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Strategic supplier selection: some emerging issues and challenges

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Abstract: Strategic sourcing plays a critical role in supply chain planning. Supplier selection represents one of the most important functions to be performed by the purchasing department that determines the long-term viability of a company. The supplier selection is a multi-criteria problem, which includes both qualitative and quantitative criteria. In order to select the best suppliers, it is necessary to make a tradeoff between tangible and intangible criteria, some of which may conflict. This paper provides an overall picture of research on Supplier Selection Process (SSP) and supplier selection practices. It deals with the 'supplier selection problem', where a state of the art is presented. We summarise the different selection criteria, the various problems of suppliers' selection and the existing methods to solve these problems. Furthermore, emerging issues and challenges resulting to scope for future works on supply chain procurement activities are identified and some clear guidelines for future research are proposed. It is aimed that the findings will lead to new research settings together with the directions for future research.

1 Introduction and motivations

Supply Chain Management (SCM) and strategic sourcing have been one of the fastest growing areas of management, particularly over the last ten years. Under the expanded heading of logistics, these are now an integral part of company activity covering areas such as purchasing management, transportation management, warehouse management, inventory management, etc. As technological complexity has increased, logistics and supply chains have become more complex and dynamic. Increase in flexibility is needed to remain competitive and respond to rapidly changing markets (Ding et al., 2005). Strategic supplier selection is an important purchasing activity for many firms. Today's consumers demand cheaper, high-quality products, on-time delivery and excellent after-sale services. Hence, companies are under intense pressure to cut product and material costs while maintaining a high level of quality and after-sale services. Achieving this starts with supplier selection. Therefore, an efficient Supplier Selection Process (SSP) needs to be in place and is of paramount importance for successful SCM (Chan et al., 2007).

Overall, there are two salient viewpoints in the literature dedicated to the purchasing activities:

- 1 The most important purchasing decision is undoubtedly selecting and maintaining close relationships with a few, albeit reliable and high-quality suppliers in order to reduce product costs while maintaining excellent product quality and customer services (Aissaoui et al., 2007).
- 2 There is a strong need for a systematic approach to purchasing decision-making especially in the area of identifying appropriate suppliers and assigning orders among them (Aissaoui et al., 2007).

Nowadays, costs of purchasing of raw materials and components or parts from external vendors (suppliers) are very important. As an example, in automotive industry, costs of components and parts purchased from external sources may total more than 50% of

revenues. It can go up to 80% of the total product costs for high-technology firms (Weber and Current, 1993). It shows the importance of decisions of the purchasing activity. Indeed, they determine the most important part of the final cost of the product. Among the decisions related to this activity, supplier selection is the most capital decision (Nydick and Hill, 1992; Mobolurin, 1995). Without any doubt, this selection is one of the decisions that determine the long-term viability of the company (Thompson, 1990).

With globalisation and the emergence of the extended enterprise of interdependent organisations, there has been a steady increase in the outsourcing of parts and services. Moreover, with increasingly competitive global world markets, companies are under intense pressure to find ways to cut production and material costs to survive and sustain their competitive position in their respective markets. Since a qualified supplier is a key element and a good resource for a buyer in reducing such costs, evaluation and selection of the potential suppliers has become an important component of SCM (Jain et al., 2004, 2007). The search for new suppliers is a continuous priority for companies in order to upgrade the variety and typology of their products' range. This is essentially due to two main reasons. At first, more generally product life cycle is very short (3–4 years) and new models must often be developed by using completely renewed material or with new technologies. Second, more industries are, historically, labour-intensive sectors. These aspects are expressed through a complex pattern of demand for material and labour.

Among various supply chain-related activities, the procurement of goods and services is playing an increasingly important role as a result of the globalisation of the economy. Purchasing expenses can consume as much as 60% or more of business' revenues. In many settings, supplier selection is a crucial strategic decision that has long-term impacts on a company's profitability and efficiency (Jain et al., 2007). Two different aspects characterise the supplier selection problem.

The first characteristic is the determination of the number of the suppliers and the mode of relations with them. Considering the characteristics of the company, product and market, its strategic plan can encourage a large number of suppliers or cannot. Today, we are involved in a 'cooperative logistics' environment. The company seeks a strong cooperation with its principal suppliers. This cooperation requires a small number of suppliers. Indeed, a strong cooperation with large number of suppliers is very difficult to manage. Ansari and Modarress (1986) show that in Just-in-Time (JIT) environment, the majority of the companies prefer to follow a strategy of a single supplier or at least with few suppliers. Quarly (1998) presents the factors that determine the policy of a single- or multi-supplier selection. An area of current research focuses on the classification of components or parts or processes to externalise in order to establish a suitable relation with the suppliers of each category. For example, a company can consider a relation of partnership or even a strategic alliance with a supplier who provides a part or a component and with which it wishes to have a durable cooperation. On the other hand, this company can have a hierarchical relation and a significant number of suppliers for the standard parts in order to establish a competition between them and thus to reduce the costs of purchasing. Several authors like Kamath and Likert (1994), Bensaou (1999) and Chan (2003) are interested in the problems of suppliers' classification. The second characteristic is the selection of the best suppliers among the existing alternatives.

This paper is aimed to explore the various issues affecting the SSP. The wide-ranging literature review suggests that much of the focus on SSP has been given to the decision criteria and the decision-making methods used for evaluating and selecting suppliers. Furthermore, emerging issues and challenges resulting to scope for future works on

supply chain procurement activities are identified and some clear guidelines for future research are proposed. It is aimed that the findings will lead to new research settings together with the directions for future research.

The rest of the paper is arranged as follows. Section 2 describes in detail the SSP. Section 3 presents the characteristics of the supplier selection problem. Section 4 examines the existing supplier selection methods. Section 5 discusses some emerging issues and challenges for the future. Section 6 concludes the paper.

