MELEK AKIN ATEŞ

Purchasing and Supply Management at the Purchase Category Level

Strategy, Structure, and Performance

PURCHASING AND SUPPLY MANAGEMENT AT THE PURCHASE CATEGORY LEVEL:

STRATEGY, STRUCTURE, AND PERFORMANCE

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STRATEGY, STRUCTURE, AND PERFORMANCE

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Chapter 1

INTRODUCTION

1.1. BACKGROUND AND MOTIVATION

Over the past two decades, purchasing has evolved from a clerical function focused on buying goods and services at a minimum price into a strategic function focused on value creation and achieving competitive advantage (Gadde and Håkansson, 1994; Carter and Narasimhan, 1996; Krause et al., 2001; Rozemeijer et al., 2003; Cousins et al., 2006; González-Benito, 2007; Schoenherr et al., 2012). This transformation is the result of an increased understanding by the top management of firms that purchasing can contribute to organizational success in many dimensions such as financial performance (Carr and Pearson, 2002; González-Benito, 2007), innovation performance (Handfield et al., 1999; Van Echtelt et al., 2008), and environmental performance (Bowen et al., 2001, Krause et al., 2009). More recent trends such as global sourcing, strategic alliances, and joint innovations with suppliers (Monczka et al., 2010; Schoenherr et al., 2012) have also contributed to the changing role of purchasing.

In line with practitioners' growing interest on purchasing's impact on performance (Monczka et al., 2011; McKinsey, 2013), researchers have also examined various antecedents of high-performance purchasing such as aligning business and purchasing strategies (Watts et al., 1992; Das and Narasimhan, 2000; Baier et al., 2008; González-Benito, 2007), purchasing organization structure (Johnson et al., 2002; Rozemeijer et al., 2003), and supply base and supplier relationship management (Humphreys et al., 2004; Choi and Krause, 2006; Krause et al., 2007). Beyond any doubt, all of these studies contribute to our understanding of the role

of the purchasing function and how it can impact firm performance. However, in the majority of these studies, the focus was on purchasing strategies and practices at the overall purchasing function/department level. For instance, Narasimhan and Das (2001) examine how strategic purchasing practices relate to firms' financial performance and David et al. (2002) investigate the impact of congruence between business strategies and purchasing department structure on firm performance. While firms might have purchasing strategies at the function level, it is crucial to successfully manage the large variety of products and services that they purchase by formulating and implementing different purchasing strategies for each so-called purchase category (Kraljic, 1983; Olsen and Ellram, 1997; Caniëls and Gelderman, 2007; Terpend et al., 2011).

A purchase category can be defined as "a homogenous set of products and services that are purchased from the same supply market and have similar product and spend characteristics" (Cousins et al., 2007; Trautmann et al., 2009; Van Weele, 2010). Firms have many different types of purchases ranging from critical raw materials to office supplies, from components to spare parts, and the competitive priorities and strategies vary across purchase categories. For instance, while firms can focus on cost reduction objectives for purchasing office supplies or raw materials with a low supply risk, they may opt to pursue joint innovations with suppliers for components with key functionalities for their final customers. Purchase category management is a very common practice among many mid- and large-size firms from different industries and its importance and usage are expected to increase even more in the near future (Carter et al., 2007; Monczka and Peterson, 2008). Despite the practical relevance, interestingly there has been very little research in purchasing at the purchase category level (Trautmann et al., 2009).

Among these few studies, the seminal paper of Kraljc (1983) has generated a lot of attention in both research and practice (Cousins et al., 2008). Despite it being introduced 30 years ago, Krajic's purchasing portfolio model is still highly popular among purchasers and consultants, especially in Western Europe (Cousins et al., 2008; Caniëls and Gelderman, 2007; Luzzini et al., 2012). The intuitiveness of his purchasing portfolio model is quite appealing: based on two dimensions – purchase importance and supply risk – four types of purchase categories were defined: strategic, leverage, bottleneck, and non-critical. Kraljic (1983) suggested a key purchasing strategy for purchases in each quadrant: focus on

efficiency for non-critical items, assurance of supply for bottleneck items, competitive bidding for leverage items, and partnerships with suppliers for strategic items. Kraljic's study (1983) has been cited more than 250 times, and also inspired other portfolio models (e.g. Olsen and Ellram, 1997; Bensau, 1999) which were quite similar to the Kraljic matrix in essence (Luzzini et al., 2012; Pardo et al., 2011). However, such models have been criticized because they focus on a limited set of contingencies, suggest only a limited set of purchasing strategies, and are not distinctive enough about the variety of purchasing practices implemented within the quadrants (Nellore and Söderquist, 2000; Caniëls and Gelderman, 2007; Krause et al., 2009, Pagell et al., 2010; Luzzini et al., 2012). For instance, Faes and Matthyssens (2009) find that the same purchasing practice (i.e. single sourcing) can be implemented in multiple quadrants of the Kraljic matrix, and Gelderman and Van Weele (2005) report that firms are already implementing multiple strategies within each quadrant. These findings clearly illustrate the need for alternative and more comprehensive ways of defining purchase category strategies.

Strategies can be conceptualized in many different ways (Ginsberg and Venkatraman, 1985, Mintzberg, 1987; Govindarajan, 1988; Van de Ven, 1992). One popular approach is to define strategies based on practices, which has so far been the most used approach in the purchasing literature (González-Benito, 2010). For instance, Treleven and Schweikhart (1988) distinguish between single versus multiple sourcing, and Birou et al. (1998) list 43 purchasing practices such as competitive bidding, supply base reduction, and early supplier involvement to define purchasing strategies. Another approach is the content focus which defines strategies based on what the firms intend to achieve in the competitive market (Hamel and Prahalad, 1993). The content focus examines the "strategic intent", and allows one to go one step back and understand "why" certain practices are being implemented. Interestingly, this approach has been rarely used in the purchasing strategy literature (Krause et al., 2001; González-Benito, 2010).

Krause et al. (2001) proposed that as the operations and purchasing functions of firms are highly interlinked, competitive priorities (i.e. cost, quality, delivery, innovation) used to define operations strategies are also highly valid in the purchasing context. However, there have been only a few empirical studies testing this argument and they only focused on the overall purchasing function level (e.g. Baier et al., 2008; González-Benito, 2010). As has been

argued above, initial evidence from practice seems to suggest that competitive priorities vary across purchase categories (Cousins et al., 2007; Van Weele, 2010), but there is a scarcity of research on this topic.

In this dissertation, I examine not only the variety in purchase category strategies, but also how these strategies are implemented. More specifically, to examine purchase category strategy implementation I refer to strategy-structure-performance paradigm that has been used to a high extent in management research (i.e. Chandler, 1962: Tushman and Nadler, 1978; Porter, 1985). In the next sections, I first state the main research questions, and then further elaborate on the motivation for focusing on these research questions.

1.2. RESEARCH QUESTIONS

In this dissertation, to investigate how companies manage[1] their various purchase categories, I specifically focus on the strategy-structure-performance paradigm and define five main research questions:

1. How do competitive priorities in purchasing (i.e. cost, quality, delivery, innovation, sustainability) combine into different purchase category strategies? *(Chapter 2)*
2. How do supply market characteristics impact the effectiveness of purchase category strategies? *(Chapter 2)*
3. What is the relationship between purchase category strategies and purchasing structure? Does the misfit between purchase category strategies and purchasing structure impact purchase category performance? *(Chapter 3)*
4. What kind of supply base structure is required to successfully manage the different purchase category strategies? *(Chapter 5)*
5. How do supply market characteristics impact the relationships between purchase category strategies, supply base structure, and purchase category performance? *(Chapter 5)*

[1] "Managing" purchase categories is a rather broad term which includes several activities ranging from tactical to strategic. In this dissertation, the focus is on how purchase category strategies are implemented most effectively (resulting in high purchasing performance) by having appropriate purchasing structures and supply base structures. Arguably, managing buyer-supplier relationships is also an important element of purchasing strategy implementation, yet this topic has received substantial attention already (Caniëls and Gelderman, 2007; Cannon and Perreault, 1999; Cousins, 2002).

