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Jafar Rezaei, Roland Ortt

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A MULTI-VARIABLE APPROACH TO SUPPLIER SEGMENTATION

Jafar Rezaei [a], Roland Ortt [b]

[a] PhD Student, Section Technology, Strategy and Entrepreneurship
Faculty of Technology, Policy and Management, Delft University of Technology
2628 BX Delft, the Netherlands
Phone: +31 15 27 82985
Fax: +31 15 27 83177
j.rezaei@tudelft.nl

[b] Associate Professor, Section Technology, Strategy and Entrepreneurship
Faculty of Technology, Policy and Management, Delft University of Technology
2628 BX Delft, the Netherlands
Tel: +31 15 27 84815
Fax: +31 15 27 83177
Email: j.r.ortt@tudelft.nl

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Abstract

The aim of this paper is to develop a new approach to supplier segmentation that considers the various variables used in existing literature to segment suppliers. A literature review reveals a serious problem from a management perspective. The problem is that many different supplier segmentation methods have been proposed in the last three decades, each of which uses different segmentation variables and hence results in different segments. An overarching supplier segmentation method, considering various segmentation variables, is lacking. Based on an extensive literature review, we have analyzed the current methods and we conclude that the literature on supplier segmentation can be divided into three different schools of thoughts. By clearly identifying the deficiencies of the existing theory on supplier segmentation, we developed a new approach. As the basis for this new approach, we developed three requirements to make an overarching approach to supplier segmentation. Firstly, supplier segmentation should be based on their long-term potential, which we propose to assess in terms of supplier capabilities and willingness to cooperate. Secondly, other functional areas beyond purchasing have to be considered when segmenting suppliers. Thirdly, supplier segmentation should be viewed as a step in a longitudinal process that includes selecting suppliers, segmenting them, managing the relationship with them and actively developing their role over time. We illustrate the proposed approach by segmenting the suppliers of a company in the food industry.

***Keywords*:** Supplier Segmentation; Supplier Management; Supplier Development; Supplier Selection; Buyer-Supplier Relationship; Supply Chain Management (SCM).

1. Introduction

Faced with a competitive global market, firms have downsized, focused on core competencies and attempted to achieve competitive advantage by managing their relationships with suppliers more effectively (Tan *et al*., 1999). The relationships between buyers and suppliers in a supply chain management (SCM) context are investigated in various recent studies. In most cases, the main objective is to evaluate suppliers based on specific criteria and using a variety of multi-attribute decision-making techniques designed to select the best available suppliers. For more information on supplier selection methods and criteria, see Wilson (1994), de Boer *et al*. (2001), Humphreys *et al.* (2003), Huang and Keskar (2007), Ho *et al.* (2010), and others. The relevant criteria can also be used to segment suppliers and are essential in creating prosperous buyer-supplier relationships (Spekman, 1988; Svensson, 2004). Generally speaking, supplier selection requires a buyer to choose a handful of qualitative and quantitative criteria and use them to select the most suitable

suppliers. In supplier segmentation, which logically takes place after supplier selection, the buyer further classifies the selected suppliers. This classification or segmentation makes it possible to choose the most suitable strategies for handling different segments of selected suppliers. In the area of marketing, segmentation usually refers to the *demand side* of the market, the goal being for companies to segment groups of potential customers with similar wants and demands that may respond to a particular marketing mix (Smith, 1956; Kotler, 1991, pp. 262-263). When companies also work with potentially different suppliers, segmenting the *supply side* of the market can be very valuable as well.

One of the fundamental problems is that different methods for supplier segmentation have been specified, all of which use different variables and neglect some other important variables. From a scientific perspective, the lack of an overarching framework including all the important variables represents a serious gap. From a management perspective, this is a problem, because it is hard to choose a method that contains all the important variables.

Another fundamental problem is that supplier selection and supplier segmentation assume a static perspective: the assumption is that suppliers are selected and segmented at one point in time, which is accurate when it comes to selecting suppliers for individual transactions. In that case we refer to purchasing. In practice, however, a buyer-supplier relationship can involve many transactions and can evolve over time. In the course of a long-term relationship, suppliers and buyers may decide to share activities, for instance marketing or research and development. Supplier selection and segmentation are closely related to supplier management. Companies first select suppliers, then segment them, adopt a strategy to cope with each segment and finally may decide to adapt this strategy over time as the relationship evolves.

The main objective of this paper is to review and discuss supplier segmentation approaches and to present a multi-variable approach. The paper contributes to this objective in the following ways: (1) by reviewing, summarizing and classifying the main methods of supplier segmentation; (2) by providing a comprehensive definition of supplier segmentation; (3) by presenting a new and more

comprehensive (multi-variable) approach to supplier segmentation; and (4) by indicating, with a flowchart, the position of supplier segmentation among other supplier-related activities and their interdependency suggesting the practical steps to achieve an effective supplier segmentation process inline with other supplier-related activities. This process and the value of our new approach is illustrated in a real-world case involving a broiler company.

In Section 2, the main approaches to supplier segmentation are described in detail in the literature review. In Section 3, a new and more comprehensive approach to supplier segmentation is formulated, based on three requirements. In section 4, we illustrate how the conceptual framework can be used in a real case. In Section 5, the conclusions, results, and future research directions are presented.

2. Literature review

Many researchers have studied supplier segmentation. We found ten major references in supplier segmentation, all of which are summarized in Table 1, as a result of a literature search. We classify existing studies into three groups (referred to as methods): (1) the process method, (2) the portfolio method and (3) the involvement method to supplier segmentation.

2.1. The process method to supplier segmentation

Parasuraman (1980) is one of the first researchers who introduce the concept of supplier segmentation. His main idea was to identify distinguishable segments of potential suppliers for each item to be purchased by an industrial company, based on characteristics that are closely related to the key characteristics of the company's own customer segments. He proposed a stepwise procedure to implement this approach:

Step 1: Identify the key features of customer segments

Step 2: Identify the critical supplier characteristics

Step 3: Select the relevant variables for supplier segmentation, and

Step 4: Identify the supplier segments.

Parasuraman's approach is a process by which supplier segments can be identified. To put it differently, it does not specify the segmentation variables (step 3) but it describes how to find these variables and then form the segments. By contrast, the other nine approaches do specify segmentation variables in advance and thereby distinguish specific segments. It would appear that Parasuraman, being one of the first authors describing supplier segmentation, understood that this type of segmentation should include the entire supply chain process. This contribution indicates how supplier segmentation is a logical step after customer segmentation. We refer to this approach of supplier segmentation as the *process* method.

2.2. The portfolio method to supplier segmentation

Kraljic (1983), another pioneer in the area of supplier segmentation, introduced the first comprehensive portfolio approach to purchasing and supply segmentation. To classify the materials or components that a firm purchases, he considered two variables: profit impact and supply risk. The profit impact of a given supply item can be defined in terms of the volume purchased, the percentage of total purchase cost or the impact on product quality or business growth. Supply risk is assessed in terms of the availability and number of suppliers, competitive demand, make-or-buy opportunities, storage risks and substitution possibilities. Based on these two variables, materials or components can be divided into four supply categories: (1) non-critical items (supply risk: low; profit impact: low), (2) leverage items, (supply risk: low; profit impact: high), (3) bottleneck items (supply risk: high; profit impact: low), and (4) strategic items (supply risk: high; profit impact: high). Each category requires a specific supplier strategy.

Kraljic's approach is different from the one proposed by Parasuraman. Kraljic pre-specifies the segmentation variables and the types of segments that can be formed. Although both Kraljic (1983) and Parasuraman (1980) believed that supplier management should be tailored to the supplier segmentation, they do so in completely different ways.

2.3. The involvement method to supplier segmentation

Dyer *et al*. (1998) compared the supplier-automaker relationships in the US, Japan and Korea and, based on the differences between outsourcing strategies, developed a strategic supplier segmentation. According to the authors, firms should determine their core competencies, relevant core activities and non-core activities. Resources that relate to core activities are strategic resources, while those that relate to non-core activities are non-strategic resources. Based on this classification, the authors suggest two types of buyer-supplier relationships:

1. *Durable arm's length (quasi-market) relationships* are suitable for the first class of inputs or resources that are necessary but non-strategic.