2 Supplier selection process

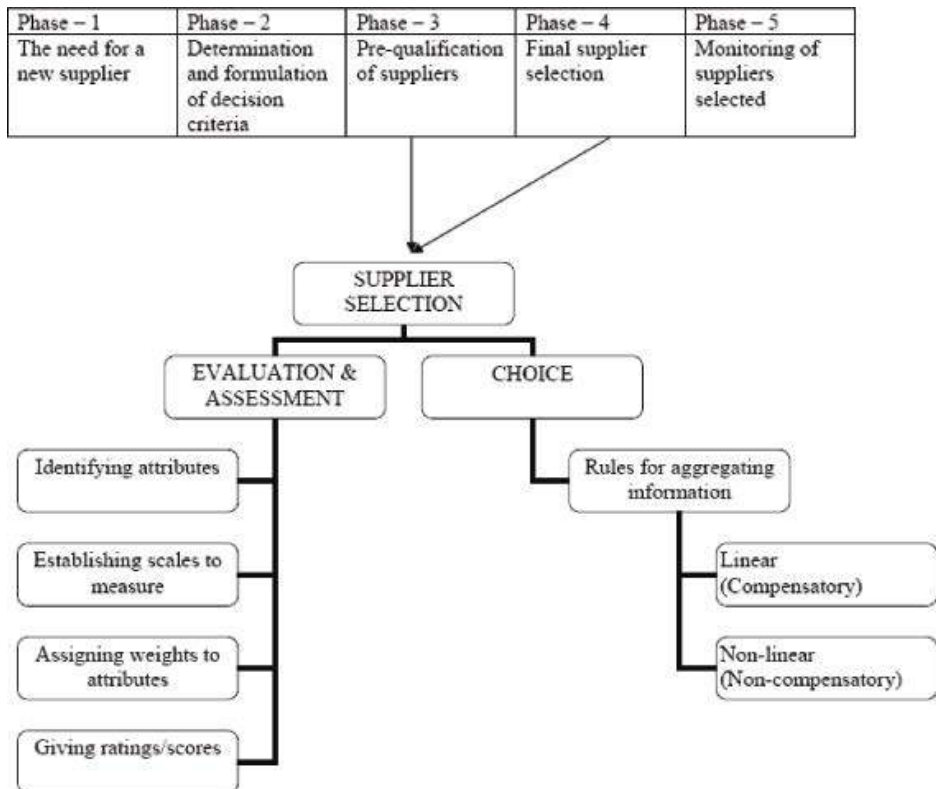
Supplier selection is generally considered as a five-phase process: the realisation of the need for a new supplier; determination and formulation of decision criteria; pre-qualification (initial screening and drawing up a shortlist of potential suppliers from a large list); final supplier selection and the monitoring of the suppliers selected (i.e. continuous evaluation and assessment). In order to ensure an uninterrupted supply of items, it has been observed that more than one supplier is normally available for each item. Periodic evaluation of supplier quality is carried out to ensure relevant quality standards for all incoming items are met. The key objective of the purchasing department is to purchase the right quality of material in the right quantity from the right source at the right time and at reasonable price. One also needs to consider many other factors with the aim of developing a long-term supplier relationship. With the increase in use of quality management and JIT concepts by a wide range of firms, the supplier selection decision has become even more critical (Muralidharan et al., 2001, 2002). As customer's demands are always uncertain, manufacturers tend to manage their suppliers in different ways leading to a supplier-supplier development, supplier evaluation, supplier selection, supplier association, supplier coordination, etc. (Jayaraman et al., 1999; Chan, 2003; Deng and Elmaghraby, 2005).

Supplier selection involves two main tasks, which are also central to any decision-making problem: (1) the process of evaluation and assessment and (2) aggregation of evaluation and assessment to make a choice. As can be seen from Figure 1, the evaluation and assessment task, first, requires the identification of decision attributes (criteria) against which the potential suppliers are to be assessed. Then, evaluation scales/metrics are determined in order to measure the appropriateness of a supplier. Such metrics or scales are useful and necessary to determine the likely worst and best outcomes for each attribute. The next requirement is to assign weights to attributes to indicate the relative importance and contribution of each criterion to the supplier evaluation and assessment.

Chan (2003) proposed a model named Interactive Selection Model (ISM) with Analytical Hierarchy Process (AHP) to handle the SSP systematically and quantitatively. However, the calculation of preference among criteria is mainly based on some quantitative business data and the subjective judgement from senior level (Ghodsypour and O'Brien, 1998; Humphreys et al., 1998; Verma and Pullman, 1998), field experts (Mandal and Deshmukh, 1994; Rebstock and Kaula, 1996; Barbarosoglu and Tagzac, 1997; Babic and Plazibat, 1998; Cheng and Li, 2001; Humphreys et al., 2001) and project team (Ragatz et al., 1997). Because of the imprecise nature of linguistic attributes, the decision of those decision-makers may be subjected to ambiguity. When supplier ranking is carried out by pairwise comparison-based method such as AHP, the results are prone to

judgemental error. Moreover, use of AHP is clearly not straightforward for most users and it makes the process quite cumbersome. Though heavily based on the principle that experience, knowledge and judgement of decision-makers are as valuable as the data they use, human judgement is always subjective and is biased towards their own intuitive thought processes (Min 1994; Rebstock and Kaula, 1996). The decision criteria used for supplier selection and the weightings assigned to them can be different due to a number of factors: the demographic characteristics of the purchasing managers (Sharland et al., 2003; Kamann and Bakker, 2004; Murray et al., 2005), the size of the buyer organisation (i.e. small vs. large), the preferred sourcing strategy (i.e. single vs. multiple), the existence of a supply chain (purchasing) strategy (Lin et al., 2005) and the type of products and/or services purchased (Sharland et al., 2003; Gonzalez et al., 2004; Katsikeas et al., 2004; Svensson, 2004). Some researchers have emphasised the need for integrating environmental criteria into the SSP as more and more end users (customers) are becoming aware and concerned about the environmental issues (Humphreys et al., 2003).

Figure 1 Phases of SSP and tasks in supplier selection



Source: Sarkis and Talluri (2002)

Nowadays, from a manufacturer's point of view, customers turn out to be increasingly influential in terms of purchasing and bargaining power. In this association, manufacturers have to cooperate or interact with suppliers to maximise the productivity

at the minimum cost while satisfying customer requirements. Furthermore, the participation of a large number of narrowly interrelated assessments regarding negotiations, financing, distribution, procurement and product quality assurance at the source implies the significance and long-lasting impact of suppliers' selection on sourcing. Companies in order to accomplish the goals of low cost, consistent quality, flexibility and quick response have increasingly considered superior supplier selection approaches. These approaches require collaboration in sharing costs, benefits, expertise and an attempt to understand one another's strength and weaknesses, which in turn leads to single sourcing and long-term partnerships (Bhutta and Huq, 2002).

It is worth mentioning that these criteria are interrelated. Some of the criteria are also used in previous studies, but others are long term and more subjective or judgemental in nature. Most of the methodologies proposed treat all the individuals as equivalent when undertaking the aggregation procedure. Obviously, some individuals are more important to an organisation than others. In such decisive situations, the criteria to be considered are highly diverse and no single expert can be expected to have 'expertise' to comment on all such criteria (Muralidharan et al., 2002). In the next subsection, we will discuss in detail the decision criteria for supplier selection.

2.1 Decision criteria

Supplier or vendor selection decisions are complicated by the fact that various criteria must be considered in decision-making process. The analysis of criteria for selection and measuring the performance of suppliers has been the focus of many scientists and purchasing practitioners since 1960s.

An interesting work, which is a reference for the majority of papers dealing with supplier or vendor selection problem, was presented by Dickson (1966). Dickson's study was based on a questionnaire sent to 273 purchasing agents and managers selected from the membership list of the National Association of Purchasing Managers. The list included purchasing agents and managers from the USA and Canada. A total of 170 (62.3%) responses were received. Table 1 summarises the finding of Dickson's study regarding the importance of 23 criteria for supplier (vendor) selection. Indeed, the 23 criteria are ranked with respect to their importance observed in the beginning of the 1960s. At that time (1966), the most significant criteria were the 'quality' of the product, the 'on-time delivery', the 'performance history' of the supplier and the 'warranty policy' used by the supplier.

