisational competence development, indicating significance from several different angles: knowledge dependency, switching costs, resources, types of competencies involved, exchange of information, interaction approach, time frame, learning process/roles and typical sourcing. The different stages or steps in the development towards system supply are characterized by enhanced exchange of information, increasing investments and an increasing amount of shared resources. The borderlines between intra- and interorganizational competencies are beginning to be blurred. A study made by Håkansson et al., (1999) concludes e.g. that “the more relationships companies have to others in a business network, the more the companies seem to learn.” Chaston and Mangles (2000) discuss the significance, and the difficulties, for small and medium-size enterprises to form networks in order to acquire the required knowledge to survive in rapidly changing and/or highly competitive markets.

Other aspects on supplier roles and supplier development

The importance of supplier proactiveness, supplier’s co-operativeness, supplier-initiated suggestions for improvement, and openness to new ideas are often stressed. Worth noting in connection to this is that several studies indicate that the supplier’s involvement also assumes an active customer (Bessant et al., 2003, Stjernström & Bengtsson, 2004).

The risk aspect of product development has been investigated by Wynstra and ten Pierick (2000) who introduced development risk as a criterion in their Supplier Involvement Portfolio (developed from Kraljic, 1983). Their findings, as well as Mikkolas (2003), supports prioritizing supplier involvement in new product development projects in order to optimize both management capacity (time and money spent on communication, coordination, etc) and the use of suppliers’ expertise. Mikkola (2003) focuses on inter-firm learning and supplier-buyer interdependencies and her ideas are partly very similar to those of Kaufman et al., (1996), comparing prerequisites for different collaboration and technology levels, although from another angle of approach. She sees three alternatives for a system producer to manage the development of new components: in-house sourcing, outsourcing, or co-development. She claims that one main purpose of outsourcing is “to have the supplier assume certain classes of investments and risks, such as demand variability.” This can be achieved through modular product design. Decomposing complex systems into more manageable parts is one way to gain flexibility and cost savings through economies of scale.

Duration of the relationship is another key factor in the development of a supplier. Sobrero and Roberts (2002) mean that expectations of a commodity supplier are mainly about lower prices and differ from the more long-range expectations of learning in relation to a strategic supplier. In a study Kalwani and Narayandas (1995) found that long-term relationships with selected customers made it possible for the suppliers to reduce costs and reach higher profitability.

Different supplier companies fulfil their role in different ways. Karlsson et al. (1998) identify that systems correspond to “a function that needs to be satisfied”. A system supplier may thus supply sub-systems or possibly an object. It is the customer who creates the opportunities for a supplier to develop into a more customer integrated role and different customers make it necessary for the supplier to act in several supplier roles simultaneously. The way to reach a more integrated role in the value chain may also bee a bit “crooked” depending on where a supplier initially starts – competencies, special interests and intentions of the management decide how to proceed. An important task though, is to clarify the customer demands on different supplier roles in order to make it possible for the supplier to form a strategy and see what gaps to fill up.

The literature review indicates a number of customer demands, relevant to understand the demands on different types of suppliers. Delivery precision with ever shorter leadtimes, quality and environmental management systems, and high process and labour flexibility to handle small runs are frequently mentioned. Price is important, and cost reduction is often discussed in connection
with suppliers’ participation in product development. Purchasing and logistics, as well as communication and information, are stated to be of various importance to different types of suppliers. Increasing collaboration also raise questions about responsibilities and liabilities.

The aim to increase competitiveness and reduce the importance of the price factor compels many companies to try to develop into the role as system supplier. As the brief theory review indicates, the picture of what demands must be fulfilled is not very clear. Different purposes emphasize different demands.

In order to specify the demands and get a notion of how companies interpret these demands on different supplier roles and how they apprehend this development, a survey questionnaire was sent out. Despite a concluding warning from Karlsson et al. (1998) to use the term system supplier with cautions, I will use the denominations “component supplier” and “system supplier” to indicate the scope of the supplier roles, although this obviously is a gross simplification.

METHOD

This paper is based on a single case study, in which an exploratory survey and a number of existing customer agreements are used to identify differences in demands upon a system supplier compared to those of a component supplier.

The following definitions were used in the survey:

- A **component supplier** refers to a supplier that delivers a well-defined component or service, produced in one or few process steps.
- A **system supplier** refers to a supplier with an overall responsibility for the functionality of a product or a system of assembled components, produced in several process steps, and the thereto belonging liability for purchase of material and services.

The survey instrument covers 46 items. These are mainly based on explicit demands in existing general purchase agreements with large, Swedish-based but internationally active industrial customers, to some extent supplemented with items from customers’ supplier evaluations. The demands listed in the survey are grouped under eight headings: delivery precision (5 items), quality & environment (8 items), purchase & logistics (7 items), price (3 items), flexibility (4 items), development (4 items), communication & information (5 items), and liability (10 items). The value 1 on a 7 point scale indicates a “totally unimportant demand” while 7 indicates an “absolutely decisive demand”. The respondents were also asked, in their own words, to point out the most important differences between a component supplier and a system supplier.