2. *Strategic Partnerships (quasi-hierarchies)* are suitable for the second class of inputs or strategic inputs that are important in differentiating the buyer's final product.

With this method, the level of involvement determines the type of the relationship. There are other classifications that use the level of involvement and coordination between buyer and supplier. Ellram (1991), for example, determined a continuum to classify relationships in the supply chain as: short-term contracts, long-term contracts, joint ventures and equity interests. Cox (1996) considered the relationships in a continuum from arm's length to strategic alliance. However, Dyer *et al*. (1998) used involvement to classify suppliers in the most explicit way.

An overview of the ten approaches to supplier segmentation is provided in Table 1. The information in columns 1-4 of Table 1 is self-explanatory and is directly derived from the papers. The information in the fifth column, however, is our assessment of the theoretical approach in each paper, and therefore requires some explanation. A paper is assumed to adopt a process approach when it describes the process of finding segmentation variables without specifying them. A paper is assumed to adopt a portfolio approach when it focuses exclusively on the characteristics of the supplied items. Finally, a paper is assumed to adopt an involvement approach when it uses segmentation variables that focus on the strength of the relationships between buyers and suppliers. In practice, we found that many supplier segmentation methods consist of a combination of the

portfolio and involvement methods. The other seven approaches to supplier segmentation, which appeared at later dates, can all in some way be considered successors of Kraljic (1983) or Dyer *et al*. (1998), because they adopt similar variables or methods.

TABLE 1 GOES ABOUT HERE

Table 1 shows that, with the exception of Parasuraman (1980) and Dyer *et al*. (1998), all approaches use only two segmentation variables. Parasuraman (1980) did not pre-specify segmentation variables, while Dyer *et al*. (1998) used only one segmentation variable on two levels. What the other eight approaches with two segmentation variables have in common is that they distinguish two levels per segmentation variable, which implies that they describe four supplier segments. Although their structure may be similar to a 2x2 matrix, their exact segmentation variables vary considerably, which is a problem and at the same time a sign. The problem is that buyers cannot know whether the approach they apply includes the most appropriate variables (Gelderman and van Weele, 2005), which reinforces the need for a unifying conceptual framework with dimensions that combine the segmentation variables from different methods. Although we agree with Olsen and Ellram (1997) that these dimensions should not be too complex, the complexity of the dimensions should not be reduced at the expense of important variables that are required to operationalize these dimensions. Another important weakness of existing literature is that, in most cases the supplier side is neglected (Gelderman and van Weele, 2003, 2005).

2.4. Evolution of supplier segmentation methods

The references are ordered in Table 1 using the year of their publication. The order of these papers indicates that the process and portfolio approaches appeared in the early 1980's and the involvement approach emerged much later, in the late 1990's. Since the late 1990's, all papers can be classified as a mixture of the portfolio and involvement methods. This allows us to the following two interesting observations regarding the evolution of supplier segmentation literature:

1. The "pure" methods (process, portfolio, and involvement) appeared first and the combination methods (portfolio-involvement) appeared later. An analysis of the references cited in the three

papers that introduced these methods, confirms this notion. Parasuraman (1980) (the process approach), Kraljic (1983) (the portfolio approach) and Dyer *et al.* (1998) (the involvement approach) do not refer to each other's work. In terms of evolution, it appeared that the three methods developed independently and not as variations or improvements of each other.

2. From the three main references cited and the resulting segmentation methods, it would appear that Kraljic (1983) had the greatest impact on subsequent approaches. Most other authors developed portfolio methods similar to Kraljic's. His segmentation variables (profit impact and supply risk) re-appeared later (see, for example, van Weele, 2000). Kraljic's method is also dominant in terms of the number of citations. It is interesting to note, however, that all of the later papers that followed Kraljic's method also adopted the idea that involvement is an important aspect in supplier segmentation, which suggests that the involvement approach also had a lasting impact on supplier segmentation. Kraljic's basic approach, as adopted by subsequent authors, evolved over time, for example by adding involvement-related aspects, for example by Masella and Rangone (2000), whose approach we categorized as portfolio-involvement, and who viewed the nature of relationship between buyer and supplier as one dimension of their segmentation approach. One level of that dimension was *strategic integration,* which refers to arrangements that involve, for example, joint development of new product and technology. This approach to segmentation in fact shows a transition from the focus of the Kraljic's approach on purchasing and arm's length relationship towards an approach that includes more functional areas as well as a strategic integration between buyer and supplier. As another evolution in Kraljic's approach, we refer to Hallikas *et al*.'s approach (2005), which considered the management of risk involved in buyer-supplier relationship through collaborative learning, while the strategy suggested by Kraljic with regard to handling supply risk focuses on diversity, which means changing suppliers. The evolution in Kraljic's approach towards including involvement-related aspects can be seen in multiple publications, for instance the interdependency between buyer and supplier suggested by Bensaou

(1999), partnership by Kaufman *et al*. (2000) and van Weele (2000), and supplier's commitment as one dimension of the segmentation by Svensson (2004).

3. Whereas the first two "pure" approaches (the process and portfolio methods), were static by nature, the involvement method, which appeared much later, seemed to adopt a more dynamic perspective. The involvement method focuses on the relationships between suppliers and looks at the evolution of buyer-supplier relationships over time.

The evolution in supplier segmentation theory took place within a business context where the role of purchasing had changed fundamentally. Adapting Ellram and Carr (1994), we can view the evolution of the role of purchasing, albeit in a somewhat stylized and simplified way, as follows:

• *Passive role*: In 1970s, the purchasing function had a passive role in the business organization. It was viewed as an administrative rather than a strategic function.

• *Strategic role:* In 1980s, the role of purchasing shifted from passive to strategic.

• *Integrative role:* In 1990s, the purchasing function received more attention as a more significant contributor to the firm's success compared to some other functions.

If we look at the inception of each of the three methods, we can see that the process method (Parasuraman, 1980) and portfolio method (Kraljik, 1983) were introduced when purchasing was viewed as a strategic function, while the involvement method (Dyer *et al*., 1998) appeared when the purchasing function began to assume a more integrative role.

The term 'supply chain management' (SCM) originated in the early 1980s, when Oliver and Webber (1982) first coined the term to refer to the integration of different business functions. However, it was not until much later in the 1990s and 2000s, that the area of SCM received real attention. In contrast to the process and portfolio methods, which focus on supplier selection and assume an arm's length relationship between buyer and supplier, the involvement method considers the strategic partnership between buyers and suppliers that is common in SCM (Lambert, 2008). Therefore, the involvement method of supplier segmentation is also congruent with the SCM concept.

3. A New Approach to Suppler Segmentation

This section focuses on developing a new approach, in which we integrate the variables used by portfolio and involvement segmentation methods. In addition, we extend the previous methods to include variables and functional areas that thus far as missing in contemporary segmentation literature. Furthermore, our approach provides a practical vision for an effective transition from supplier segmentation towards supplier management. Our approach is a process-driven scheme for supplier segmentation. The meaning of the word "process" is different from the way it is used in Parasuraman's (1980) process method. There are several elements that form the basis for our new approach to supplier segmentation. They are explained in the following sections:

3.1. Supplier selection and segmentation variables

Supplier segmentation should reflect supplier selection criteria, which will determine which suppliers have the potential to be selected. We therefore refer to these criteria as supplier potential criteria. In general, there are three kinds of supplier selection criteria: 'element of exchange'-related criteria, supplier-related criteria and relationship-related criteria (there are other classifications of supplier selection criteria, see for example Sen *et al*., 2008, 2009). 'Element of exchange'-related criteria refer to characteristics of the goods or activities that are provided by a supplier, while supplier-related criteria refer to the characteristics of the supplier and relationship-related criteria refer to the characteristics of the buyer-supplier relationship. Since suppliers can perform differently with regard to the desired criteria, they need to be managed accordingly. Using these to segment suppliers helps the buyers manage their suppliers more effectively.