Table 1 Dickson's supplier or vendor selection criteria

<i>Rank</i>	<i>Criteria</i>	<i>Mean rating</i>	<i>Evaluation</i>
1	Quality	3.508	Extreme importance
2	Delivery	3.147	
3	Performance history	2.998	
4	Warranties and claim policies	2.849	
5	Production facilities and capacity	2.775	Considerable importance
6	Price	2.758	
7	Technical capability	2.545	

Table 1 Dickson's supplier or vendor selection criteria (continued)

<i>Rank</i>	<i>Criteria</i>	<i>Mean rating</i>	<i>Evaluation</i>
8	Financial position	2.514	Considerable importance
9	Procedural compliance	2.488	
10	Communication system	2.426	
11	Reputation and position in industry	2.412	
12	Desire of business	2.256	
13	Management and organisation	2.216	
14	Operating controls	2.211	
15	Repair service	2.187	Average importance
16	Attitude	2.120	
17	Impression	2.054	
18	Packaging ability	2.009	
19	Labour relations record	2.003	
20	Geographical location	1.872	
21	Amount of past business	1.597	
22	Training aids	1.537	Slight importance
23	Reciprocal arrangements	0.610	

Criteria used in Dickson's study are as follows:

- 1 the *net price* (including discounts and freight charges) offered by each supplier
- 2 the ability of each supplier to meet *quality* specifications consistently
- 3 the *repair service* likely to be given by each supplier
- 4 the ability of each supplier to meet specified *delivery schedules*
- 5 the *geographical location*
- 6 the *financial position* and credit rating of each supplier
- 7 the *production facilities and capacity* of each supplier
- 8 the *amount of past business* that has been done with each supplier
- 9 the *technical capability* (including research and development facilities) of each supplier
- 10 the *management and organisation* of each supplier
- 11 the *future purchases* each supplier will make from your company
- 12 the *communication system* (with information on progress data of orders) of each supplier

- 13 the *operational controls* (including reporting quality control and inventory control systems) of each supplier
- 14 the *position in the industry* (including production leadership and reputation) of each supplier
- 15 the *labour relations record* of each supplier
- 16 the *attitude* of each supplier towards your organisation
- 17 the *desire for your business* shown by each supplier
- 18 the *warranties and claims policies* of each supplier
- 19 the ability of each supplier to meet your *packaging* requirements for its product
- 20 the *impression* made by each supplier in personal contacts with you
- 21 the availability for training *aids* and educational courses in the use of the product of each supplier
- 22 compliance or likelihood of *compliance with your procedures* (both bidding and operating) by each supplier
- 23 the *performance history* of each supplier.

Weber et al. (1991) present a classification of all the articles published since 1966, according to the treated criteria. Based on 74 papers, they observe that 'price', 'delivery', 'quality' and 'production capacity and location' are the criteria most often treated in the literature.

Overall, the 23 criteria presented by Dickson still cover the majority of the criteria presented in the literature until today. On the other hand, the evolution of the industrial environment modified the degrees of the relative importance of these criteria. For example, Weber et al. (1991) insists on the high importance of the geographical position of the supplier in JIT environment, whereas this criterion appeared at the 20th position in 1966. Also, the criteria at the 10th, 12th and 13th positions (communication system, desire of business, management and organisation), of Dickson's study, are very important for the actual industrial environment. Indeed, the actual situation requires a perfect coordination and a durable cooperation between various actors of the supply chain.

More and more companies establish close connections with their suppliers. This leads to the concepts of partnership, privileged suppliers, long-term agreement, etc. (Dyer and Forman, 1992). The traditional management of customer-supplier (or customer-vendor) relationships, which encouraged competition between suppliers (or vendors), made place with new fashions of arrangement based on the cooperation between supplier and company starting from the design of the product. This mode of relation privileges selection criteria which are, more particularly, the capacity of cooperation, communication system, and control and coordination of flows rather than the traditional criteria which are cost, quality, etc.

Related to supplier or vendor selection problem, the literature is very rich. We refer to the following works as an example to show the criteria treated in the literature of the 1990s. Ellram (1990) proposes three principal criteria which are as follows: (1) the financial statement of the supplier, (2) organisational culture and strategy of the

supplier and (3) the technological state of the supplier. For each one of these three criteria, the author presents several sub-criteria. Barbarosoglu and Yazgac (1997) distinguish three principal criteria: (1) the performance of the supplier, (2) technical capability and financial of the supplier and (3) the quality system of the supplier. Similar to Ellram (1990), they propose some sub-criteria for each principal criteria.

As an example related to a practical study, we summarise, in this section, the most important criteria presented in the paper by Barbarosoglu and Yazgac (1997). The purpose of the study is to design an AHP model (which will be presented in the next section) to solve the supplier selection problem in the Turkish industry. The general-purpose model was applied to the leading electromotor manufacturer of Turkey.

The hierarchy developed by Barbarosoglu and Yazgac (1997) is a five-level, incomplete hierarchy in which the top level represents the main mission of the supplier selection and the last level consists of the alternative suppliers. The primary objectives affecting the supplier selection are grouped under three main categories: performance assessment, business structure/manufacturing capability assessment and quality system assessment. The evaluation criteria that influence each of the primary objectives are included at the second level. The sub-criteria which are related to the second-level criteria are given in the third and fourth levels.

In this paper, we will summarise the different criteria presented by Barbarosoglu and Yazgac, which are basically related to a practical case study.

1 First level: Performance assessment

1.1 Second level: Shipment quality

- 1 Rejection in incoming quality control: the percentage of defective incoming material detected by the incoming quality control
- 2 Rejection in the production line: the percentage of defective incoming material not detected by the incoming quality control, but noticed during production
- 3 Rejection from final customer: the percentage of incoming material accepted by the incoming control and production line, but returned from the customer
- 4 Lot certification: the practice of using a reliable lot certification in all procurement transactions
- 5 Sorting effort: the man-hours spent for sorting the defective material shipped to the company
- 6 Defective acceptance: the percentage of defective material which can be tolerated in the final product.

1.2 Second level: Delivery

- 1 Compliance with quantity: the supplier's compliance with the predetermined order quantity within the tolerance limits
- 2 Compliance with due date: the supplier's compliance with the predetermined order due date within the tolerance limits
- 3 Compliance with packaging standards: the supplier's compliance with the packaging standards (dimension, labelling, etc.).

1.3 Second level: Cost analysis

- 1 Compliance with cost analysis system: the consistency of the price increase request made by the supplier with the costing system agreed upon between the supplier and the company
- 2 Compliance with sartorial price behaviour: the consistency of the price increase request made by the supplier with the sectoral average
- 3 Cost reduction activities: the actual cost reduction achieved by the supplier as a result of corrective actions and technological investments and reflected upon its pricing policy.