Before discussing how each of the research questions above is addressed in different chapters of this dissertation, first Table 1.1 is presented which provides the definitions for the key concepts investigated.

Table 1.1. The definitions of key concepts investigated in this dissertation

Concepts	**Definitions**	**Remarks**
Purchasing	The design, initiation, control and evaluation of activities within and between organizations aimed at obtaining inputs from suppliers at the most favorable conditions (Van Weele 2010).	Several terms are used interchangeably in the literature to refer to purchasing activities; i.e. sourcing, procurement, supply, buying. Although it is argued that there are slight differences among these terms, a consensus has not yet been reached. In order to be consistent throughout the dissertation, the term purchasing is chosen.
Purchase category	A homogeneous set of products and services that are purchased from the same supply market and have similar product and spend characteristics (Cousins et al. 2007; Van Weele 2010).	The term "purchase category" is used in this dissertation not to refer to firms that have highly structured purchase category management systems in place, but to explicitly state that the unit of analysis is at the purchased item level.
Purchase category strategy	A set of competitive priorities emphasized to manage a purchase category.	Strategy can be defined in several ways. The majority of studies investigating purchasing strategies focus on the practices implemented. Krause et al. (2001) suggest that another approach that is very informative but has been examined to a much lesser extent is the competitive priorities of purchasing.
Competitive priorities	Strategic preferences, the dimensions along which a company chooses to compete (Hayes and Wheelwright, 1984; Krause et al., 2001); e.g. cost, quality, delivery, innovation.	Several researchers define operations strategies by the competitive priorities emphasized by that plant/firm. Scholars have also argued that as operations and purchasing functions are highly inter-linked, competitive priorities can also be used to define purchasing strategies (González-Benito 2007; Watts et al. 1992).
Purchase category performance	The extent that the perceived performance in the emphasized purchasing competitive priorities are in line with the targets.	Purchasing performance can be assessed in several ways. As purchase category strategy is defined by competitive priorities in this dissertation, outcomes are also measured in terms of competitive priorities.

Purchasing structure	The level of centralization, formalization, and cross-functionality of purchasing at the purchase category level (not at the overall purchasing function/department level).	Organization structure can be considered as consisting of many different dimensions, but the three most discussed dimensions both in organization and innovation literatures are centralization, formalization, and cross-functionality (Aiken and Hage, 1971; Damanpour, 1991; Miller et al., 1988).
Purchasing proficiency	The quality of executing the purchasing processes used to manage a purchase category.	
Supply base structure	The characteristics of the total supply base of a purchase category; i.e. the number of suppliers, the degree of supplier heterogeneity, the degree to which suppliers interrelate, the relationship/contract duration with suppliers, and the extent that suppliers share information with the focal firm (Choi and Krause, 2006; Gadde and Håkansson, 1994)	This construct has been developed by adopting and extending the supply base complexity construct discussed in the conceptual paper of Choi and Krause (2006). Whereas purchasing structure refers to the internal structure, supply base structure refers to the external structure (that can be affected by the focal firm).
Sourcing mode	The number of suppliers for each product being purchased (Richardsson, 1993); e.g. single sourcing, dual sourcing, multiple sourcing.	Several studies identify single, dual, multiple sourcing as purchasing strategy types (e.g. Burke et al., 2007; Treleven et al., 1988). In this dissertation, strategy is conceptualized based on the competitive priorities emphasized, and in order to prevent confusion the term sourcing mode (e.g. Yu et al., 2009) instead of purchasing strategy is used.
Heterogeneity of suppliers	The degree of different characteristics such as organizational cultures, operational practices, technical capabilities, and geographical separation that exist among the suppliers in the supply base (Choi and Krause, 2006).	
Interaction between suppliers	The extent of competition and collaboration between the suppliers of a purchase category (Choi and Krause, 2006).	

Contract duration	The duration of contracts the focal firm usually has with the suppliers of a purchase category; i.e. short, medium, long-term contracts (Gadde and Snehota, 2000; Spekman, 1998).	
Supplier information sharing	The extent to which suppliers of a purchase category openly share information about the future that may be useful to the customer relationship (Cannon and Homburg, 2001); e.g. financial, operational, and technical (Swink et al., 2007).	
Supply market characteristics	The characteristics of the supply market of a purchase category which can be examined in terms of supplier scarcity, entry barriers for new suppliers, supply continuity risk, product customization, supplier power (Kraljic, 1983; Luzzini et al., 2012; Zsidisin et al., 2004)	When assessing supply market characteristics and the impact of supply market on purchasing strategies and practices, several studies adopt a "risk" perspective (e.g. Gelderman and van Weele 2005; Zsidisin et al., 2004), which is the perspective also adopted in this dissertation.
Purchase category characteristics	The importance of the purchase category among all the other purchase categories of a firm; examined in terms of financial impact, priority, criticality, and necessity (Olsen and Ellram, 1997; Lewin and Donthu, 2005; Kraljic, 1983)	Several characteristics of purchase categories can be defined. In order to be consistent with earlier portfolio models, we only focus on purchase importance.

1.3. OUTLINE OF THE DISSERTATION

Although purchasing portfolio models such as Kraljic's (1983) are highly used in practice, due to the recent developments such as increasing outsourcing (Handley and Benton, 2012) and the concomitant growth in the variety of purchases, such portfolio models no longer support the increasing requisite variety (Ashby, 1958) in purchasing strategies. In practice, firms are already using portfolio models where more dimensions such as competitive priorities (e.g. cost, innovation, and sustainability) are considered. For instance, Vodafone and Sonoco use

purchase category segmentation models, which incorporate not only the spend importance but also innovation objective (Procurement Strategy Council 2007). Similarly, Krause et al. (2009) and Pagell et al. (2010) find that when firms emphasize sustainability for their purchase categories in different quadrants of the Kraljic (1983) matrix, they implement practices other than the ones suggested by Kraljic (1983). These examples from practice clearly illustrate that the contingencies identified in current portfolio models do not fully reflect the complexities faced today (Mahapatra et al. 2010) and must be complemented through the consideration of additional dimensions.

Considering that the existing purchasing portfolio models do not fully cover the variety and richness of purchasing strategies, and that the purchasing literature suggests the use of competitive priorities to define purchasing strategies, I first develop a taxonomy of purchase category strategies based on competitive priorities. Keeping in mind the role of existing purchasing portfolio models in developing purchase category strategies, I also investigate how this taxonomy relates to earlier purchasing portfolio models and whether it complements them. This results in a more comprehensive approach in understanding the variety of purchase category strategies and the conditions under which they are most effective. This study is discussed in detail in *Chapter 2*.

While defining competitive priorities to be emphasized for various purchase categories is the first step of the strategy process, another critical issue is how these strategies are implemented. The strategy process view suggests that strategy consists of two parts that need to be examined in relation to each other: strategy formulation and strategy implementation (Ginsberg and Venkatraman, 1985). Upon formulating strategies and deciding on which competitive priorities to emphasize, firms focus on the elements that impact the successful implementation of these strategies (Olson et al., 1995).

In this dissertation, in order to investigate strategy implementation in more detail, I focus on two types of purchase category strategies that have been found to be the most distinctive (Baier et al., 2008; David et al., 2002; Terpend et al., 2011): Cost Leadership and Product Innovation. Cost management and cost reduction are traditionally argued to be the most prevalent priorities in purchasing in general (Carter and Narasimhan, 1996; Zsidisin et al., 2003), but in line with the increasing understanding of the role of suppliers in generating innovation, many firms also engage in innovation strategies in their purchasing function

(Handfield et al., 1999; Narasimhan and Das, 2001; Wynstra et al., 2003). Additionally, these two purchasing strategies have also been acknowledged by other studies as the most important ones (e.g. David et al., 2002; Baier et al., 2008, Terpend et al., 2011). It should be stressed once more that although such purchasing strategies have been examined in the literature before, the focus has always been on the function level, and the possibility that these strategies might differ at a more micro level, at the purchase category level, has been somewhat neglected.