Table 1 shows that most of the variables used by the supplier segmentation methods come from the 'element of exchange'-related criteria (specifically those criteria related to material assets). In other words, the variables used by the previous supplier segmentation methods are a specific sub-set of supplier selection criteria. As we discussed before, this has to do with the fact that, historically, the focus with regard to supplier segmentation has been on purchasing. Contrary to supplier segmentation literature, which is still in its infancy, supplier selection literature is well-developed

and well-researched. The supplier segmentation methodology and research can then be improved by considering the available literature on supplier selection.

By using the 'element of exchange'-related criteria and supplier-related criteria the buyer evaluates different *capabilities* of the suppliers in different areas. For example, 'quality' (from 'element of exchange'-related criteria) may reflect the ability of the supplier to produce/offer good products/services. Relationship-related criteria, on the other hand, include criteria that are related to the *willingness* of the exchange partners to start and maintain the relationship. For example, relationship closeness may indicate the extent to which the partners are willing to work closely together.

It is important to note that the idea of forming *capability* and *willingness* dimensions arose from the need for an overarching model to sort out an overwhelming number of different variables in supplier segmentation and selection literature. In addition, we believe that taking the supplier potential into account is important when it comes to managing and developing suppliers more efficiently. For example, Kraljic (1983) divided buying items into four categories and then segmented suppliers based on these items, indicating that the various suppliers ought to be managed in particular ways. The question is, however, how suppliers with different *capabilities* that fall into the same segment should be treated.

Here, as an example, we cite some important reasons that have been mentioned in existing literature to explain why considering suppliers' *capabilities* and *willingness* is important. Geldermann and van Weele (2003), who conducted case studies to study the measurement issues of Kraljic's model, found that experienced portfolio users always included some additional information (apart from the two dimensions suggested in Kraljic's model), one of which is the capacities (can be considered as supplier's *capability*) and the intention (can be considered as supplier's *willingness*) of individual suppliers. Having a long-term relationship with suppliers requires the consideration of *supplier capabilities* (Talluri and Narasimhan, 2004), which are also the main factor involved in a strong and close buyer-supplier collaboration (de Leeuw and Fransoo, 2009). In addition, the first

and most important step in developing suppliers is to evaluate their capabilities (Krause *et al*., 2001; Wynstra *et al*., 2001). Trust (categorized as *willingness*) in long-term relationships can overcome a lot of the difficulties in relationships in the supply chain, such as abuse of power, conflicts and low profitability (Sullivan and Peterson, 1982). Trust can reduce perceived relational risk (Das and Teng 2000) and help maintain the stability of the supply chain in the long term (Handfield and Bechtel, 2002; Chen and Paulraj, 2004).

We now define 'supplier potential' as the buyer's perception of *supplier capabilities* and *supplier willingness* to engage and maintain a partnership to achieve mutual objectives. Therefore, we use two dimensions (*capability and willingness*) to assess the potential of a supplier for a particular buyer. Adopting Day's (1994) definition of capabilities, we define supplier's *capabilities* as follows:

> *Supplier's capabilities* are complex bundles of skills and accumulated knowledge, exercised through organizational processes that enable firms to coordinate activities and make use of their assets in different business functions that are important for a buyer.

We define *supplier's willingness* as follows:

> *Supplier's willingness* is confidence, commitment and motivation to engage in a (long-term) relationship with a buyer.

We can now present our first requirement for supplier segmentation:

> **Requirement 1.** ***Supplier segmentation should rely on supplier potential, which in turn is driven and defined by supplier selection criteria. Effective supplier segmentation should be based on a supplier's capabilities and willingness.***

Using the definition of potential, in terms of supplier capabilities and supplier willingness, we can segment potential suppliers in a matrix into four categories. These categories include high/low capabilities and high/low willingness, as shown in Figure 1 (it is also possible to consider three levels (low, medium and high) or even more for *capabilities* and *willingness* depending on the complexity and availability of the relevant data.

FIGURE 1 GOES ABOUT HERE

Let us now take another look at the variables included in Table 1. Many of these variables can be translated into the dimensions of *capabilities* or *willingness*. A review of literature of buyer-supplier relationships and supplier selection (e.g. Dickson, 1966; Weber *et al*., 1991; Swift, 1995; Choi and Hartley, 1996; Kannan and Tan, 2002; Smeltzer, 1997; Huang and Keskar, 2007; Handfield *et al*., 2002; Humphreys *et al*. 2003; Chan, 2003; Ho *et al*.; 2010) reveals that there are other variables that have not been considered in existing literature on supplier segmentation. We establish a relatively complete list of these variables under two the headings capabilities and willingness, as shown in Tables 2 and 3.

It is important to note that some of the variables that are in the list of *capabilities* variables are not capabilities as such but proxies of capabilities. For example "price" itself is not a capability, but a low price means that a company is able to offer its products or services at a low price. The capability to reduce costs is manifested in lower prices. Note also that there is no one-to-one translation of some of the segmentation variables included in Table 1 to the *capabilities* and *willingness* categories presented in Tables 2 and 3.

TABLES 2 AND 3 GO ABOUT HERE

The variables summarized in Tables 2 and 3 further enhance the practicality of the use of supplier *capabilities* and *willingness* as a basis for supplier segmentation. It is clear that, for different functions, different capabilities and willingness may be considered relevant. For example, while buyers may consider 'purchasing price' one of the variables to segment suppliers who provide materials, it may be less relevant when it comes to segmenting suppliers who partner in buyer's new product development project. However, the number of relevant variables for each function would be still a large number. As such, selecting the most relevant variables to segment the suppliers for each function is an important step in practice. Several factors may be considered when selecting the most relevant variables, including firm strategy, product life cycle, industry competition, etc. In practice, the final variables are usually selected by a panel of experts/decision-makers (DM). Because different DMs may have different ideas about the most relevant variables, a group decision-making

methodology (e.g. the Delphi method (Linstone and Turoff, 1975); the Nominal Group Technique (Delbecq *et al*., 1975); Consensus Support System (Alonso *et al*., 2010)) will help produce a consensus concerning the most relevant variables.

3.2. Partnership and collaboration in other activities and functional areas

To leverage their company's skills and resources effectively, managers should concentrate on some of their own core competencies and strategically outsource other functions and activities. Firms can benefit from this combined approach in several ways, including maximizing their returns on internal resources by focusing on the functions they perform best and use their suppliers' capabilities to the fullest, which increases their ability to respond to customer needs (Quinn and Hilmer, 1995). As our literature review indicates, almost all existing supplier segmentation studies focus entirely on the purchasing function. Our approach takes into account the possibility that suppliers enter into a partnership and collaborate in other business activities and functions with a buyer in the supply chain. These activities and functions, as described by Lambert (2008) and Mentzer (2004), include: production, finance, logistics, marketing and sales, and R&D. Croom *et al*. (2000) describe a similar list of functions based on "what" is exchanged between suppliers and buyers in the supply chain (e.g. material assets, financial assets, human resource assets, technological assets, information, and knowledge). Gadde and Snehota (2000) also argue that most relevant studies focus on the importance of buying products (material assets), although the role and value of a buyer-supplier relationship should be assessed well beyond its product/service content.

For each function, the *capabilities* of a supplier and its *willingness* to cooperate should be assessed. If we consider the *willingness*/*capability* matrix as an X-Y-Z plane grid, we can consider different options for all functions that are shared by the participants in the supply chain.

FIGURE 2 GOES ABOUT HERE

Within the context of SCM, companies should coordinate the traditional business functions and activities within the company and across the supply chain partners. Based on the discussions presented above, the following requirement is developed:

Requirement 2. ***Effective supplier segmentation should go beyond the mere purchasing function and should include other activities and functional areas, such as production, finance, logistics, marketing and sales, and R&D.***

These activities and functions are not equally important to each individual buyer. For example, while the marketing function is perhaps the most important function when it comes to running a restaurant, purchasing and/or R&D can be the most important functions for a car manufacturer. Therefore, firms should determine the relative importance of their functional areas and segment their suppliers on the basis of their potential suppliers' *capability* and *willingness* regarding each function desire to share with a supplier.