2 First level: Business structure/manufacturing capability assessment

2.1 Second level: Technical cooperation

- 1 Response to quality problems: the supplier's ability to solve the quality problems detected by the company during audit, incoming quality control, production or new product development
- 2 Design capability: the supplier's capability to develop a new design
- 3 Level of cooperation and information exchange: the supplier's cooperation and information exchange with the company about technical processes such as design, prototype building, die alterations and other phases from design to production.

2.2 Second level: Employee profile

- 1 Organisational structure: the organisational structure of the supplier and the clarity of employee job definitions within this structure
- 2 Number of employees: the total number of employees
- 3 Number of technical staff: the number of employees in technical departments (i.e. purchasing, quality, production, laboratory)
- 4 Education: the availability of professional educational activities and scheduled yearly training programme, the accurateness of personnel educational database and the percentage of staff attending the training programmes in the supplier manufactory.

2.3 Second level: Financial status

- 1 Total revenue: the total revenue of the previous year
- 2 Profitability: the total profit of the previous year
- 3 Company share within the work volume: the share of the company within the total work volume of the supplier.

2.4 Second level: Equipment

- 1 Production machinery: the number, model, capacity utilisation ratio and the energy requirement of the production, repair/maintenance, laboratory and die-shop machine groups
- 2 Technological compatibility: the technological compatibility of the service, material or part provided to the company
- 3 Computer hardware: the capability of the computer hardware and basic software packages available in the supplier manufactory.

2.5 Second level: Manufacturing

- 1 Production planning system: the effectiveness of the production planning functionality and communication with the shop floor
- 2 Lead time: the time taken from receipt of an order to delivery
- 3 Maintenance activities: the extent of preventive maintenance and the conformance between the actual and the planned activities
- 4 Plant layout and material handling: the efficiency of the plant layout from the material handling point of view
- 5 Transportation, storage and packaging: the effectiveness of the transportation, storage and packaging functions.

3 First level: Quality system assessment

3.1 Second level: Management commitment

- 1 Quality assurance system documents
- 2 Role of the quality function in the manufacturing
- 3 Internal audit
- 4 Work force participation in quality improvement.

3.2 Second level: Product development

- 1 Assessment of design development activities
- 2 Design functionality and reliability experiments
- 3 Quality techniques in design.

3.3 Second level: Process improvement

- 1 Process improvement activities
- 2 Process and machine capability indices
- 3 Quality techniques in process improvement.

3.4 Second level: Quality planning

- 1 Compliance with company specifications
- 2 Prototype controls
- 3 Traceability
- 4 Assessment of quality improvement activities
- 5 Quality costs
- 6 Quality database.

3.5 Second level: Quality assurance in supply

- 1 Purchasing procedures and supplier evaluation
- 2 Quality certified shipment
- 3 Approval of changes
- 4 Incoming quality control procedures.

3.6 *Second level: Quality assurance in production*

- 1 Part/product definition and sorting
- 2 Rework
- 3 Process control and interference
- 4 Statistical applications
- 5 Application of advanced quality techniques
- 6 Corrective action response.

3.7 *Second level: Inspection and experimentation*

- 1 In-process inspection and reliability tests
- 2 Final inspection and reliability tests
- 3 Product audits
- 4 Measuring and testing equipment
- 5 Calibration activities.

3.8 *Second level: Quality staff*

- 1 Number of quality staff
- 2 Education of quality staff.

3 Concept and characteristics of ‘strategic supplier’

In this section, we summarise the concept and characteristics of the strategic supplier selection problem.

3.1 Concept of ‘strategic supplier’

We briefly recall the concept of the strategy of the company before defining the concept of strategic supplier.

The strategy of the company chooses the spheres of activities in which it intends to be present and allocates the necessary resources, in order to guarantee its long-term viability and development. This definition identifies two levels of strategy: (1) strategy of group called cooperate strategy, which determines the spheres of activities of the company, and (2) business strategy which must be put into each one of these spheres. The business strategy defines the operations that the company must achieve in order to favourably get a good position compared to its competitors in a given sector. Moreover, three basic business strategies are identified for each company: (1) domination by the costs, (2) differentiation and (3) concentration, respectively.

The fact that the business strategy of the company is the manner by which it plans to carry on its competitors implies the selected suppliers must be perfectly able to satisfy this strategy from the concept of ‘strategic supplier’. Normally, the company must select its suppliers among the strategic suppliers. For example, a company having a *strategy of differentiation by the ‘delivery time’* and which is in a market with a personalised and not very foreseeable demand must choose obviously a supplier who can deliver the components (products) within a minimum time. For this reason, the supplier must have, for example, an Electronic Data Interchange (EDI) system adapted to the company system. Consequently, they can exchange information and orders as quickly as possible

with 'reactive' production systems (both supplier and company production systems). On the other hand, if the *strategy of the company is the domination by the cost*, it must seek its strategic suppliers in another category of suppliers who offer less expensive products and not inevitably with an excellent quality or a short delivery time.

3.2 Characteristics of the supplier selection problem

3.2.1 Strategic decision

Selecting the most appropriate suppliers has long been regarded as one of the purchasing department's most important functions. In one of the very early purchasing texts, Lewis (1943) stated: "It is probable that of all the responsibilities which may properly be said to belong to the purchasing officers, there is none more important than the selection of suppliers. Indeed, it is in some respects the most important single factor in purchasing". Later, England and Leenders (1975) said that "supplier selection is purchasing most important responsibility". Furthermore, Dobler et al. (1984) make the same point with the following words: "Selecting capable suppliers is one of a purchasing manager's most important responsibilities".

Both the difficulty and the importance of supplier selection are being exacerbated by recent business trends. These developments include the increase in the value of purchased components as a percentage of the total revenue for manufacturing firms, an expansion of foreign sourcing (suppliers) and the increased rate of technological change, accompanied by shorted product life cycles. Hence, without any doubt, the decisions related to the supplier selection problem determine the long-term viability of the firm or the company (Thompson, 1990).

These decisions influence first the coordination of various services of the company, and second its competitive position in the market. Consequently, this decision (supplier selection) must be in conformity with the strategy that the company decided to achieve its goals. Section 5 deals about the different methods to take into account in order to have coherence between the strategy goals and the suppliers' selection function of the company.

3.2.2 Multi-players

The supplier selection decision requires the intervention of the various services of the company (Dyer and Forman, 1992; Mobolurin, 1995). Indeed, this (these) decision(s) will be reflected on several services of the company such as production, transport, storage, purchase, etc. Moreover, the majority of the decision criteria are subjective; this is why it must be decided under the consensus of a group of decision-makers with various points of view. The members of this group must consider the interest of all the services, and thus the representative of each service must know well the needs for the other services of the company. A discussion enables them to better know the interests of the various services of the company.

3.2.3 Multi-criteria

Normally, the decision on the suppliers' selection requires considering several criteria. These criteria are often contradictory (e.g. the quality of the component (or product) and the cost of the component). Consequently, we decide to select the supplier who establishes a better compromise between the criteria.