In this dissertation, I build on the contingency framework to increase the understanding about how cost leadership and product innovation purchasing strategies are implemented. More specifically, I follow the strategy-structure-performance paradigm[2] that has been examined extensively in the organization literature (i.e. Chandler, 1962: Tushman and Nadler, 1978; Porter, 1985), but remarkably less so in the purchasing context. This paradigm suggests that strategy drives structures and processes, and only when there is a fit between them firms can benefit from performance gains. Two types of structures that are of utmost importance to successful implementation of purchasing strategies are investigated in this dissertation: purchasing structure (internal structure) and supply base structure (external structure).

Various studies in the organization literature highlight the importance of having an organizational structure that enables the chosen strategy and thereby results in superior performance outcomes (Chandler, 1962; Tushman and Nadler, 1978; Porter, 1985; Miller, 1987). Innovation literature has also greatly examined organization structure in relation to innovation generation and innovation performance (Burns and Stalker, 1961; Zaltman et al., 1973; Damanpour, 1991; Cooper, 1998). Organization structure can be considered as consisting of many dimensions, but the three most discussed dimensions in organization and innovation literatures are centralization, formalization, and cross-functionality. Burns and Stalker (1963) view these three dimensions in combination, and distinguish between two types of organization structures: a mechanistic structure which is argued to be more suitable for

[2] This paradigm is different than the structure-conduct-performance that has been a dominant approach in industrial organization economics literature. Structure refers to the market structure in the latter paradigm which suggests that market characteristics (external factors) determine the conduct (actions, processes, organizational structures) of firms which then impact firm performance. Thus, this paradigm has a specific focus on the role of external market characteristics. In the strategy-structure-performance paradigm, structure is associated more with internal factors such as organizational structure, but can also refer to other types of structures which can be affected by an organization and need to be aligned with strategies to achieve high performance.

implementing cost leadership strategies, and an organic structure which is argued to be more suitable for implementing product innovation strategies.

Organizational structure in purchasing has definitely generated some attention; however, past research mostly adopted a fragmented approach where the effects of structure variables on purchasing performance have been examined individually. For instance, Rozemeijer et al. (2003) investigate the factors that impact the choice of centralized versus decentralized purchasing organizations, and Moses and Åhlström (2008) examine problems in cross-functional purchasing processes. Foerstl et al. (2013) compare the effects of centralization ("functional coordination") and cross-functional integration on purchasing performance at the firm level. A holistic approach where multiple dimensions of purchasing structure are analyzed is yet to be developed (Schiele, 2010). Additionally, purchasing structure has not been examined at the category level, although there is some evidence that the levels of centralization, formalization, and cross-functionality vary across purchase categories (Trautmann et al., 2009, Karjalainen, 2009). In *Chapter 3*, I examine how purchase category strategies (cost leadership and product innovation) impact purchasing structure, and whether a (mis)fit between the two (negatively) positively impacts purchase category performance. Furthermore, I discuss the mechanism of how a misfit can potentially impact purchasing performance, and investigate the mediating role of purchasing proficiency (the quality of executing purchasing processes).

While purchasing structure reflects how purchase category strategies might impact the internal structure within the buying firm, supply base structure can be considered as the external structure that is also affected by the purchasing strategy (Trautmann et al., 2009). Supply base is defined as "the total number of suppliers that are actively managed by the focal firm, through contracts and purchase of parts, materials and services" (Choi and Krause, 2006, p.639). In their conceptual paper, Choi and Krause (2006) define three dimensions of the supply base structure: number of suppliers, differentiation of suppliers, and interaction between suppliers, and examine how these dimensions impact costs, risks, responsiveness, and innovation. One of the crucial tasks in purchasing is developing a supply base that supports the purchasing strategy. Das and Narasimhan (2000) call it "purchasing competence" which they define as "the capability to structure the supply base in alignment with the manufacturing and business priorities of the firm" (p.18). For instance, if a firm puts more emphasis on being

innovative, the purchasing function also needs to back this strategy up by having a supply base structure that leverages the firm's innovation performance.

It seems plausible to argue that in line with the variety of purchase categories firms have, they also have different supply base structures for these purchase categories. As the traditional focus of purchasing was on cost reduction (Carter and Narasimhan, 1996; Zsidisin et al., 2003), it can be stated that firms are more experienced in structuring their supply base for cost leadership purchasing strategy. Therefore, it is especially interesting to examine how a focus on product innovation purchasing strategy impacts the supply base structure. Despite the vast number of studies about supplier involvement in innovation, the unit of analysis was mostly on the new product development project level (Handfield et al., 1999; Ragatz et al., 2002; Corsten and Felde, 2005) and the literature currently lacks an understanding of what is an effective supply base structure for a purchase category managed with product innovation strategy. As a response to this research gap, in *Chapter 5* I examine the supply base structures for purchase categories managed with cost leadership versus product innovation strategies. Additionally, the role of supply market characteristics as an alternative mechanism explaining the supply base structure is also discussed.

In conclusion, the aim of this dissertation is to examine how firms can effectively manage their various purchase categories in order to have a high purchasing performance. I investigate this by specifically focusing on the link between purchase category strategies, purchasing and supply base structures, and purchase category performance.

1.4. RESEARCH STRATEGY AND DATA COLLECTION

Before discussing each individual study, it is useful to describe the research strategy and the data collection process. In this dissertation, two types of research strategies have been utilized: survey and case study.

A survey is "a systematic method for gathering information from (a sample of) entities for the purposes of constructing quantitative descriptors of the attributes of the larger population of which the entities are members" (Groves et al., 2004, p.2.). The survey is a preferred research strategy when the knowledge about the investigated topic is not too underdeveloped, when the variables can be clearly defined, and when the purpose is to find "how variables are

related, where the relations hold, and to what extent a given relation is present (Forza, 2009). Although survey research can be used for exploratory and descriptive purposes, the main objective is often confirmatory, or in other words, theory-testing (Forza, 2002, 2009; Rungtusanatham et al., 2003). Several data collection tools can be used to conduct a survey such as mailed questionnaires, telephone calls, and personal interviews (Forza, 2002).

A case study can be defined as "an empirical research that primarily uses contextually rich data from bounded real-world settings to investigate a focused phenomenon" (Barratt et al., 2011, p.329). The case study is a preferred research strategy when the researchers are especially interested in understanding "why" the investigated concepts happen or relate to each other (Yin, 1994; Voss et al., 2002; Voss, 2009; Barratt et al., 2011). Additionally, the case study method is more suitable when there are not a lot of prior studies about the investigated issue, and when even the concepts and variables are not well-defined (Yin, 1994; Voss et al., 2002; Voss, 2009). Although the case studies can be used for theory testing, they are mostly used for theory building (Voss et al., 2002). There are several types of case studies such as the single case study, multiple case studies, and longitudinal case studies where data can be collected by means of several tools such as interviews, analyzing documents, and direct observation (Yin, 1994; Dul and Hak, 2008; Voss, 2009).

In this dissertation, survey research is utilized for *Chapters 2, 3,* and *4*, and multiple-case study research is utilized for *Chapter 5*. In *Chapters 2* and *3*, the current state of scientific knowledge available allows developing some propositions. Additionally, some of the concepts investigated in these chapters are developed in prior literature, but they have not been tested at the unit of analysis in this dissertation (i.e. at the purchase category level). Therefore, conducting a survey serves objectives of these two chapters well. The topic of *Chapter 4* is assessing and testing for measurement equivalence in survey research, thus the aim is not to test a theory but contribute to the knowledge about conducting high quality survey research. In *Chapter 5* the aim is not to merely find a relationship between the investigated concepts, but also understand "why" such a link exists, which is best explained by the richness of case studies (Yin, 1994; Voss et al., 2002; Barratt et al., 2011). Additionally, the key concept investigated in this chapter, supply base structure, is not very well developed. Therefore, the use of case studies seems more appropriate than other research strategies such as surveys.

Regarding the data collection tools, we used a large scale international questionnaire for *Chapters 2, 3, and 4,* and semi-structured interviews for *Chapter 5*. Detailed information about the semi-structured interviews are presented in *Chapter 5*, but in order to not repeat the details of the large scale international questionnaire in multiple chapters, it was deemed more appropriate to discuss it in this section. Additionally, as the large scale international questionnaire[3] has been the main source of data for the majority of the chapters, it warrants further elaboration.