3.3. Supplier management and supplier development

Ultimately, supplier segmentation should provide a solid basis for supplier management and supplier development over time. Supplier management and development transcend individual orders. The buyer can benefit from a structural approach to developing and maintaining the relationship with different supplier segments (Lambert, 2008), as there is no single ideal relationship for each situation (Lambert *et al*., 1996). While the buyer may decide to have close relationships with suppliers that belong to a specific segment, an arm's length relationship may be preferred for other segments. In addition, some selected suppliers may lack the adequate capability to perform well in some functional areas (Morgan, 1993; Krause and Ellram, 1997a). Here, the buyer is faced with two possibilities: (1) find alternative suppliers; (2) help supplier improve their performance in the areas in question. Supplier segmentation should provide a suitable framework for the buyer within which to make the best choice of supplier.

Supplier management refers to managing the relationships with suppliers over time and can be defined as the communication, evaluation and relationship-building efforts involving suppliers (Anderson *et al*., 1998). After the suppliers have been selected and segmented by the buyer, the relationships with the various suppliers should then be managed.

Supplier development is defined as any set of activities undertaken by a buying firm in coordination with a supplying firm to identify, measure and improve supplier performance and

facilitate the continuous improvement of the overall value of goods and services supplied to the buying company's business unit. These activities include, but are not limited to, goal setting, plant visits, supplier audits, supplier training, performance measurement, supplier certification, supplier recognition and efforts to instill a philosophy of continuous improvement in the supplier (Krause *et al*., 1998). The aim of supplier development is to improve the *capabilities* and performance of the suppliers and consequently the overall performance of the buyer-supplier relationships. Based on recent studies (e.g. Doney and Cannon, 1997; Shin *et al.*, 2000; Kannan and Tan, 2002, 2003, 2006; Kang *et al.*, 2009), we also found that *willingness* may be a very important dimension that indicates how suppliers should be developed and managed. Based on the information discussed above, we present our last requirement as follows:

Requirement 3. ***Supplier segmentation should be viewed as the basis of and driving force behind many subsequent activities associated with supplier management and supplier development.***

This means that the new approach to supplier segmentation proposed in this paper is not a simple 2x2 matrix as found in most studies. Instead, we present a *systematic* approach that effectively links supplier selection and segmentation to supplier development and management. We believe that the supplier segmentation methods proposed in existing literature, especially the portfolio method, do not provide such a link within the context of SCM. Kraljic (1983, p.113), one of the main pioneers in the field of supplier segmentation, said the following:

> "The purchasing portfolio matrix plots company buying strength *against* the strength of the supply market …" "On items where the company plays a dominant market role and suppliers' strength is rated medium or low, a reasonably *aggressive* strategy is indicated."

Not only the above link that we pursue in our paper is missing from this major work in supplier segmentation, but also this work views the suppliers as the firm's opponent or competitor (rather than as partners).

Based on the approach introduced in this paper, the buyer and supplier can decide to develop and advance their relationships, allowing the supplier to move to a better segment. To some extent, this decision pertains to supplier management and supplier development.

Existing literature on supplier development focuses mainly on supplier capabilities (e.g. Watts and Hahn, 1993; Hartley and Choi, 1996; Krause and Ellram, 1997a, 1997b; Krause *et al.,* 1998; Dunn and Young, 2004; Humphreys *et al.* 2004, Wagner, 2006). Krause and Ellram (1997a), for example, define supplier development as "any effort of a buying firm with its supplier(s) to increase the performance and/or capabilities of the supplier and meet the buying firm's short- and/or long-term supply needs." Based on an extensive literature review, Humphreys *et al.* (2004) identify the ways by which the buyer may improve supplier capabilities: to increase supplier performance goals; to train the supplier; to provide the supplier with equipment and technological support; to provide the supplier with investments; to exchange personnel; to evaluate supplier performance and to recognize supplier progress in the form of awards. As a result, the supplier moves from SM1 to SM3 or from SM2 to SM4 (see Figure 3).

FIGURE 3 GOES ABOUT HERE

We believe that, in addition a supplier's performance and *capabilities*, increasing the level of supplier *willingness* is also important. For example, Kannan and Tan (2002) found that a *supplier's willingness* to develop closer ties and share confidential information is likely to affect the buying firm's business performance, which is one of the main purposes of supplier development. As a result of these improvements, the supplier moves from SM1 to SM2 or from SM3 to SM4. Keeping these in mind, we define supplier development as any effort to increase the *capabilities* and *willingness* of the supplier, which in turn results in improving the long-term relationships between buyers and suppliers and their long-term performance.

In our approach, supplier development means any effort on the part of the buyer (or even the buyer and supplier together) to promote suppliers from SM1 to SM2 or SM3 or even to SM4 and from SM2 or SM3 to SM4.

After considering all the requirements and their related elements in our new approach to supplier segmentation, we can now define supplier segmentation as follows:

Supplier segmentation is the identification of the capabilities and willingness of suppliers by a particular buyer in order for the buyer to engage in a strategic and effective partnership with the suppliers with regard to a set of evolving business functions and activities in the supply chain management.

This definition takes into account an effective supplier selection methodology as well as an effective partnership with suppliers in terms of supplier management and development, thus providing the connection discussed earlier.

3.4. The practical steps of supplier segmentation

Based on the new supplier segmentation approach, we propose a mechanism to segment suppliers in practice. The following practical steps are involved:

Step 1. Determine the functions and activities that the buyer tends to carry out either internally or externally;
Step 2. Determine the relative weight of functions the buyer wants to delegate to suppliers;
Step 3. Select the suitable suppliers for the different functions and activities (supplier selection);
Step 4. Categorize the buyer's suppliers based on different functions determined in step 1;
Step 5. Segment the suppliers based on their *capabilities* and *willingness* for each function separately (supplier segmentation);
Step 6. Determine and implement the suitable strategy to manage each segment (supplier management);
Step 7. Determine and implement the suitable strategy to develop the supplier relationships over time (supplier development);
Step 8. Evaluate the performance of suppliers (supplier evaluation). The evaluation of suppliers can loop back to step 1, 3 or 5 in the future as the relationships change or evolve.

Effective supplier segmentation should consider past and present partnerships with suppliers and provide suitable strategies to manage and develop existing and future suppliers. We present the practical steps of our approach to supplier segmentation and its relationship to other supplier-related activities in Figure 4. This flowchart illustrates the dynamic nature of the proposed supplier segmentation approach. In other words, if we consider the concepts of supplier selection, segmentation, management, development, and evaluation as a single integrated closed chain, it becomes clear why it is necessary to update the status of suppliers or their segments.

FIGURE 4 GOES ABOUT HERE

4. Illustration of the proposed approach in a real-world situation

In this section, we illustrate how the proposed conceptual framework can be used in practice, based on a case involving a company from the poultry industry. This industry was chosen since concentration downstream in this industry has resulted in concentration upstream (Ryder and Fearne, 2003), which means that many food companies have become more reliant on external suppliers (van der Valk and Wynstra, 2005) to satisfy the fast-changing customer requirements. The input materials are mostly perishable and the quality of the final product is highly dependent on the suppliers. Furthermore, because the final product should be sold and delivered on time, marketing and sales are crucial activities in this industry. As such, companies operating in this industry need to segment their selected suppliers in order to manage them adequately. In addition, with respect to the potential transmission of diseases from the suppliers' products, they should be frequently evaluated. These characteristics require a dynamic system for selecting, segmenting, managing, developing and evaluating suppliers. A simplified map of the company's supply chain is presented in Figure 5.