3.2.4 *Subjective criteria*

In practice, a significant number of decision criteria is subjective. The subjective criteria are criteria that we cannot represent in a quantitative way. For example, the decision ‘desire of business’, expressed by a supplier, is a subjective criterion.

In addition to the subjective criteria, the objective criteria are to be considered. An objective criterion is a criterion that we can measure by a concrete quantitative dimension (e.g. cost). We give attention here to the question: How to find a quantitative dimension? Indeed, it is not always easy to get it directly. For example, the criterion ‘price of the product’ is ‘easy’ to measure; it can be obtained directly. The quality of products and services is a ‘difficult’ criterion, because we cannot measure it directly. We should take into account the cost of rejection of the product, the cost of the services after sale, etc.

3.2.5 *Other characteristics*

Other characteristics must be taken into account by the decision-makers in order to reach an efficient suppliers’ selection, which guarantees the long-term viability of the company.

Most of the time, the supplier selection problem deals with more than one supplier, called multi-supplier choice or situation. Indeed, when, for example, the best supplier cannot satisfy all the customer demands or orders (capacity limitation constraint), the customer must satisfy its demands with several suppliers. In a multi-supplier case, we are interested in the following two questions: which suppliers to choose and how much is it necessary to order from each one? In certain cases, even if the supplier can satisfy the total demand, the company prefers to have more than one supplier. Even if this choice needs more flexibility from the company, it is very interesting when one of the suppliers, for any reason (strike, weather conditions, war, etc.), cannot satisfy the assigned demand.

Moreover, comparing to the criteria, the parameters of the problem or the behaviours of the suppliers can be stochastic or determinists. Also, in this problem, we can have various constraints concerning the customers or the suppliers, or both, such as limited capacity of the supplier, minimum and maximum order quantity, quality, delivery time, etc.

A global solution must be able to consider these above characteristics. It is important to state that the majority of these characteristics are of a comparable nature. Furthermore, the characteristics of the problem ‘make or ask to make’ the component or the part, in particular, forms the strategic and the multi-criteria aspects of this problem.

4 **Supplier selection methods**

In past, several methodologies have been proposed for the supplier selection problems; we can classify the majority of the existing methods, to solve the supplier selection problem, in three principal categories. A method can, of course, be the combination of the elementary methods presented below.

4.1 *Elimination method*

For this method, on each level, we eliminate, from the suppliers list, suppliers that do not satisfy the selection rule. With a ‘conjunctive’ rule (Crow et al., 1980), we eliminate the suppliers whose mark, with respect to a criterion, is lower than the minimal mark. Thus, we choose one of the suppliers satisfying the minimum level of all the criteria. In a ‘lexicographic’ rule (Wright, 1975), on the first level, we select the most significant criterion and then we compare the suppliers with respect to this criterion. If a supplier satisfies this criterion much better than the other suppliers, then it is chosen and if not, we compare the suppliers with respect to the second criterion, and so on.

4.2 *Optimisation methods*

For this method, we optimise an objective function, which can consist of a single criterion or a set of criteria subject, or not, to a set of constraints. Below, we present the two situations. Indeed, we consider first the situation without constraints, and after that we focus on the situation where we optimise subject to a set of constraints, which must be respected.

4.2.1 *Without constraints*

In the situation with a single criterion, generally one retains the cost like the most important criterion. We compute all the direct costs, e.g. the purchase price, the transport cost, etc., associated to each supplier, and we choose the least expensive one (Timmerman, 1986). A considerable number of companies choose practically their suppliers starting from this method. The companies that choose a strategy of ‘*domination by the costs*’ are susceptible to use this method. Moreover, Verma and Pullman (1998) show that, although the managers declare quality as the most significant criterion, in practice rather they often decide (which supplier to take) starting from the direct cost and quality of delivery given by each supplier.

In a multi-criteria situation, we appreciate each criterion by a weight. This weight shows the relative importance of the criterion. Then, we choose the supplier who has the best mark compared to the whole of the weighted criteria.

In the case with ‘identical weights’ (situation where all the weights are identical), we associate good (+), neutral (0) or unsatisfactory (–) to each supplier with respect to each criterion.

In the situation with different weights, the AHP approach can be used. With this approach (Saaty, 1980), we determine the weight of each criterion by a binary comparison method. The mark of each supplier is calculated by comparing the suppliers with respect to each criterion. For example, Houshyar and Lyth (1992) distinguish three types of criteria: critical criteria (these are essential for a supplier selection), objective criteria (monetary) and subjective criteria (qualitative). For the subjective criteria, they propose the AHP approach. Linked to the importance of this method, we propose, in details, its description.

4.2.2 Subject to a set of constraints

The purpose of these methods is to select one or more suppliers who maximise an objective function (decision criteria) subject to a set of constraints related basically to the suppliers and/or the customers (companies). The objective function can be with a single criterion (often met in mathematical optimisation models) or multi-criteria ('goal programming' or 'multi-objective programming'). Weber et al. (1991), in their state of the art, count ten articles, which used mathematical optimisation with constraints for supplier selection problem. Ghodsypour and O'Brien (1998) present seven other articles published during the period 1991–1998. The methods used are as follows: 'linear programming', 'mixed integer programming', 'multi-objective programming' and 'no-linear programming'.

The objectives presented in these models are as follows: the minimisation of the total cost, the minimisation of the number of components which does not respect the customer conformity (quality), the minimisation of the number of components delivered late or delivered in advance, the minimisation of the distance (or time) between the supplier and the customer (Weber and Current, 1993), etc.

The constraints of these methods are as follows: production capacity of the supplier, the satisfaction of the request or the demand, the minimum order quantity, the total budget of purchasing, the minimum or maximum number of suppliers, the geographical preference (Weber and Current, 1993; Weber et al., 2000a, 2000b), etc. For example, Ghodsypour and O'Brien (1998) use 'the linear programming' to determine the optimal order quantity of each supplier. The constraints of the mathematical model are as follows: the supplier capacity, the demand, which must be satisfied and the tolerated number of components, which does not respect the conformity (quality). The objective of the model is to maximise the total utility of the selected suppliers, where the utility (of each supplier) is the final mark of the supplier calculated by the AHP method.

4.3 Probabilistic method

The supplier selection decision can often be handled in a relatively routine fashion, either because there is little probability of the customers making an error or because an error would not seriously impact the performance. Under certain conditions, however, there is a relatively high probability that an inappropriate supplier will be selected and that such an error will adversely affect the customer.

When the assumptions on which purchase order requirements are based prove faulty, it may be necessary to change quantities, delivery rates, design specifications or other important terms of the contract. Even though the selected supplier was best able to meet the terms of the original purchase order, it may not be the best choice for the modified contract.

According to the method called 'Payoff Matrix' (Soukup, 1987), we define several scenarios of the future behaviour of the suppliers. For each scenario, we associate a mark to the suppliers with respect to the criteria. Then we compute the total mark of each supplier and choose, for example, the supplier who has a stable mark according to various scenarios.