The author of this dissertation is an active member of a research initiative called "The International Purchasing Survey (IPS) project" (www.ipsurvey.org). The IPS project was started in 2007, and currently it consists of 26 academic researchers in Purchasing and Supply Management from 12 different countries, from the following institutes: Politecnico di Milano (Italy), Rotterdam School of Management, Erasmus University (The Netherlands), University of Manchester, Manchester Business School (United Kingdom), Universität der Bundeswehr, München (Germany), Linköpings Universitet, Stocholm University School of Business, and Högskolan i Gävle (Sweden), Aalto University School of Business (Finland), EADA Business School (Spain), Bowling Green State University and Georgia Southern University (United States of America), Richard Ivey School of Business (Canada), Audencia, Nantes, (France), University College Dublin (Ireland), and University of Melbourne (Australia).

The main objective of the IPS project is to investigate purchasing strategies and practices of companies as well as business and purchasing performance outcomes of such strategies and practices. While the first part of the survey focuses on purchasing strategies and practices at the overall firm level, in the second, and largest part of the survey the respondents are asked to choose a purchase category which they are most knowledgeable about, and answer the questions accordingly. IPS is a longitudinal research study and the first wave of data collection has been completed in Fall 2009[4]. The second round of data collection is planned for Fall 2013.

[3] Although we acknowledge that "survey" refers to a research strategy and "questionnaire" refers to a data collection tool, as the literature quite often uses these terms interchangeably, from this point on we also use both terms to refer to a questionnaire.

[4] The IPS data used in this dissertation comes from the first round of data collection.

The survey questions were prepared after several rounds. First of all, the main themes were identified based on the most contemporary topics in the purchasing and supply management field. Then, the research team developed a comprehensive list of questions representing these topics and concepts, which were described in detail in a codebook. The survey was originally designed in English and subsequently translated in seven other languages according to the TRAPD (Translation, Review, Adjudication, Pre-testing, and Documentation) procedure, which is gaining popularity and is argued to be more accurate than the often used back-translation approach (Harkness, 2003). The survey questions were pre-tested with two/three target respondents in each country, and after the pre-tests only minor wording changes were done.

The comparability of samples has been assured by centrally established guidelines on sampling design requiring a minimum company size and the relevant ISIC codes (Lynn et al., 2007). However, countries were allowed some flexibility in their sampling and contacting approaches (i.e., contact by telephone or e-mail) to accommodate differences in the availability of resources and sampling frames (Kish, 1994). The target respondents were purchasing managers or higher. The actual data collection was hosted by Rotterdam School of Management, Erasmus University by using the Globalpark online survey platform. In total, 681 data points were gathered resulting in an overall response rate of 9.5%, which is comparable to that of most recent studies adopting such complex survey tools (e.g., Carey et al., 2011; Kristal et al., 2010; Wu et al., 2012).

Given the different socio-economic and linguistic environments, one of the challenges of conducting a multi-country survey project is to establish construct and measurement equivalence between the respondents (Bensaou et al., 1999; Hult et al., 2008). A measurement procedure is equivalent when the relations between the observed variables and the latent variables are identical across groups that operate in apparently different settings (Drasgow, 1984). Without the assessment of equivalence, it is hard to know if findings reflect 'true' similarities and differences between selected groups rather than the spurious effect of cognitive or socio-cultural differences in response to a survey (Mullen, 1995). Rungtusanatham et al. (2008) argue that different cultures and countries are not the sole source behind possible measurement inequivalence, but any study that has data collected from different populations and wherein the intent is to draw comparative inferences about differences and similarities

across these different populations should assess measurement equivalence. Considering this, in *Chapter 4* we discuss how we assessed measurement equivalence in the IPS project, and also elaborate on the state of examining measurement equivalence in the operations and supply management literature.

1.5. DECLARATION OF CONTRIBUTION

In this section, I declare my contribution to the different chapters of this dissertation and also acknowledge the contribution of other parties where relevant.

Chapter 1: The majority of the work in this chapter has been done independently by the author of this dissertation, and the feedback from the promoter and co-promoter has also been implemented.

Chapter 2: The majority of the work in this chapter has been done independently by the author of this dissertation. The author formulated the research question, performed the literature review, conducted the data analysis, interpreted the findings, and wrote the manuscript. The main source of data for this chapter comes from the IPS project. The author participated in the last round of questionnaire development and refinement for this IPS project. The author was also responsible for the central coordination of the data collection in various countries (e.g. invitation and reminder emails). Obviously, at several points during the process, each part of this chapter was improved by implementing the detailed feedback provided by the promoter and the co-promoter. This chapter is currently under review at an operations management journal. The author of this dissertation is the first author of this paper, and the promoter and the co-promoter are the two co-authors.

Chapter 3: The majority of the work in this chapter has been done independently by the author of this dissertation. The author formulated the research question, performed the literature review, conducted the data analysis, interpreted the findings, and wrote the manuscript. Similar to Chapter 2, the main source of data for this chapter comes from the IPS project. Obviously, at several points during the process, each part of this chapter was improved by implementing the detailed feedback provided by the promoter and the co-promoter. An earlier version of this chapter was awarded the best student paper prize at an international operations management conference. This chapter is currently under review at an

operations management journal. The author of this dissertation is the first author of this paper, and the promoter and the co-promoter are the two co-authors.

Chapter 4: The first author of this chapter is a member of the IPS project, and the author of this dissertation is a co-author together with four other IPS members including the promoter and the co-promoter. This chapter includes two key parts: an extensive literature review about the state of measurement equivalence tests in the operations and supply management literature, and a detailed framework about assessing and testing for measurement equivalence. The author of this dissertation contributed to a great extent to the first part by i) writing parts of the literature review defining the various sources of data heterogeneity, ii) participating to the development of the coding scheme, iii) coding more than 150 survey articles published in six key operations management journals (two other co-authors also coded about 150 papers each), iv) combining all the papers coded and preparing the summary tables, and v) writing the relevant parts of the manuscript related to the coding and analysis. For the other parts of the chapter, the author of this dissertation provided feedback. Two papers have been developed based on this chapter: a technical note which is currently under review at an operations management journal, and a literature review which is still work-in-progress. The author of this dissertation is a co-author on both papers.

Chapter 5: The majority of the work in this chapter has been done independently by the author of this dissertation. The author formulated the research question, performed the literature review, collected the data, conducted the data analysis, interpreted the findings, and wrote the manuscript. Obviously, at several points during the process, each part of this chapter was improved by implementing the detailed feedback provided by the promoter and the co-promoter. The data used in this chapter comes from 19 face-to-face and phone interviews in two companies conducted by the author of this dissertation. In two of these meetings, the promoter was also present. The case selection was done jointly with the company sponsors based on the criteria defined by the author of this dissertation. Upon request of the companies, we do not disclose the company names and their detailed descriptions.

Chapter 6: The majority of the work in this chapter has been done independently by the author of this dissertation, and the feedback from the promoter and co-promoter has also been implemented.

1.6. CONCLUSION

This PhD dissertation advances purchasing and supply management literature by contributing to the knowledge about purchase category management, purchasing and supply base structures, and purchase category performance. Purchase category management has high practical relevance, but theory and empirical evidence about it are lacking. Due to this scarcity, in order to investigate the research questions of this dissertation, I quite often refer to other related research areas such as operations management, organizational design, and innovation. By doing so, I aim to respond to the recent calls about conducting cross-disciplinary research which do not only foster scholarly development, but also more clearly represent the multi-faceted decision-making challenges organizations face in real life. The findings of this dissertation do not only fill certain research gaps, but they also suggest future avenues of research and generate valuable recommendations for purchasing professionals.