FIGURE 5 GOES ABOUT HERE

The selected company (ABC Company) does not share production, finance and logistics functions with its suppliers and does not carry out any R&D activities, while for the other functions (purchasing, and marketing & sales) the company relies on its supply chain partners. Based on the proposed conceptual framework, we should segment the suppliers of each of these two functions separately, considering different criteria for their capabilities and willingness.

4.1. Supplier segmentation for purchasing function

ABC Company is a broiler company that buys newly hatched chicks and other materials, such as fodder, medication and equipment, from 43 suppliers, raising chicks to market weight and selling them after some processing.

To segment the suppliers, some criteria regarding their capabilities and some criteria regarding their willingness are needed. Interviewing the manager of the company yielded six criteria for capabilities and six for willingness that have been applied to the suppliers who provide newly

hatched chicks, fodder, medications and equipment as follows. The criteria were selected from the criteria presented in Tables 2 and 3.

The capabilities-related criteria are price, delivery, quality, reserve capacity, geographical location and financial position. During the interview with the manager of the company, we found that, because demand for the final product is relatively elastic and the selling price is highly dependent on the purchasing price of the input materials, price is an important segmentation variable. The quality of the final product is also highly dependent on input materials, which is why quality is selected by the manager as a segmentation variable. Delivery, reserve capacity and geographical location are important because most the input materials are highly perishable and customer demand also fluctuates. The financial position of the supplier is important because credit purchase is highly preferred by the buyer. The manager believes that, in this industry, these supplier capabilities are crucial to a broiler company. The willingness-related criteria are commitment to quality, communication openness, reciprocal arrangement, willingness to share information, supplier's effort in promoting JIT principles and willingness to maintain a long-term relationship. The willingness criteria selected by the manager are important to make a close relationship in order to guarantee meeting the desirable requirements the buyer needs to satisfy its customers.

We used score sheets to assess the suppliers with respect to different capabilities and willingness criteria (1: very low to 5: very high), based on the interview with the manager. The scores were then equally rated and averaged, which provided us with two indexes. The results are presented in Figure 6.

FIGURE 6 GOES ABOUT HERE

The number of suppliers categorized in each segment is as follows. Suppliers with low capabilities and low willingness (SM1): 3; suppliers with low capabilities and high willingness (SM2): 6; suppliers with high capabilities and low willingness (SM3): 2; and suppliers with high capabilities and high willingness (SM4): 32. Note that some points in Figure 6 overlap and represent more than one supplier.

4.2. Supplier segmentation for marketing & sales

Eight suppliers provide marketing and sales services to the ABC Company. They deliver the raised chicken to processing plants and sell the finished products to fast-food, restaurants and retailers. Based on the interview with the manager, yielded four important criteria for capabilities (price, geographical location, market knowledge and financial position) and three for willingness (honest and frequent communications, willingness to share information and a long-term relationship). We found that, as storing the final product is very expensive, pricing is very crucial when it comes to selling the final product on time. The geographical location of the suppliers is also considered because of the importance of the market coverage. Market knowledge and the financial position of the suppliers are important to the company because they affect its market share and liquidity respectively. The willingness variables are also considered relevant because the information suppliers can provided about the market in the long term affects the company's overall performance.

The same score sheets are used to assess the suppliers with respect to different criteria (1: very low to 5: very high). The score sheets were completed during an interview with the manager. The scores of each dimension (capabilities and willingness) were then equally rated and averaged providing two indexes. The results are presented in Figure 7. The number of suppliers categorized in each segment is as follows. Suppliers with low capabilities and low willingness (SM1): 0; suppliers with low capabilities and high willingness (SM2):1; suppliers with high capabilities and low willingness (SM3): 1; and suppliers with high capabilities and high willingness (SM4): 6.

FIGURE 7 GOES ABOUT HERE

This segmentation indicates how the firm can manage its suppliers differently by considering their capabilities and willingness. It also provides an adequate basis for developing the suppliers. For instance, suppliers who are placed in SM1 are neither capable nor willing to have a relationship with the firm. The firm may decide to try and develop the supplier. However, in some cases, there is no possibility or feasibility to improve the supplier. The firm may then terminate its relationship

with these suppliers in favor of better alternatives. However, the firm may have a completely different strategy towards handling the suppliers in the SM2 segment. The firm may try to develop the capabilities of these suppliers. However, if that is not possible in the short term and there are several alternative suppliers, the firm may replace these suppliers with more capable ones. With regard to handling the suppliers segmented in SM3, the buyer should focus on improving and strengthening the relationship, as they are capable suppliers. The suppliers segmented in SM4 are the most valuable and the firm should invest in those relationships.

We also asked the company manager to rank the relative importance of the two functions (purchasing, and marketing and sales) they share with their suppliers. He thinks that, in this industry, marketing and sales are more important than purchasing, which means that, based on our approach, the company should focus more on managing the relationships the company has with the suppliers who market and sell the company's final product.

We discussed the results of the segmentation with the manager of the company we studied. He was very satisfied with the results and has already started to implement the proper strategies for each segment. To benefit from the dynamic feature of the proposed framework, the company also planned to follow the supplier-related phases we already talked about in section 3.4 and conduct the segmentation phase twice a year.

The results obtained in the real-world study demonstrate the main advantages of our proposed approach as follows:

- It does not restrict the DM to using a pre-defined limited number of segmentation variables, but instead allows the DM to use the most relevant variables within a given situation,
- It not only segments the suppliers for each function, which in turn calls for different supplier relationship management and supplier development strategies, but also determines the relative importance of the segmentation for different functions.

- It takes into account the inherent connections that exist between supplier-related activities in SCM framework, and facilitates the implementation of supplier segmentation in a dynamic fashion.

5. Discussion, Conclusion and Future Research Directions

Supplier relationships are crucial to the success of many companies. From a buyer's perspective, this paper identifies four related-supplier activities: selection, segmentation, management and development. Suppliers have to be selected before they are segmented and strategies can then be adopted to manage the relationships with these suppliers over time. From a managerial perspective, it is obvious that the four activities (selection, segmentation, management and development) are closely connected. By contrast, the way these four topics are views in scientific literature varies considerably. This can be explained by the way ideas about supplier relationships have evolved in recent decades. One of the aims of this paper is to integrate the supplier-related activities into a unifying framework. Existing studies present a fragmented and incomplete picture and there is no unifying framework or theme.

A review of supplier selection literature revealed many selection methods. Along with a comprehensive set of selection variables, have been identified. In terms of scientific contributions, supplier selection is the most mature activity in the field of buyer-supplier relationships. Supplier selection literature roughly goes back to the 1970s (see for example: Dickson, 1966; Berens, 1971-1972; Håkansson and Wootz, 1975). In this paper, our primary focus has been on supplier segmentation literature that was published much later (in the 1980s). Ten different segmentation approaches were discussed and categorized in three methods or schools of thought (the process method, the portfolio method and the involvement method).

A major contribution of this paper is the development of new and broader approach to supplier segmentation, embedded in the concept of SCM and developed on the basis of three main elements of buyer-supplier relationships, which we translated into three important requirements, which increased our knowledge of supplier segmentation, for instance by allowing us to propose a new

definition for supplier segmentation, which may serve as a basis for future research in supplier segmentation and related issues.

The essence of these requirements included three findings: Firstly, all supplier-related activities must be integrated to optimize the overall buyer-supplier relationships. Secondly, the exclusive focus on purchasing should be widened to include other functions and activities of the buying firm. Thirdly, the supplier-buyer relationships, within the supplier segmentation context, should be managed over time. Furthermore, these relationships should become the basis for effective supplier management and development by the buying firm over time. On the basis of these ideas and insights, we categorized all the variables we found in supplier selection and segmentation literature into two distinct dimensions (*capabilities* and *willingness)*. The variables reflecting the *suppliers' capabilities* and those reflecting the *suppliers' willingness* to engage in a relationship with a buying company have been described in detail. Using these two dimensions allowed us to identify four quadrants of supplying companies, which were used to sketch the changing position of suppliers over time from the buyer's perspective. The two-dimensional supplier segmentation was further extended to a three-dimensional supplier segmentation by allowing suppliers and buyers to work together in activities and functional areas other than purchasing. The suppliers can be categorized separately on the basis of their *willingness* and *capabilities* with regard to each of the functional areas.