Soukup (1987) suggests following three categories of supplier selection decisions:

- 1 The suppliers under considerations are similar under all foreseeable circumstances: only minor differences in performance can be expected. *This decision should be handled routinely.*
- 2 The potential suppliers differ significantly: one supplier is superior under all foreseeable conditions. *This decision should be handled routinely.*
- 3 The candidate suppliers differ significantly under at least some future conditions that may be expected: the best supplier under some circumstances will not be the best under other circumstances. This decision category presents the customer with a moderate to high probability of making an error in the selection of a supplier, coupled with the possibility of serious consequences of such an error. *This supplier selection situation warrants considerable effort and care.*

In Table 2, we summarise the conditions under which suppliers must be selected.

Table 2 Classification of supplier selection decisions (Soukup, 1987)

<i>Condition</i>	<i>Probability of error</i>	<i>Consequences of error</i>	<i>Decision mode</i>
Suppliers are similar under all conditions	High	Very small	Routine
Suppliers differ significantly: one supplier superior under all conditions	Low	High	Routine
Suppliers differ significantly: best supplier depends on future conditions	High	Unknown: may be very high	Complex: requires thorough analysis

In Table 3, we summarise the different advantages and limitations of various supplier evaluation methods.

A synthesis of the literature shows us the following points:

- 1 The strategic nature of the supplier selection decision determines the long-term viability of the company. However, the majority of the existing models are based on functional criteria such as quality, price, delivery time, etc., and do not take into account the repercussions of the company strategy on this decision.
- 2 The multi-criteria aspect of the supplier selection problem is an essential aspect when we deal with a global approach. The majority of the existing models can treat this significant aspect of the problem.
- 3 The supplier selection problem is a decision or a set of decisions, which requires the intervention of different services (departments) of the company (Dyer and Forman, 1992). That privileges methods, which cover the multi-decision-maker aspect. The AHP (version ‘group decision-making’) method can take into account this aspect of the problem. Indeed, Saaty (1982, 1989) has described group decision-making with AHP, including suggestions for assembling the group, running the decision-making session, trying to get the group to agree, inequalities

of power, concealed or distorted preferences and implementing the results. Although the preferred size and composition of the group is very much context dependent, Mitchell and Wasil (1989) observed that in applications, smaller decision groups were more efficient but larger groups are often required for effective decision-making so that stakeholders are represented and the final decision is accepted, and implementation is facilitated.

- 4 In practice, if a supplier cannot satisfy a minimal threshold compared to certain criterion, it cannot be selected in spite of its possible effectiveness with respect to other criteria. The elimination method is the only method in the literature that takes into account this aspect of the problem. But this method does not plan to choose the most powerful among qualified suppliers (Thompson, 1990; Mobolurin, 1995). Indeed, with this method we are not interested in the total performance of the suppliers with respect to all the criteria. A method that can take into account the conjunctive rules (minimal threshold) and can choose the most powerful suppliers (by considering all the criteria) is lacking in the literature.
- 5 In the supplier selection problem, we have *various constraints* to take into account. These constraints are of different nature. It can be the constraints evoked by the suppliers (e.g. minimal order quantity or maximum production capacity, etc.) or the constraints of the customer (budget devoted to the purchasing activity, maximum rate of not qualified products, etc.). In addition, if the company would wish several suppliers, it must choose at the same time which suppliers and which quantity to be ordered from each one. Consequently, a mathematical optimisation method is the only method that can take these aspects of the problem. Unfortunately, this method cannot consider the *subjective criteria*.
- 6 In reality, the future behaviours of the suppliers and the environment are uncertain. Consequently, it is difficult to assign a fixed mark to the suppliers with respect to a criterion. However, it is more practical to affect a fork of mark or a random variable that describes the probabilistic behaviour of the supplier. The scenario method treats this type of problems. On the other hand, this method does not have the advantages of the mathematical optimisation methods, which are essential for an 'optimal' selection.

The previous synthesis shows us that the current methods cannot cover the various aspects of the supplier selection problem. Our objective is to build a method which can take into account all the characteristics of the problem: the strategy of the company, the multi-actors aspect, the subjective and objective criteria, the constraints of both suppliers and customer (company), the multi-suppliers aspect and the probabilistic aspect (supplier behaviours and the economic environment, etc.). Table 4 describes the applicability of each existing method with respect to the various situations of the problem.

Table 3 Advantages and limitations of various supplier evaluation methods

<i>Method</i>	<i>Authors</i>	<i>Advantages</i>	<i>Limitations</i>
Categorical	Houshyar and Lyth (1992)	<ul style="list-style-type: none"> • Can include both qualitative and quantitative criteria • Easy implementation and requires minimum data • Lowest implementation cost • Simple to understand • Easy implementation 	<ul style="list-style-type: none"> • Equal weight to all criteria • Subjective
Weighted point plan	Dobler et al. (1990)	<ul style="list-style-type: none"> • Can guarantee optimum solution • Objective evaluation 	<ul style="list-style-type: none"> • Subjectivity of the decision maker in the identification of weights • Assumption of ordinal scale as cardinal scale • All factors need to be expressed in standardised or normalised units • Difficult to include multiple decision-makers • Requires arbitrary aspirations levels • Objective function coefficients should be determined prior to making the model
Mathematical programming	Ghodsypour and O'Brien (1998)	<ul style="list-style-type: none"> • Can guarantee optimum solution • Objective evaluation 	<ul style="list-style-type: none"> • In LP/MIP. Many objectives are regarded as constraints, since their formulations allow only one objective function • Requires lot of data • Complex approach requiring a comprehensive cost accounting system to generate the precise cost data needed • High implementation cost • Can deal with only relatively small number of criteria • May not be useful in comparing supplier performance because of the difficulties inherent in translating all aspects of supplier performance into precise cost figures • Difficult to include multiple decision-makers • It may not be able to structure complex problems • Giving weights to various criteria is subjective • The interpretation of the resulting distribution of scores happens by judging modus, variance, and overlap
Cost approach	Youssef et al. (1996)	<ul style="list-style-type: none"> • Cost control oriented • Bias can be eliminated • Allows to quantify internal production problems caused by supplier • Objective evaluation 	<ul style="list-style-type: none"> • Subjectivity of the decision maker in the identification of weights • Assumption of ordinal scale as cardinal scale • All factors need to be expressed in standardised or normalised units • Difficult to include multiple decision-makers • Requires arbitrary aspirations levels • Objective function coefficients should be determined prior to making the model • In LP/MIP. Many objectives are regarded as constraints, since their formulations allow only one objective function • Requires lot of data • Complex approach requiring a comprehensive cost accounting system to generate the precise cost data needed • High implementation cost • Can deal with only relatively small number of criteria • May not be useful in comparing supplier performance because of the difficulties inherent in translating all aspects of supplier performance into precise cost figures • Difficult to include multiple decision-makers • It may not be able to structure complex problems • Giving weights to various criteria is subjective • The interpretation of the resulting distribution of scores happens by judging modus, variance, and overlap
Vendor profiles analysis	Barbarosoglu and Yazgac (1997)	<ul style="list-style-type: none"> • Incorporates uncertainty in the assessment procedure 	<ul style="list-style-type: none"> • Subjectivity of the decision maker in the identification of weights • Assumption of ordinal scale as cardinal scale • All factors need to be expressed in standardised or normalised units • Difficult to include multiple decision-makers • Requires arbitrary aspirations levels • Objective function coefficients should be determined prior to making the model • In LP/MIP. Many objectives are regarded as constraints, since their formulations allow only one objective function • Requires lot of data • Complex approach requiring a comprehensive cost accounting system to generate the precise cost data needed • High implementation cost • Can deal with only relatively small number of criteria • May not be useful in comparing supplier performance because of the difficulties inherent in translating all aspects of supplier performance into precise cost figures • Difficult to include multiple decision-makers • It may not be able to structure complex problems • Giving weights to various criteria is subjective • The interpretation of the resulting distribution of scores happens by judging modus, variance, and overlap