Chapter 2

DEVELOPING A PURCHASING STRATEGY TAXONOMY BASED ON COMPETITIVE PRIORITIES

2.1. INTRODUCTION

Over the past decade in particular, purchasing and supply management (PSM) has received considerable attention from top management in firms, transforming from a purely tactical and operational function into a more strategic one (Carr and Pearson 2002; Chen et al. 2004; Lawson et al. 2009; Schoenherr et al. 2012). This transformation is the result of an increasing understanding that PSM can contribute to business performance in various dimensions, such as financial performance (Carr and Pearson 2002; González-Benito 2007), innovation performance (Handfield et al. 1999; Schoenherr et al. 2012; Van Echtelt et al. 2008), and environmental performance (Bowen et al. 2001; Schoenherr et al. 2012; Krause et al. 2009). To benefit from these performance effects, it is crucial for firms to successfully manage the variety of products and services that they purchase, applying distinctive purchasing strategies and supplier management approaches for each so-called purchase category (Caniëls and Gelderman 2007; Kraljic 1983; Olsen and Ellram 1997; Terpend et al. 2011).

Consistent with this finding, defining the variety and richness of purchasing strategies and the different conditions under which they are effective has been a top priority on purchasing professionals' agenda for quite some time now (Kraljic 1983; Luzzini et al. 2012; Pagell et al. 2010; Terpend et al. 2011). The importance of variety has also been acknowledged in the PSM literature. In his seminal paper, Kraljic (1983) proposed a purchasing portfolio based on two contingencies, purchase importance and supply risk, and defined four types of purchase categories: strategic, leverage, bottleneck, and non-critical. He suggested a focus on efficiency for non-critical items, the assurance of supply for bottleneck items, competitive bidding for leverage items, and strategic partnership for strategic items. His model also inspired many other, similar portfolio models (e.g., Caniëls and Gelderman 2007; Olsen and Ellram, 1997) that are widely adopted in practice (Gelderman and van Weele 2005; Pagell et al. 2010).

However, these models have been criticised for identifying only a limited set of purchasing strategies (Caniëls and Gelderman 2007; Gelderman and Mac Donald 2008; Krause et al. 2009) and for focusing on a limited set of contingencies (Luzzini et al. 2012; Mahapatra et al. 2010; Nellore and Söderquist 2000; Pagell et al. 2010). In a context of increasing outsourcing (Handley and Benton 2012) and the concomitant growth in the variety of purchases, such portfolio models no longer support the increasing requisite variety (Ashby 1958) in purchasing strategies.

In fact, in practice, to manage the variety of purchase categories and the associated complexities, firms are already implementing multiple purchasing strategies within each portfolio quadrant of the Kraljic model (Gelderman and van Weele 2005) and distinguishing between different competitive priorities. For instance, Vodafone and Sonoco use purchase category segmentation models, which incorporate not only the spend importance but also innovation objective and suppliers' technical capabilities (Procurement Strategy Council 2007). Similarly, Krause et al. (2009) and Pagell et al. (2010) find that when firms emphasize sustainability in their purchase categories, they implement practices other than the ones suggested by Kraljic (1983). These examples from practice clearly illustrate that the contingencies identified in current portfolio models do not fully reflect the complexities faced today (Mahapatra et al. 2010) and must be complemented through the consideration of additional dimensions.

The above examples also suggest an alternative approach to defining purchase category strategies: focusing on the "strategic intent" or, in other words, the competitive priorities such as cost, quality, delivery, innovation, and sustainability (Krause et al. 2001; Watts et al. 1992). Contingency theory suggests that an important antecedent of strategy is contextual characteristics (Ginsberg and Venkatraman 1985) but that such characteristics do not exclusively determine purchasing strategies per se. An alternative approach to defining strategies is to focus on strategic intent rather than on internal (purchase importance) and external (supply risk) contextual factors (Hamel and Prahalad 1989). Strategic intent signals what the firm aims to accomplish in the competitive market given a set of contingencies and is therefore a more direct predictor of different practices and processes.

In operations strategy, strategic intent has been measured using competitive priorities, which have been found to successfully predict differences in operations practices adopted (Boyer and Lewis 2002; Kathuria 2000; Miller and Roth 1994). As the operations and purchasing functions of firms are highly interlinked (Baier et al. 2008; González-Benito 2007, 2010; Narasimhan and Das 2001), it has been suggested that the same competitive priorities are also valid in the purchasing context (Krause et al. 2001; Pagell and Krause 2002; Watts et al. 1992). Watts et al. (1992) argue that the first step before deciding on certain purchasing practices is to define purchasing objectives, which must be consistent with operations objectives. However, surprisingly, there have been very few attempts to define and empirically validate purchasing strategies through the examination of such competitive priorities.

Following this stream of research and applying it to the purchase category level, in the present research we aim to develop a purchasing strategy taxonomy on the basis of competitive priorities. Additionally, we investigate the conditions under which these strategies are effective. To the best of our knowledge, this research question has not been examined before, and as the literature on this topic is relatively limited, we largely adopt an exploratory approach.

The remainder of the paper is organized as follows. In the Literature Review section, we first discuss the use of competitive priorities in defining operations and purchasing strategies. Then, building on the input-strategy-output model of the contingency framework (Ginsberg and Venkatraman 1985), we discuss how competitive priorities can be linked to previous portfolio models, and consider the performance implications of strategies. In the Research

Methods section, we explain the data collection, measure development, and checks for various biases. The results of the cluster analysis and an illustration of how our purchasing strategy taxonomy is related to the Kraljic matrix are presented in the Results section. We discuss relations within and among clusters more extensively in the Discussion section and, finally, summarize the study's contributions and limitations in the Conclusions section.

2.2. LITERATURE REVIEW

Defining appropriate purchasing strategies is important for firms, as strategies guide practices and processes and impact performance (Baier et al. 2008; Ginsberg and Venkatraman, 1985). Although the emphasis of purchasing has traditionally been on reducing costs and creating efficiencies, with the increasingly strategic role of purchasing and supplier management, buying firms consider additional competitive priorities such as innovation and sustainability in their purchasing strategies (Handfield et al. 1999; Krause et al. 2009; Pagell et al. 2010). Surely, these competitive priorities differ at not only the overall purchasing function level but also the purchase category level (Luzzini et al. 2012; Terpend et al. 2011). For instance, although firms can focus exclusively on lower costs when purchasing office supplies, on-time delivery and availability might be more important in the purchase of spare parts. Alternatively, for a component with key functionalities for the final customer, the focus might be on innovation, which requires the purchasing function to invest in the development of collaborative relationships with innovative suppliers. It might also be the case that multiple competitive priorities are emphasized in critical, high-importance purchase categories. Currently, the purchasing literature lacks a detailed discussion of how competitive priorities can be used to define purchasing strategies. Therefore, in the next section, we first discuss how competitive priorities have been examined in the operations strategy literature.

2.2.1. Competitive Priorities in Operations and Purchasing

In their influential research, Miller and Roth (1994) argue that firms adopt different sets of competitive priorities – objectives pursued in operations to gain competitive advantage (Boyer and Lewis 2002; Kathuria et al. 2010). These particular combinations of competitive priorities constitute distinct operations strategies that impact practices, processes, and performance

(Christiansen et al. 2003; Kathuria 2000). Investigating combinations of competitive priorities requires the adoption of a configurational approach, which has been used extensively to define operations strategies (e.g., Frohlich and Dixon 2001; Kathuria 2000; Miller and Roth 1994; Zhao et al. 2006).

Configuration theory is concerned with patterns or profiles and focuses on classifications of commonly occurring phenomena instead of independently examining the effect of each phenomenon on certain outcomes (Fiss 2007; Ketchen and Shook 1996). Taxonomies, which can be viewed as empirical tests of configuration theory, are therefore argued to better represent the complex relationships among various organizational issues (Miller and Roth 1994).

One of the key debates regarding competitive priorities concerns the question of whether there is a trade-off between different competitive priorities or priorities can be emphasized simultaneously (Boyer and Lewis 2002; Ferdows and De Meyer 1990; Hayes and Wheelwright 1984; Skinner 1985). Although the earliest works suggest that it is not possible for firms to excel in multiple competitive priorities simultaneously (Hayes and Wheelwright 1984; Skinner 1985), recent evidence indicates that more and more firms are striving for excellence in multiple objectives (Kathuria et al. 2010; Kristal et al. 2010; Rosenzweig and Easton 2010). The development of taxonomies through the adoption of a configurational approach allows for a combination of these two perspectives and empirical tests of whether certain strategies are characterized by a focus on a single competitive priority whereas others are characterized by the pursuit of multiple competitive priorities.