The choice of companies for this survey was made from their relation to a relatively small Swedish subcontractor (slightly more than 100 employees) that is in progress of evolving from component manufacturer to system supplier. This company describes itself as a complete supplier of mechanics, whose strength lies in becoming involved as a design and production partner in the production chain at various levels. It claims to have expertise in the fields of design, logistics, industrial engineering, quality, high-speed machining, and laser technology.

The survey was submitted to eight large customer companies and, as a complement, to two relatively small manufacturing companies (of which one is the above mentioned company) with ambitions to develop as system suppliers. One response each were received from purchasing managers of seven of the large customers, and totally seven responses (from executives in leading positions within management, sales, purchase and quality departments) were received from the two suppliers.

The outcome of the survey and the analysis of the customer agreements have been used to identify the steps necessary for a small supplier to consider in order to meet demands in a more customer integrated role.
FINDINGS
The study shows that a number of demands are alike for different types of suppliers. Such basic requirements concern for instance delivery precision. At the same time the results clearly points out some fields that need to be improved as firms develop system delivery capability. It mainly concerns changes in purchasing and supply management, product design and development capability, project management competence, and increased overall liability. A system supplier should e.g. manage spare parts liability as well as systematic work with supplier assessments.

View of customer demands on different types of suppliers

The pattern showing higher importance for the demands on system suppliers is very clear. Only two statements received any other rating: two customer companies evaluated short leadtimes or safety stock as more important for a component supplier, and one customer company noted slightly more importance for a component supplier to draw up correct measurement protocols.

An interesting finding is that the customers consistently show much smaller differences than the suppliers as regards the importance between demands on these two supplier roles (see Diagram 1). The overall degree of importance of the demands, especially on a component supplier, is also considerably higher in the customers’ responses. Only one field show a clear divergence here – the importance of Purchase & logistics to a system supplier is more emphasized by the suppliers in the survey. A probable reason could be that the suppliers are focused on the differences rather than on the levels, as they are in the middle of the process of developing system delivery capabilities.

Diagram 1. View of customer demands on different types of suppliers

- **Delivery precision:** A larger importance for the system supplier to be responsible for stock-replenishment based on forecast or consumption was shown in the replies. As regards demands for right-time delivery, short lead-times, correct documentation and packaging the differences were small.

- **Quality & environment:** Here the most emphasized demand on a system supplier, compared to a component supplier, was to have subcontractors fulfilling the same quality and environmental demands as the supplier itself. Higher rated were also the demands for quality and environmental certificates and for working proactively with quality improvements. Differences in the other demands regarding quality issues were quite small.
- **Purchase & logistics:** This area showed the most emphasized differences, with considerably higher rates on a system supplier for all seven statements: systematic work with supplier assessments and development, work to render the buying processes and the logistic solutions more effective, low cost sourcing, effective material replenishment systems and competence in the logistics organisation. The demand for low cost sourcing was in this connection the one considered most alike for the two supplier types.

The suppliers commented that the demands on purchasing and logistics are considerably higher on system suppliers, being more dependent on broad competences and a wide contact net in order to take on larger complex assignments. Logistics competence is emphasized, as well as buying and production competence. One of the customers (who also defines itself as a system supplier) means that system deliveries consist of more cooperation, where logistics and purchase are very important ingredients to make it work. Component deliveries are more built upon that the internal production competence is very high. A system supplier must be more complete than a component supplier, with ability to actively handle their subcontractors. One customer say: “In my experience the most difficult task for many companies is to guide their subcontractors, this probably applies for both purchases and quality. To secure quality and delivery precision with the subcontractors is a challenge, especially for smaller companies who take an overall responsibility for a product. The difficulty is probably due to that the companies have not understood the scope of the task and ‘taken height’ for it. The more complex a product is, the more steps are required – how do you direct a subcontractor’s subcontractor if you are not organized for it? That’s quite another thing than keeping a check on what’s produced in the own plant.”

- **Price:** The demand for “open book” calculation was assessed as being considerably more important to a system supplier. The other demands, activities to increase productivity and reduce cost, and total cost responsibility, were much more alike for both supplier types – highly and equally important.

Total cost is emphasized and one of the customers elucidates: “This is not only a question of price, but quality, delivery precision, flexibility, etc affects the picture.” They also point at the importance of productivity - that a system supplier simply must be more aggressive in things affecting the final customer.

- **Flexibility:** In this area the highest differences were focused on production equipment to manage rapid product changes, and, to a slightly less degree, on an organisation to manage changes in customer demands. The demands for competence in production engineering and for managing rapid volume changes showed very small differences.

- **Development and project management competence:** This area showed very marked differences. A system supplier is expected, to a much higher degree than a component supplier, to have access to competent project leaders and project teams. This is in fact the most pronounced difference in the whole survey. A system supplier is also more distinctly required to collaborate in design and product development, contribute with competence as regards material choices, technical solutions etc. The demand for development of tools and production processes were more alike.