Table 3 Advantages and limitations of various supplier evaluation methods (continued)

<i>Method</i>	<i>Authors</i>	<i>Advantages</i>	<i>Limitations</i>
Statistical	Muralidharan et al. (2001, 2002)	<ul style="list-style-type: none"> • Uncertainty can be incorporated 	<ul style="list-style-type: none"> • Assumption of distributions • Difficult to grasp as they involve complex computational features
Vendor Performance Index (VPI)	Humphreys et al. (2001)	<ul style="list-style-type: none"> • Each criterion can be measured in its own units • Single measure of supplier performance • Can be used as an assessment criterion for continuous evaluation 	<ul style="list-style-type: none"> • Rating and weighting system is subjective • It is impossible to obtain a zero score on a criterion since division by zero is not defined
Standardised Unitless Rating (SUR) index	Li et al. (1997)	<ul style="list-style-type: none"> • Single measure of supplier performance 	<ul style="list-style-type: none"> • Rating and weighting system is subjective • Cannot use the score for continuous assessment
Multi-criteria group decision-making model	Mandal and Deshmukh (1994)	<ul style="list-style-type: none"> • Inclusion of multiple decision makers • Can include both qualitative and quantitative criteria • Structuring of complex problems • Can be conducted either by face to face meeting or by postal questionnaire 	<ul style="list-style-type: none"> • Subjectivity in rating the suppliers
Analytical Hierarchy Process (AHP)	Rebstock and Kaula (1996), Ghodyspour and O'Brien (1998, 2001), Babic and Plazibat (1998), Chan (2003)	<ul style="list-style-type: none"> • Hierarchical representation of a system can be used to describe how changes in priority at upper levels affect the priority of criteria in lower levels • Stable and flexible, stable in that small changes have a small effect and flexible in that additions to a well-structured hierarchy do not disrupt the performance • The suppliers performance can be monitored or at least visible to the buyer to a certain extent leading to better management of suppliers 	<ul style="list-style-type: none"> • Use of statistical method is clearly not straightforward for most users and it makes the process quite cumbersome • Cannot effective takes into account risk and uncertainty in assessing the suppliers potential performance, because it presumes that the relative importance of criteria affecting suppliers performance is known with certainty • This may be a time-consuming activity as consensus may need to be reached by reviewing of the models with team members • Characteristic property of AHP is that it is fully compensatory that this might not always be realistic. In addition, the assumption of comparability is not valid due to lack of information or unwillingness to compare two alternatives with respect to some criterion, i.e. it is costly to obtain necessary information

Table 4 Schema of relations between problems and methods in supplier selection problem

<i>Problems</i>	<i>Methods</i>		<i>Optimisation</i>			<i>Probabilistic</i>
	<i>Elimination</i>	<i>AHP</i>	<i>Oriented cost</i>	<i>Mono-objective</i>	<i>Multi-objectives</i>	
Single criterion				X		
Multi-criteria	X	X	X		X	X
Single-actor	X	X	X	X	X	X
Multi-actors		X				
Selection of suppliers	X			X	X	
Suppliers ordering		X	X			
Without constraints	X	X	X			X
Subject to constraints				X	X	
Objective criteria	X	X	X	X	X	X
Subjective criteria	X	X				X
Certain	X	X	X	X	X	
Uncertain						X

With this approach the decisions are made in two stages. In the first stage, we choose the strategic suppliers, and this starts from the global strategy of the company. Other parameters, to be considered in this first level, are the minimum thresholds of the criteria. These are the minimum thresholds that the suppliers must be able to respect. If these thresholds are not respected, it can cause intolerable consequences on the quality of service or other constraints or objectives of the company. The selected suppliers, in this first stage, can reinforce the strategy of the company on one hand and on the other hand, they can respect the minimum thresholds of various selection criteria fixed by the company.

A sensitive analysis of these minimum thresholds can help the decision group to choose a suitable threshold for each criterion.

In reality, basically related to the market, the behaviour of a supplier with respect to the decision criteria is probabilistic (Soukup, 1987). Thus, it is difficult to assign a fixed mark to the suppliers with respect to the criteria. To treat that, one approach is to estimate the behaviour of the suppliers with three scenarios: ‘optimistic’, ‘pessimistic’ and ‘most probable’.

5 Emerging issues and challenges

The earlier sections have highlighted some trends in supplier selection practices. The identification and determination of decision criteria and the methods used for supplier selection appear to be the dominating topics in supplier management literature. However, from the late 1990s until the present time, there are more articles emphasising the importance of buyer–seller relationship, international supplier selection and online evaluation and selection of suppliers largely due to globalisation and rapid developments in information technology. Although there are a large number of articles studying the (decision) criteria to be used for SSP, these papers do fail to address the need to include the criteria related to safety and security issues, which have become extremely important given the present threats to security and current ‘climate’ around the world. The reviewed articles studied the purchasing activities of the private sector organisations. Surprisingly, there was no evidence of any research on how public organisations evaluate and select

suppliers. The review also revealed that there are a large number of decision-making methods and tools proposed for supplier selection. Due to the multi-objective nature of the SSP, there are more papers emphasising the use of mathematical programming based decision-making methods and total cost based approaches in particular. However, these approaches fail to address the subjective (qualitative) criteria for supplier selection. A decision model that accommodates both subjective and objective criteria is desirable.

GAP1: The literature requires frameworks and algorithms to aid the decision-makers by enhancing the flexibility in making decisions for evaluating suppliers with both tangible and intangible attributes.

GAP2: The extensive use of the internet has enabled buyers to locate large number of suppliers and has provided opportunities for suppliers to let buyers know of their existence. The internet has become an e-marketplace where buyers and sellers interact electronically. However, surprisingly, there were few papers focusing on e-procurement mainly from buyer–seller relationship point of view.