Before discussing the association between operations and purchasing strategies, we first identify the most commonly observed operations strategies in earlier taxonomies. A detailed review of such studies is currently not available in the literature; thus, we determined these strategies by an examination of the studies citing the pioneering work of Miller and Roth (1994). We uncovered six other empirical taxonomy studies, each identifying between two and four operations strategies, as shown in Table 2.1. Overall, six types of operations strategies are prevalent in these studies (each appearing in at least two studies).

In the first type of operations strategy, many or all competitive priorities are emphasized to a great extent (i.e., Do all [Kathuria 2000], Manufacturers pursuing excellence [Martín-Peña and Díaz-Garrido 2008], Efficient innovators [Sum et al. 2004], and Mass servers [Zhao et al.

Table 2.1. Comparison of operations strategy taxonomies

Studies	Data	Operations strategies						Performance
		Emphasize All	Emphasize Nothing	Cost Management	Delivery Reliability	Lean Management	Product Innovation	
Miller and Roth (1994)	188 man. units, USA, multi-ind.			Caretakers (n=13)		Marketeers (n=31)	Innovators (n=65)	Importance attached to perf. dimensions consistent with priorities.
Kathuria (2000)	99 man. units, USA, multi-ind., SMEs	Do all (n=15)	Starters (n=32)		Speedy conformers (n=40)			No significant man. performance difference between strategies.
Frohlich and Dixon (2001)	Man. firms, multi-country, multi-ind.		Idlers	Caretakers			Innovators	Performance not investigated.
Christiansen et al. (2003)	46 man. firms, Denmark, multi-ind.			Low price (n=9)	Speedy deliverers (n=10)	Quality deliverers (n=13)	Aesthetic designers (n=6)	Man. performance consistent with priorities, except. aesthetic designers.
Sum et al. (2004)	43 firms, Singapore, multi-ind., SMEs	Efficient innovators (n=15)	All rounders (n=19)				Differentiators (n=9)	Very few differences in terms of financial performance.
Zhao et al. (2006)	175 man. firms, China, multi-ind.	Mass servers (n=77)	Low emphasizers (n=10)			Specialized contractors (n=34)	Quality customizers (n=54)	Financial performance does not differ between strategies.
Martín-Peña and Díaz-Garrido (2008)	353 man.firms, Spain, multi-industry	Manufacturers pursuing excellence (n=184)				Manufacturers focused on quality and delivery (n=169)		Financial performance does not differ between strategies.

2006]). This type of strategy appears to be more consistent with the notion of cumulative capabilities than the trade-off notion, as firms attempt to excel in many dimensions and still be world class. We use the common label "Emphasize All" for this strategy in Table 2.1. In contrast, in the second type of operations strategy, none of the competitive priorities are emphasized to a great or moderate extent, indicating a lack of strategic orientation (i.e., Idlers [Frohlich and Dixon 2001], Starters [Kathuria 2000], All rounders [Sum et al. 2004], and Low emphasizes [Zhao et al. 2006]). We label this strategy "Emphasize Nothing". Such strategies can be observed in small firms, in firms in which there is a lack of strategic planning, or in firms operating in less competitive environments (Frohlich and Dixon 2001; Zhao et al. 2006).

In addition to these two strategies, the literature review suggests four other strategies in which some competitive priorities are emphasized more than the others. In one of these strategies, which we label "Cost Management", the sole focus is on cost (i.e., Low price [Christiansen et al. 2003], and Caretakers [Frohlich and Dixon 2001; Miller and Roth 1994]). In the fourth strategy, which we label "Delivery Reliability", firms prioritize the delivery objective over the cost objective (i.e., Speedy deliverers [Christiansen et al. 2003] and Speedy conformers [Kathuria 2000]). In the fifth strategy, which we label "Lean Management", firms focus on both cost and delivery, along with quality (i.e., Quality deliverers [Christiansen et al. 2003], Manufacturers focused on quality and delivery [Martín-Peña and Díaz-Garrido 2008], Marketeers [Miller and Roth 1994], and Specialized contractors [Zhao et al. 2006]). Finally, in the sixth type of operations strategy, firms focus on quality and innovation at the expense of higher costs (i.e., Aesthetic designers [Christiansen et al. 2003], Innovators [Frohlich and Dixon 2001; Miller and Roth 1994], Differentiators [Sum et al. 2004], and Quality customizers [Zhao et al. 2006]. We label this strategy "Product Innovation".

Given the close link between operations and purchasing (Baier et al. 2008; González-Benito 2007; Watts et al. 1992), these operations strategies are likely to have counterparts in purchasing. For instance, cost reduction is traditionally argued to be the most prevalent priority in purchasing (Carter and Narasimhan 1995; Zsidisin et al. 2003). In addition to this more traditional purchasing strategy, innovation-oriented strategies are also gaining importance, consistent with the increasing involvement of suppliers in new product development processes (Petersen et al. 2005; Wynstra et al. 2012). Lean management strategies are strongly related to just-in-time purchasing strategies, aiming for and working with suppliers

to reduce inventory levels, reduce, quality inspection, and produce higher-quality products (Dong et al. 2001; Handfield 1993).

While we thus may expect to find purchasing strategies similar to the six operations strategy types identified in Table 2.1, we explicitly choose to adopt an exploratory approach because of the scarcity of previous research. Although the strong link between operations and purchasing strategies has been suggested in many studies (Baier et al. 2008; González-Benito 2007; Pagell and Krause 2002; Watts et al. 1992), competitive priorities have not previously been empirically tested before in defining purchasing strategies using a configurational approach. Additionally, as illustrated above, management practice appears to be applying a richer variety in purchasing strategies than suggested by the scientific literature, and through an exploratory approach, we can best capture this richness.

In the next section, we discuss how our purchasing strategy taxonomy might relate to purchasing portfolio models. We specifically focus on the Kraljic matrix, which is one of the most widely adopted purchasing portfolio models.

2.2.2. Contingency Framework: Linking Purchasing Strategies to the Kraljic Matrix and to Performance

One of the most widely used (generic) theories in organizational studies is contingency theory, the basic premise of which is that there is no single best way to manage organizations (Galbraith 1973; Lawrence and Lorsch 1967). The operations management literature has also benefited greatly from this approach (Sousa and Voss 2008), particularly in relation to operations strategies (e.g., Ho 1996; Ketokivi and Schroeder 2004).

Ginsberg and Venkatraman (1985) suggest an examination of the contingency relationships of organizational strategy in an input-strategy-output model. According to this model, strategies are influenced by environmental and other contextual variables (input), and environmental fit is achieved when strategies are aligned with input contingencies. As a response to those contingencies, firms define their strategic intent, or a set of competitive priorities, which we define as the purchasing strategies.

In this study, we adopt this contingency approach and first identify purchase category strategies based on the competitive priorities emphasized. Subsequently, to assess

environmental fit, we relate the occurrence and the effectiveness of the identified strategies to contextual variables. For these contextual variables, we turn to the literature on purchasing portfolio models. As discussed in the Introduction, management practice and initial evidence appears to suggest that these models consider too few contextual variables to be able to identify uniquely appropriate purchasing strategies. By relating the identified strategies to the narrow set of contextual variables from the purchasing portfolio literature, we can empirically validate and refine these critical claims.

To achieve this aim, we select the Kraljic (1983) portfolio, as it is one of the most highly utilized purchasing portfolio models, and examine the two contextual variables used in that model: purchase importance and supply risk. Purchase importance is considered a fundamental characteristic of the purchasing task and can be defined as the (perceived) impact of purchase on organizational productivity and profitability (Lau et al. 1999). Purchase importance has been examined extensively in the literature on organizational buying behavior (OBB) and has been linked to many aspects, such as how purchasing processes are structured and decisions are made (Bunn 1993; Cannon and Perrault 1999; Lau et al. 1999). Supply risk stems from buying firms' dependence on their suppliers for various reasons, such as the limited number of available suppliers, the cost of switching and finding new suppliers, and suppliers' provision of access to unique assets or resources (Bunn 1993; Heide and John 1988; Krause et al. 2007; Schoenherr and Mabert 2011).