Customers stress that a system supplier should “understand” the complete product and be able to suggest improvements to optimize the final result regarding function, cost, lead time, etc. It concerns complex products, and quality as well as production questions are emphasized. A system supplier should be able to analyze technical problems and report conclusions as well as search out new subcontractors to solve questions within new problem areas.

- **Communication & information:** Demands about order confirmations, rapid response at technical changes as well as “early warnings” when problems arise were considered almost equally important on both types of suppliers. A more emphasized demand level was shown on the system supplier as regards the ability to handle electronic information via EDI or the like, and the demand for information to the customer before changing production process or supplier.

- **Liability:** Under this heading a wide group consisting of ten different demands was stated. Here the demands rated as considerably more important to a system supplier concerned spare parts responsibility, responsibility for subcontractors production (quality, environment, Code of Conduct
etc), product liability insurance, ability to handle patents and registered designs, and explicit routines for contingency planning. Also demands for secure IT-systems, and product guarantees showed a higher rating for the system supplier, while the demands for directory of tools and fixtures, reliable document handling and responsible management of secrecy were more alike. The suppliers stress the overall view – system supply requires a systematic work to secure the line of supply through the entire supply chain. Two of the customers (one also in the role as a system supplier) emphasizes the responsibility – with deliveries of a larger part of a finished product follows a larger responsibility and a broader range of liabilities.

- **Other comments:** The suppliers point out that the organisation of a system supplier should be “complete” with competence within several areas, e.g. IT-systems and their applications, quality- and measurement organisation and production organisation, with more diversification as a system supplier. One of the customers stress the focus on core competences, meaning that it is better to buy systems from a supplier that is competent in assemblies, modular constructions and price reductions than from a component supplier that wants to broaden itself.

**CONCLUSIONS AND DISCUSSION**

As summarized in the literature review, the empirical findings confirm that the customer requirements of a system supplier may be met by both basic (generic) requirements and what could be denoted as system competences.

**System competences: areas with most differences between demands on a component and a system supplier**

1. **Purchasing and logistics:** systematic work with purchasing processes and supplier development, together with a clear and competent logistics organisation are considered more important to a system supplier.

2. **Development and project management competence:** collaboration in construction and development work, and, above all, to have competent project leaders / teams are considered more important to a system supplier. The conclusions by both Wynstra and ten Pierick (2000) and Mikkola (2003) support prioritizing supplier involvement in new product development projects in order to optimize both management capacity (time and money spent on communication, co-ordination, etc) and the use of supplier’s expertise. This implies a competent project management by the supplier. The supplier assumes some level of design responsibility and therefore need to be involved in project discussions early in the development process. Co-developed components involve co-specialized investments which increase the mutual interdependence and serve as an economic rationale for cooperative, long-term relationships.

3. **Liability:** spare parts liability when production of an article has come to an end is stressed for the system supplier, together with the responsibility for the subcontractors’ production (quality, environment, Code of Conduct, etc) and product liability insurance. The survey also indicates that the ability to manage patents and registered designs makes a substantial difference towards a component supplier.

In addition to this two specific questions are pointed out as important for the system supplier: being able to handle electronic communications, via EDI or the like, and open book calculation, with separately stated material price.

**Generic competences: areas with little or no differences**

1. **Delivery precision and short lead times** are seen as equally important to both types.

2. **Quality and environment:** also here the demands seem to be quite alike.

3. **Price:** activities to increase productivity in order to obtain cost savings and reduce prices, and total cost responsibility are marked as highly and equally important to both supplier roles.

4. **Flexibility:** production equipment capacity for rapid product and volume changes, high production engineering competence, and an organisation able to manage rapid changes in customer demands are important matters to both types of production suppliers.
5. Communication and information: rapid order confirmation and response to technical changes, information before change of production process or supplier, and early warnings as problems arise are also pointed out as important to both types of suppliers.

A core matter for many subcontractors aiming to maintain their competitiveness in the future is to learn how to manage in a more demanding role as system supplier. The study shows that this role is not homogenous – it depends on how customer and supplier interpret the mission. It is however essential to cope with the increasing complexity in production and to cooperate with customers and subcontractors to suggest the best production solutions and continuously work on cost reduction and productivity improvement measures. Effective logistic solutions form an essential part of the picture.

The larger overall responsibility means a considerable obligation to manage and coordinate an increasing number of suppliers – handling matters concerning their quality and delivery reliability as well as conveying demands on their environmental action programme and Code of Conduct. This requires more cooperation within networks and effectively managing the supply chain. Competence management and communication patterns are, besides thorough competencies regarding production technology and a well developed network of competent suppliers, brought out as important ingredients to achieve the important enhanced supplier involvement in product development. Multiple competencies are required for carrying out dialogue and development work with customers as well as suppliers.

Further research
In order to clarify how a small supplier looks on and may live up to increasing logistic demands in a more integrated supplier role deeper studies of the focal company will be carried out. Measures taken to meet customer demands will be analysed, as well as the reasoning behind these measures.

In order to get a more generally applicable result these studies must be made in a much larger scale, as the preconditions are very varying for small and medium sized suppliers. The line of business could possibly also involve different scenarios.

REFERENCES