We also explained how the proposed approach for supplier segmentation could be used in practice. The practical steps showed how a buying company can carry out various necessary activities in order to effectively manage its supplier-related activities. Within this framework, we attempted to assist the buyer to make the most robust and logical connection between the most important decisions buyers have to make in the relationships with their suppliers. This framework provides buyers with a much greater understanding of how to develop and maintain relationships with their suppliers. A real case study was used to illustrate our approach in practice.

We think that the proposed approach can be further developed in the future. First of all, segmenting suppliers cannot by itself result in a good supplier management and development strategy without considering the buyer potential as well. Undoubtedly, the suitable approach to dealing with a supplier with low *capabilities* and high *willingness* is different for a buyer with high *capabilities* and high *willingness* compared to a buyer with low *capabilities* and low *willingness*. Indeed, considering the potential of the buyer and supplier simultaneously and combining the two potentials may result in more effective buyer-supplier strategies. Therefore, we believe that an appropriate approach should consider (1) the conditions and circumstances of suppliers, and (2) the conditions and circumstances of buyers. Secondly, as the proposed framework contains multiple variables (criteria), it is suggested to apply some multi-criteria decision-making methodologies to aggregate these variables (criteria) when constructing the dimensions (see for example Lee and Drake, 2010). A third suggestion is to integrate supplier segmentation with other supplier-related optimization problems, such as 'lot-sizing and supplier selection' (Rezaei and Davoodi, 2008; 2011) and pricing (Rezaei and Davoodi, 2011). Another future research would be developing proper strategies for handling the suppliers in each segment in addition to proper strategies for upgrading suppliers. Finally we think longitudinal studies in a firm can provide the information needed to assess the dynamic aspects of the proposed approach.

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Table 1. The approaches and methods to supplier segmentation

Author(s') approaches	Variables considered	Segments used in supplier relationships	Methodology used	Segmentation method
Parasuraman (1980)	Supplier segmentation is identified for each item based on characteristics that are closely related to the key characteristics of that item's costumer segments*		Conceptual	Process
Kraljic (1983)	Profit impact; Supply risk	Non-critical items; Bottleneck items; Leverage items; Strategic items.	Conceptual	Portfolio
Olsen and Ellram (1997)	Difficulty of managing the purchase situation; Strategic importance of the purchase	Non-critical; Leverage; Bottleneck; Strategic.	Conceptual	Portfolio
Dyer *et al.*(1998)	Resource allocation	Durable arm's-length; Strategic partnership.	Empirical	Involvement
Bensaou (1999)	Supplier's specific investments; Buyer's specific investments	Market exchange; Captive buyer; Captive supplier; Strategic partnership.	Empirical	Portfolio and Involvement
Kaufman *et al*. (2000)	Technology; Collaboration	Commodity supplier; Collaboration specialist; Technology specialist; Problem-solving supplier.	Empirical	Portfolio and Involvement
Masella and Rangone (2000)	Time frame; Content	Short term and logistic; Long term and logistic; Short term and strategic; Long term and strategic.	Conceptual	Portfolio and Involvement
van Weele (2000)	Profit impact; Supply risk	Partnership; Competitive bidding; Securing continuity of supply; Systems contracting.	Conceptual	Portfolio and Involvement
Svensson (2004)	Supplier's commitment; Commodity's importance	Friendly; Transactional; Family; Business partner.	Empirical	Portfolio and Involvement
Hallikas *et al*. (2005)	Supplier dependency risk; Buyer dependency risk	Non-Strategic; Asymmetric (Captive supplier); Asymmetric (Captive buyer); Strategic	Empirical	Portfolio and Involvement

*As mentioned previously, Parasuraman did not determine specific variables for his model.

Table 2. Variables of suppliers' capabilities for possible supplier segmentation

Capability variables	Supporting references
Price/cost	Dickson, 1966; Weber *et al.,* 1991; Kannan and Tan, 2002; Day, 1994; Choi and Hartley, 1996; Swift, 1995; Chan, 2003; Rezaei and Davoodi, 2011
Profit impact of supplier	Chio and Hartley, 1996; van Weele, 2000; Kraljic, 1983
Delivery	Dickson, 1966; Weber *et al*., 1991; Kannan and Tan, 2002; Day, 1994; Choi and Hartley, 1996; Swift, 1995; Tan *et al*., 2002; Chan, 2003; Rezaei and Davoodi, 2011
Quality	Dickson, 1966; Weber *et al*., 1991; Tan *et al*., 2002; Chan, 2003; Rezaei and Davoodi, 2011
Reserve capacity	Kannan and Tan, 2002
Industry knowledge	Kannan and Tan, 2002
Production, manufacturing/ transformation facilities and capacity	Dickson, 1966; Weber *et al*., 1991; Day, 1994
Geographic location/proximity	Dickson, 1966; Weber *et al.,* 1991; Kannan and Tan, 2002; Swift, 1995
Design capability	Chio and Hartley, 1996; Chan, 2003
Technical capability	Dickson, 1966; Weber *et al.,* 1991; Chio and Hartley, 1996; Swift, 1995; Chan, 2003
Technology monitoring	Day, 1994
Management and organization	Dickson, 1966; Weber *et al*., 1991
Supplier process capability	Kannan and Tan, 2002
Reputation and position in industry	Dickson, 1966; Weber *et al*., 1991; Chio and Hartley, 1996; Swift, 1995
Financial position	Dickson, 1966; Weber *et al*., 1991; Kannan and Tan, 2002; Day, 1994; Choi and Hartley, 1996; Swift, 1995; Chan, 2003
Performance awards	Chio and Hartley, 1996
Performance history	Dickson, 1966; Weber *et al*., 1991; Chan, 2003
Cost control	Day, 1994
Technology development	Day, 1994
Repair service	Dickson, 1966; Weber *et al*., 1991
After sales support	Chio and Hartley, 1996
Packaging ability	Dickson, 1966; Weber *et al*., 1991
Reliability of product	Chio and Hartley, 1996; Swift, 1995
Operational controls	Dickson, 1966; Weber *et al*., 1991
Training aids	Dickson, 1966; Weber *et al*., 1991
Labor relations record	Dickson, 1966; Weber *et al*., 1991
Impact on energy utilization	Swift, 1995
Ease of maintenance design	Swift, 1995
Communication system	Dickson, 1966; Weber *et al*., 1991
Desire for business	Dickson, 1966; Weber *et al*., 1991
Human resource management	Day, 1994
Amount of past business	Dickson, 1966; Weber *et al*., 1991
Warranties and claims	Dickson, 1966; Weber *et al*., 1991; Swift, 1995
Market sensing	Day, 1994
Customer linking	Day, 1994
Environmental health and safety	Day, 1994
Innovation	Spina *et al*., 2002
Supplier's order entry and invoicing system including EDI	Kannan and Tan, 2002
Public disclosure of environmental record	Handfield *et al*., 2002, Humphreys *et al*. 2003
Availability of clean technologies	Noci, 1997; Humphreys *et al*. 2003
Hazardous waste management	Noci, 1997; Handfield *et al*., 2002; Humphreys *et al*. 2003
Pollution reduction capability	Handfield *et al*., 2002; Humphreys *et al*. 2003
ISO 14000 and 14001 certification	Handfield *et al*., 2002; Humphreys *et al*. 2003
Recycling and reverse logistics program	Handfield *et al*., 2002; Humphreys *et al*. 2003
Environmentally friendly product packaging	Handfield *et al*., 2002
Hazardous air emissions management	Noci, 1997; Handfield *et al*., 2002; Humphreys *et al*. 2003