Based on these two contingencies, Kraljic (1983) defines four types of purchase categories: strategic (high importance, high risk), leverage (high importance, low risk), bottleneck (low importance, high risk), and non-critical (low importance, low risk). The model then suggests four main strategies: ensuring efficiency for non-critical items, creating assurance of supply for bottleneck items, applying competitive bidding for leverage items, and building strategic partnerships for strategic items.

The contextual variables of purchase importance and risk can also be related to competitive priorities; however, the scarcity of research allows us only to make preliminary predictions. If purchase importance is high, it appears likely that buying firms will emphasize many different competitive priorities in the strategy for that purchasing category. Conversely, the on-time delivery of purchased goods and services may be the sole consideration if the purchase importance is low, particularly from a financial point of view. If supply risk is high,

the buying firm may not even be able to prioritize any competitive priority at all and is simply forced to accept what the supply base is willing to offer. An alternative view is that dependence on a few suppliers, an indication of high supply risk, actually enables the buying firm to pursue quality and innovation objectives, provided that the relationships are managed successfully.

As our motivation to examine these antecedents is not to test a specific hypothesis – which is also prevented by the paucity of research – but to elaborate on our purchasing strategy taxonomy, we only assert that in some quadrants of the Kraljic matrix, certain purchase category strategies might be more likely to be implemented. However, we also argue that within each Kraljic quadrant, more than one purchase category strategy might be implemented effectively.

Strategies or, in other words, plans of strategic intent, also impact the performance (output) of a system (Bozarth and McDermott 1998; Ginsberg and Venkatraman 1985; Hambrick 1980). Of crucial importance to firms is determining whether particular purchase category strategies result in higher performance and whether the performance effects change in relation to contingencies. Therefore, after developing our purchase strategy taxonomy and investigating the conditions under which (i.e., in which portfolio quadrants) each of the strategies is being implemented we also examine the differences in purchase category performance.

2.3. RESEARCH METHOD

2.3.1. Sample and Data Collection

We used data from the International Purchasing Survey (IPS), which is a multi-country survey project on business strategies, purchasing strategies and practices, and their effects on performance (Knoppen et al. 2010). Within IPS, purchasing strategies and practices are analyzed at both the organizational level and the purchase category level. Because our aim in this study was to develop a purchasing strategy taxonomy at the purchase category level, we used data related to this level only.

We took various steps in the IPS project to improve the construct and measurement equivalence of responses between countries (Bensaou et al. 1999; Hult et al. 2008). We

ensured item face validity by following recently advocated approaches such as developing a codebook indicating the constructs, providing balanced statements in the questions (e.g., "how important or unimportant is…" rather than simply asking "how important is…"), and avoiding a neutral middle category for scale options when possible (Saris and Gallhofer 2007). A multi-language survey tool was prepared using the TRAPD (Translation, Review, Adjudication, Pre-testing, and Documentation) procedure, which is gaining popularity and is argued to be more accurate than the often used back-translation approach (Harkness 2003). The survey was pre-tested with target respondents in each country to check the clarity of questions for respondents in different countries. The comparability of samples has been assured by centrally established guidelines on sampling design requiring a minimum company size and the relevant ISIC codes (Lynn et al. 2007). However, countries were allowed some flexibility in their sampling and contacting approaches (i.e., contact by telephone or e-mail) to accommodate differences in the availability of resources and sampling frames (Kish 1994).

The joint data collection effort of the purchasing and supply management researchers from ten countries in Europe and North America occurred in 2009. In total, 681 data points were gathered using an online survey and resulted in an overall response rate of 9.5%, which is comparable to that of most recent studies adopting such complex survey tools (e.g., Carey et al. 2011; Kristal et al. 2010; Wu et al. 2012). Approximately 83% of the respondents were purchasing managers or higher, which indicates that our respondents had sufficient knowledge and were capable of answering our questions about purchasing strategies. Although the total data set includes companies from both the manufacturing and service industries, in this study, we focused only on manufacturing firms to increase homogeneity and to render our classification comparable with earlier operations strategy taxonomies that focused primarily on manufacturing firms. We removed four observations with missing data from the set of manufacturing firms.

The final data set used in the cluster analysis contains 318 observations. Table 2.2 summarizes the descriptions of our sample regarding country and manufacturing sub-sector distribution and number of employees (FTEs). There is a good spread over various firm sizes, and a variety of manufacturing sub-sectors are present, with the majority active in equipment manufacturing.

2.3.2. Measurement

The unit of analysis in this study is the purchase category. We define a purchase category as a homogeneous set of products and services that are purchased from the same supply market and have similar product and spend characteristics (Cousins et al. 2007; Van Weele 2010). The respondents were asked to choose a purchase category about which they were knowledgeable. An examination of the category descriptions provided by the respondents indicated that there was great variety in the purchase categories chosen, ranging from raw materials to office supplies, several types of components, and services.

Table 2.2. Descriptive statistics

Number of employees	**Frequency**	**%**	**Countries**	**Frequency**	**%**
less than 100	34	10.7%	Canada	16	5.0%
100-250	71	22.3%	Finland	25	7.9%
250-500	54	17.0%	France	29	9.1%
500-1000	44	13.8%	Germany	40	12.6%
1000-2500	36	11.3%	Italy	37	11.6%
more than 2500	67	21.1%	Netherlands	37	11.6%
not indicated	12	3.8%	Spain	35	11.0%
Total	*318*		Sweden	23	7.2%
Manufacturing sectors	**Frequency**	**%**	United Kingdom	42	13.2%
Equipment	78	24.5%	United States	34	10.7%
Chemicals and plastics	33	10.4%	*Total*	*318*	
Metals	32	10.1%			
Food and beverages	28	8.8%			
Other manuf. sectors	70	22.0%			
Not specified	77	24.2%			
Total	*318*				

We use operations competitive priorities to operationalize purchase category strategies, an approach also suggested by previous studies (e.g. Krause et al. 2001; González-Benito 2007; Watts et al. 1992). In addition to most commonly used competitive priorities of cost, quality, and delivery, in line with recent studies we also examine the competitive priorities of innovation (Krause et al. 2001) and sustainability (González-Benito 2007; Krause et al. 2009; Pullman et al. 2009; Vázquez Bustelo and Avella Camarero 2010) due to their increasing importance in shaping purchasing and supply management practices. We measure each dimension with the items adopted from Carter and Jennings (2004), González-Benito (2010),

Krause et al. (2001), Pagell and Krause (2002), Maignan et al. (2002), and Zsidisin et al. (2003) (See Appendix for the complete list of questions).

In order to assess how our resulting purchase strategy taxonomy fits to the Kraljic matrix, we examine its two dimensions: purchase importance and supply risk. We define purchase importance as the buyer's assessment of the strategic significance of the purchase in terms of not only costs, but also more strategic effects such as quality and internal processes, and use measures adopted from Stump and Heide (1996). We define supply risk as the buyer's resource dependence on its suppliers due to essentiality and substitutability. We measure it by availability of alternative resources and criticality of the resources using scales developed by Heide and John (1988), Krause et al. (2007), and Caniëls and Gelderman (2007).

Finally, to study the outcomes of purchasing strategies, we examine purchase category performance, where we ask the respondents to rate the purchase category performance in each individual competitive priority as compared to targets set by their purchasing function. It is difficult to find an objective purchasing performance measure that is widely adopted across firms at the purchase category level, and if they exist they mostly focus on financial measures (whereas we also investigate performance in the competitive priorities of innovation, quality, and sustainability, for instance). Therefore, we measure purchase category performance as the perceived purchasing performance in each individual competitive priority as compared to targets set by the purchasing function. In situations like this, where performance compared to competitors is difficult or impossible for informants to assess, assessing performance compared to targets or expectations is a more valid approach (cf. Handley and Benton, 2009).