For supply chain optimisation practitioners, one major obstacle is the uncertainty and dynamics along supply chain. Supply chain's stochastic nature makes most analytical models either over simplistic or computationally intractable. Therefore, computer simulation, because of its capability for handling variability, is the most popular tool for these systems. In particular, Discrete-Event Simulation (DES) is one of the most widely used and accepted tools in supply chain analysis. Also, some of the emerging issues and challenges for the future are as follows:

- 1 *The role of technology as it shapes supplier–buyer relationships:* How do such technologies as internet, Enterprise Resource Planning (ERP), EDI, product data exchange and logistics management software impact supplier–buyer relationships?
- 2 *New logistics technologies for manufacturing SCM:* What kinds of operations strategies lead to high-quality, low-cost and short-lead time management of the manufacturing supply chain? These include new operational strategies such as JIT philosophies and methods.
- 3 *Implementation issues in supply chain technologies:* What kinds of cultural and organisational changes are needed to implement new manufacturing supply chain technologies? These include ERP, advanced planning systems, product data exchange, EDI and simulation algorithms.
- 4 *New organisational forms for technology partnering across the manufacturing supply chain:* These include joint ventures, technology licensing, partial ownership and virtual organisations.

Generally, supply chain planning processes are divided into three hierarchical-based levels: strategic, tactical and operational. Configuration of a supply chain, in particular facility location, is the primary objective of strategic optimisation problems. Tactical and operational decisions cover shorter period and short-term arrangement such as inventory control policy and order assignment ratio for each Stock-Keeping Unit (SKU) at each location. One critical question for supply chain planning is that: *How to make strategic decisions while taking operational performances into consideration?* Lots of deterministic and stochastic supply chain models have been developed in the literature (Cohen and Moon, 1990; Lee and Billington, 1993; Arntzen et al., 1995). Due to the complexity, rare of them deal with strategic planning together with the operational decisions considering the supply chain uncertainties (Sabri and Beamon, 2000).

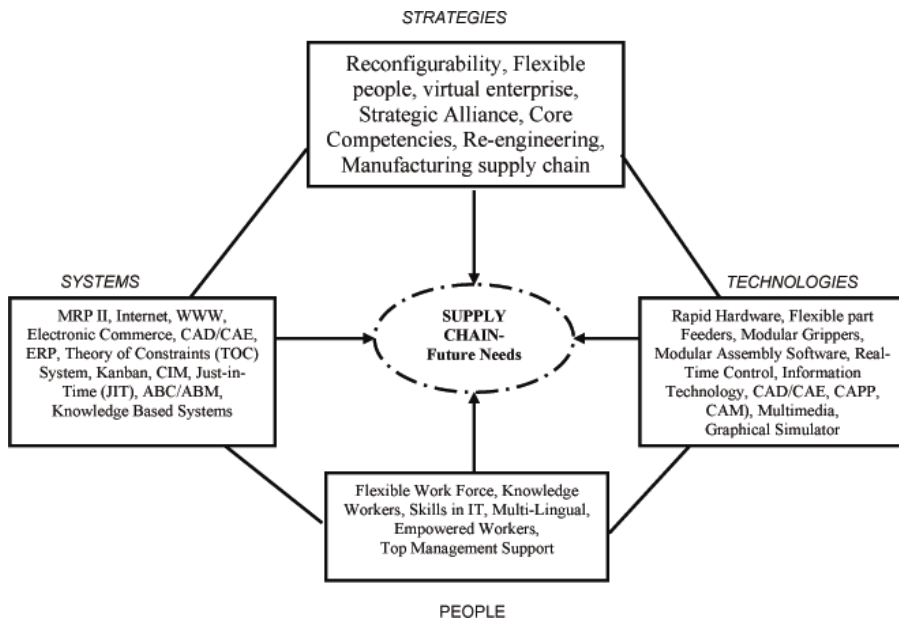
In the area of supply chain optimisation, advances have been made in optimising quantitative variables with computer simulation (Fu, 2002). But most procedures require the variables in question to be quantitative. In addition, those optimisation programmes are only used to change the simulation model parameters (Paul and Chaney, 1998; Disney et al., 2000). However, many of supply chain design decisions involve variables, which are not only discrete but also qualitative. For instance, First-Come-First-Service (FCFS), Priority Service (PS) and Shortest Processing Time (SPT) could be three qualitative choices concerning the production planning policy. Regarding industrial requirements, there is a need for a comprehensive supply chain planning method.

Confronted with a highly competitive circumstance, SCM is generally referred as an effective means to help companies reduce costs, improve responsiveness, etc. SCM is a way to supervise the flow of products and information as they move along the supply chain. The goal is to optimise supply chain decisions, which not only reduce inventories but may also create a higher profit margin for finished goods by giving customers exactly what they want. Besides its effectiveness, SCM is a complex process because of the stochastic nature and ever-increasing complexity of supply chains. Hence, there is no generally accepted method by researchers and practitioners for designing and operating a supply chain.

5.1 To a global strategy

Abundant literatures on various domestic supplier selection techniques are available, whereas the global supplier selection problem is not adequately discussed in past researches. Any analytical study on this seems to be virtually absent (Chan et al., 2007). Global supplier selection has a critical effect on the competitiveness of the entire supply chain network. Research results indicate that the SSP appears to be the most significant variable in deciding the success of the supply chain. Figure 2 highlights the various emerging strategies to be addressed in the future.

Figure 2 The emerging strategies addressing challenges for supply chain in future



6 Conclusion

In this era of global competition, the modern business organisations pay particular attention to the identification and selection among alternative supply sources. Today's highly competitive environment is forcing the manufacturing organisations to establish a long-term effective collaboration with the efficient organisations. As a result, an effective SSP is very important to the success of any manufacturing organisation. Global economy not only offers new business opportunities for companies but also challenges companies to optimise their business processes to remain competitive. Competition is not between individual organisations but between competing supply chains (Christopher, 1998). In order to retain the competence in the global market, companies should be responsive to the rapidly changing demand and improve the flexibility.

In this paper, we aimed to explore the various issues affecting the SSP. The wide-ranging literature review suggests that much of the focus on SSP has been given to the decision criteria and the decision-making methods used for evaluating and selecting suppliers. Furthermore, emerging issues and challenges resulting to scope for future works on supply chain procurement activities are identified and some clear guidelines for future research are proposed. It is aimed that the findings will lead to new research settings together with the directions for future research. This paper provides an overall picture of research on SSP and supplier selection practices. This piece of research would be of value to both academics and practitioners interested in supplier management. The review also exposed the areas that attracted little or no research attention.

More specifically, in this paper, a state of the art related to the supplier selection problem was presented. We summarised the different selection criteria, the various problems of suppliers' selection and the existing methods to solve the problems. An analysis enabled us to find some lacks in the literature. Indeed, the principal lack of the literature was the absence of a total approach, which can treat various characteristics of the problem. To contribute to solve this lack, we showed the essential points which can help define a suitable approach to efficiently solve the SSP, for example conjunctive rules, multi-actors (decision-makers) aspect, subjective and objective criteria, constraints of both the suppliers and the company, the multi-supplier aspect (best suppliers and required quantities) and the probabilistic aspect. Particularly, a concept of 'strategic supplier' was suggested, in order to select the suppliers, which guarantees the long-term viability of the company.

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