Table 3. Variables of suppliers' willingness for possible supplier segmentation

Willingness variables	Supporting references
Commitment to quality	Kannan and Tan, 2002; Svensson, 2004
Honest and frequent communications/ communication openness	Kannan and Tan, 2002; Chio and Hartley, 1996; Smeltzer, 1997
Commitment to continuous improvement in product and process	Kannan and Tan, 2002; Svensson, 2004; Urgal-González, and García-Vázquez, 2007
Relationship closeness	Chio and Hartley, 1996; Kaufman *et al*., 2000; Chan, 2003
Open to site evaluation	Kannan and Tan, 2002
Attitude	Dickson, 1966; Weber *et al*., 1991
Bidding procedural compliance	Dickson, 1966; Weber *et al*., 1991
Reciprocal arrangements	Dickson, 1966; Weber *et al*., 1991; Kaufman *et al.,* 2000
Prior experience with supplier	Swift, 1995
Impression	Dickson, 1966; Weber *et al*., 1991
Ethical standards	Kannan and Tan, 2002
Willingness to co-design and participate in new product development	Spina *et al*., 2002; Tan *et al*, 2002
Willingness to integrate supply chain management relationship	Kannan and Tan, 2002
Mutual respect and honesty	Smeltzer, 1997
Willingness to share information, ideas, technology, and cost savings	Kannan and Tan, 2002; Smeltzer, 1997; Tan *et al*, 2002
Consistency and follow-through	Smeltzer, 1997
Supplier's effort in eliminating waste	Kannan and Tan, 2002
Supplier's effort in promoting JIT principles	Kannan and Tan, 2002
Dependency	Hallikas *et al*., 2005; Kaufman *et al.,* 2000
Willingness to invest in specific equipment	Urgal-González, and García-Vázquez, 2007
Long term relationship	Chio and Hartley, 1996

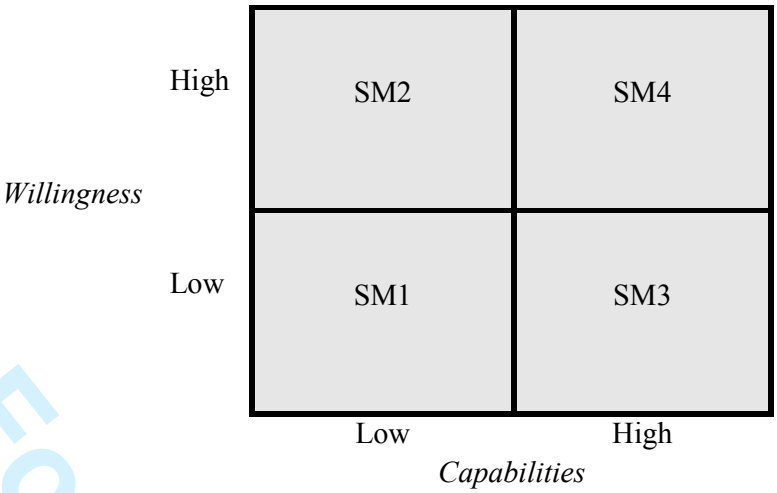

Figure 1. Supplier segmentation based on supplier potential

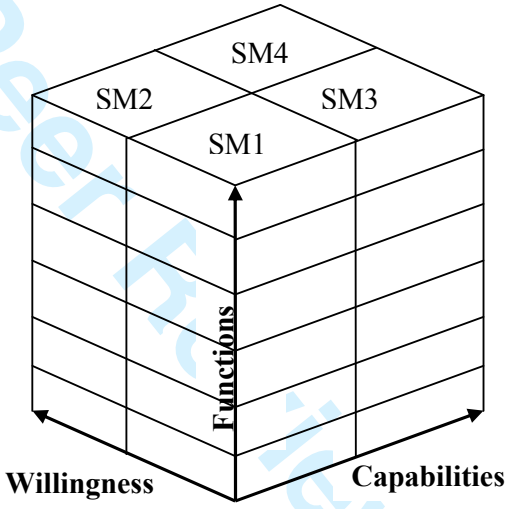

Figure 2. Different supplier segmentation based on three dimensions

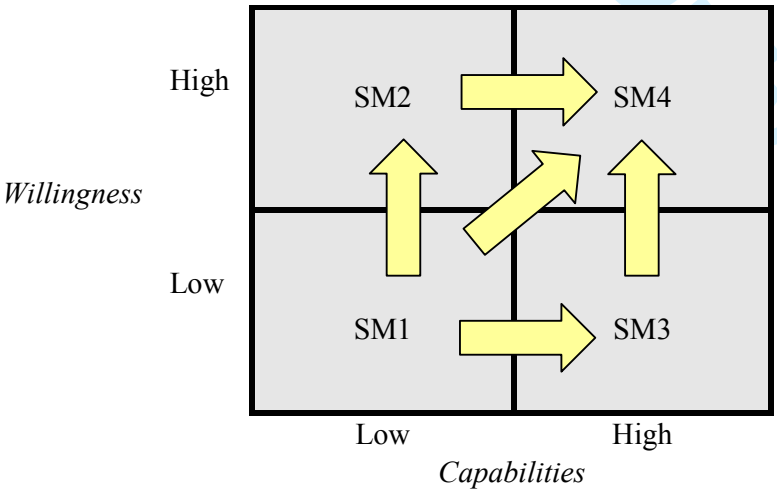

Figure 3. Supplier development based on supplier potential

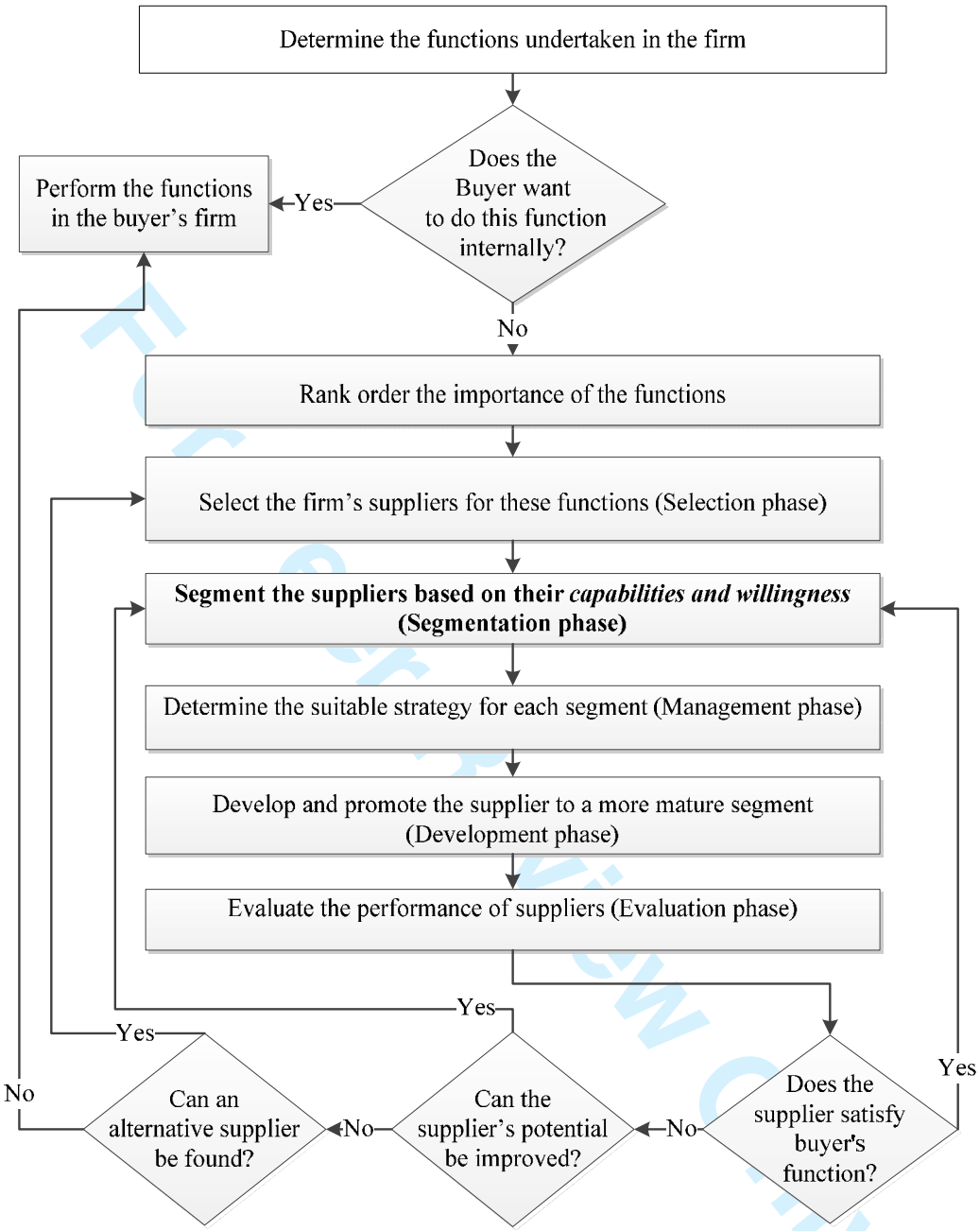

Figure 4. The conceptual framework for *supplier*-related activities for a buyer

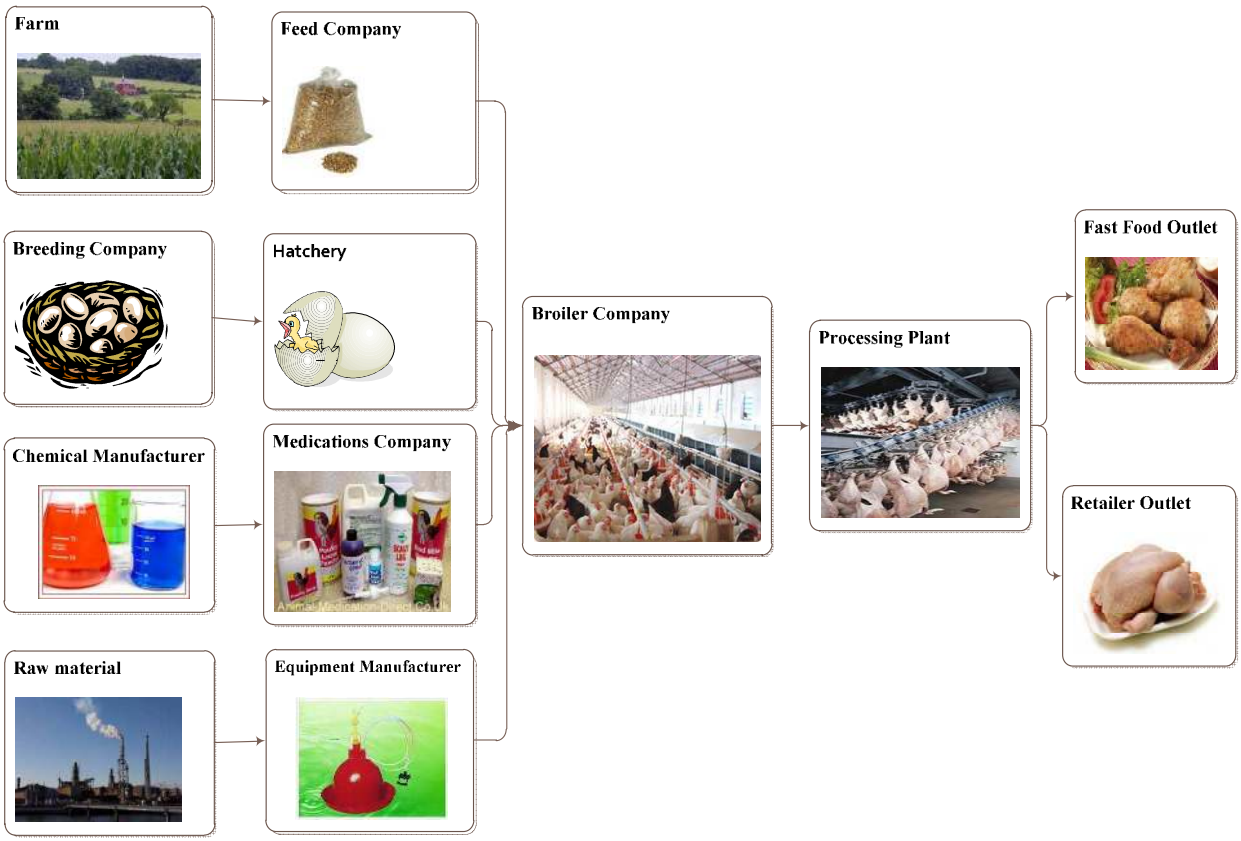

Figure 5 supply chain of the broiler company

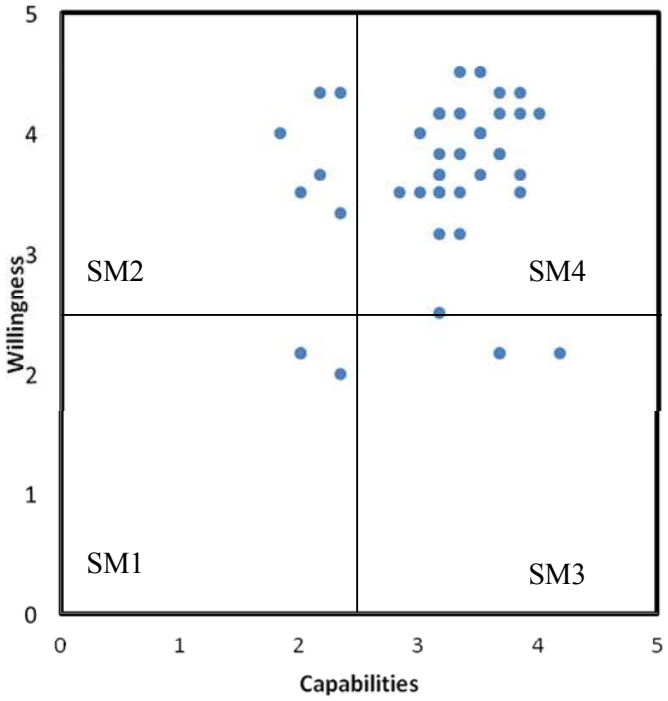

Figure 6 supplier segments (purchasing)

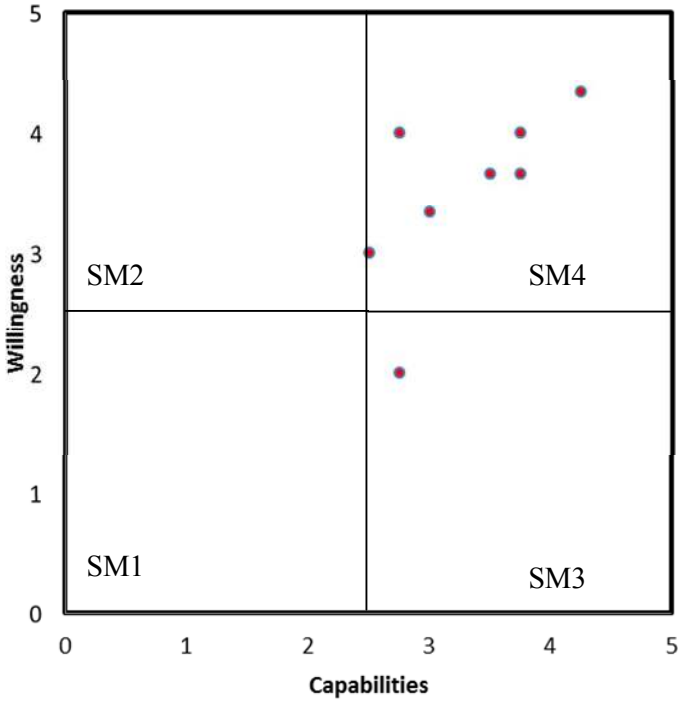

Figure 7 suppliers segments (marketing & sales)