To examine the unidimensionality and the psychometric properties of all of the constructs, we conducted a confirmatory factor analysis (CFA) by using the maximum likelihood estimation in LISREL 8.8 software. The fit indices suggested a good model fit. The chi-square test statistic ($\chi 2=765.82$) per degree of freedom was 1.41, which is well below the suggested threshold level of 3.00 (Bollen and Long 1993). The RMSEA value was 0.041 (with a 90% confidence interval of 0.034 - 0.048), which is less than the recommended cut-off of 0.05 (Hu and Bentler 1999). The suggested threshold level of 0.90 was achieved with the CFI, IFI, and NNFI values, which were 0.96, 0.96, and 0.94, respectively (Bentler 1990; Bollen 1989). To evaluate convergent validity, we checked the standardized factor loadings, which are indicated in Table 2.3, along with the composite reliabilities and AVE values. Standardized factor

loadings are recommended to be higher than 0.3 or 0.4 (Handley and Benton 2012; O'Leary-Kelly and Vokurka 1998), which was the case for all of the items.

Table 2.3. Confirmatory factor analysis results

Variables			**Std. loadings**	**Composite reliability**	**AVE**
Purchasing competitive priorities	Cost competitive priority			0.68	0.51
		CCOS1	0.67		
		CCOS2	0.76		
	Quality competitive priority			0.76	0.62
		CQUA1	0.82		
		CQUA2	0.75		
	Delivery competitive priority			0.85	0.73
		CDEL1	0.90		
		CDEL2	0.81		
	Innovation competitive priority			0.79	0.65
		CINN1	0.81		
		CINN2	0.80		
	Sustainability competitive priority			0.87	0.77
		CSUS1	0.88		
		CSUS2	0.87		
Kraljic dimensions	Purchase importance			0.67	0.41
		IMPA1	0.65		
		IMPA2	0.65		
		IMPA3	0.61		
	Supply risk			0.49	0.25
		RISK1	0.59		
		RISK2	0.38		
		RISK3	0.51		
Purchasing performance	Cost performance			0.69	0.53
		PCOS1	0.62		
		PCOS2	0.82		
	Quality performance			0.80	0.66
		PQUA1	0.81		
		PQUA2	0.82		
	Delivery performance			0.88	0.78
		PDEL1	0.91		
		PDEL2	0.86		
	Innovation performance			0.65	0.50
		PINN1	0.86		
		PINN2	0.50		
	Sustainability performance			0.84	0.73
		PSUS1	0.91		
		PSUS2	0.79		

All constructs except supply risk had composite reliability values higher than the suggested level of 0.6 (Bagozzi et al. 1991), indicating high construct reliability. Out of 16 constructs, 13 had AVE values higher than 0.5 (Fornell and Larcker 1981), and two constructs had AVE values between 0.4-0.5, which is also considered acceptable in recent studies in OM (e.g., Handley and Benton 2012). The dependence on suppliers construct had a lower AVE value, but considering the other psychometric properties of this construct and the overall model fit, we decided to retain the construct in the analysis. Finally, discriminant validity was achieved, as the square root of the AVE of each construct was higher than their correlations with other constructs. Overall, the measurement model exhibits good reliability and validity.

2.3.3. Checking for Biases: Measurement Equivalence, Common Method Bias, and Non-response Bias

In this sub-section, we elaborate on three important issues that can threaten the reliability and validity of the results: measurement inequivalence across countries, common method bias, and non-response bias.

Measurement equivalence

When data are collected in different countries and cultures, measurement equivalence must be ensured before pooling the data for further analyzes (Malhotra and Sharma 2008). In other words, the measures developed should have the same meaning across countries. The effect of cognitive or socio-cultural differences in response to a survey instrument can heavily distort results (Mullen 1995). Although checking for measurement equivalence has been common practice in cross-country studies in the marketing field (Steenkamp and Baumgartner 1998), such practices are quite rare in the operations management field, despite the growing number of studies using cross-country data.

Multi-group confirmatory factor analysis (MGCFA) is arguably the most powerful approach for measurement equivalence tests (Steenkamp and Baumgartner 1998). However, because this technique requires large sub-sample sizes for each group, in this study, we used generalizability theory (Cronbach et al. 1972). Generalizability theory, which provides estimates of the variance contributed by different sources (i.e., items, country) and estimates of the variance associated with interactions between the various sources, has been suggested

as the next best alternative for measurement equivalence testing when sub-sample sizes are small (Malhotra and Sharma 2008; Sharma and Weathers 2003).

Table 2.4 provides the results of the generalizability theory analyzes. We examine five sources of variance: items, countries, interaction of items and countries, subjects within countries, and error and other sources. Item variance (I) indicates the variance created by the items intended to measure the construct. A lower variance suggests a well-developed scale. Country variance (C) indicates the extent to which the item scores differ across countries. High values suggest measurement inequivalence. The variance of subjects within countries (S) indicates the extent to which responses to the items vary across subjects. Variation resulting from this source is desirable and greater variation increases generalizability. The variance of highest importance is that created by the interaction between countries and items (C x I); lower values are desired because high variation indicates that patterns of responses are not the same across countries. The final source of variation stems from errors and interactions of different sources of variance (E). Our analyses indicate that the highest variation is caused by the variance of subjects within countries, not by country variance; thus, there is no indication of measurement inequivalence. From this result, we derive confidence that the data can be pooled.

Table 2.4. Generalizability theory analysis results

Constructs	Items (I)	Countries (C)	Subjects within countries (S)	C x I	Error, interaction terms (E)
CCOS	0.01	0.00 (0.2%)	0.66 (54.5%)	0.01	0.52 (43.6%)
CQUA	0.02	0.03 (2.2%)	0.80 (58.4%)	0.01	0.51 (37.2%)
CDEL	0.00	0.01 (0.9%)	0.89 (68.1%)	0.01	0.39 (29.8%)
CINN	0.03	0.05 (3.0%)	1.10 (63.4%)	0.00	0.55 (31.7%)
CSUS	0.00	0.05 (2.8%)	1.27 (71.7%)	0.00	0.45 (25.5%)
IMPA	0.01	0.01 (0.8%)	0.45 (36.1%)	0.02	0.76 (61.0%)
RISK	0.09	0.02 (1/1%)	0.40 (22.8%)	0.01	1.22 (70.4%)
PCOS	0.04	0.01 (0.8%)	0.62 (46.8%)	0.00	0.65 (49.0%)
PQUA	0.02	0.04 (3.5%)	0.66 (64.9%)	0.01	0.29 (28.6%)
PDEL	0.00	0.08 (8.1%)	0.65 (65.4%)	0.02	0.24 (24.3%)
PINN	0.02	0.03 (3.7%)	0.33 (39.0%)	0.02	0.45 (52.6%)
PSUS	0.01	0.02 (2.8%)	0.48 (66.9%)	0.02	0.19 (26.2%)

Common method bias

Because we collected our data from single informants using perceptual measures, we checked whether common method bias (CMB) poses a threat to the validity of our results. Although it might not be possible to eliminate all sources of CMB, we attempted to minimize its effect by using several procedural remedies during the design stage (Podsakoff et al. 2003). First, we ensured that the respondents would have full anonymity. Second, we improved the credibility of the answers by targeting purchasing managers and those above the purchasing manager level and by specifically asking respondents to answer for a purchase category about which they are knowledgeable, which also decreases the risk of common method bias (Narayanan et al. 2010). Third, we distributed the questions on separate pages in the IPS online questionnaire, which decreases item priming effects, in which the positioning of certain questions might suggest to the respondent an association with other variables (Podsakoff et al. 2003). Finally, to overcome one of the most important sources of CMB, we varied scale formats and anchors according to what was most appropriate for each question.

In addition to using these procedural remedies, after data collection, we checked for CMB using Harman's (1967) single factor approach by using exploratory factor analysis (EFA). The EFA results indicated a solution with nine factors that accounted for 77.46% of the total variance, and the first factor accounted for only 18.28% of the variance in the data. Because we obtained neither a single-factor solution nor a first factor that captured a great deal of the variance, CMB does not appear to be a threat in our study.

Non-response bias

To assess the threat of non-response bias, we compared early respondents with late respondents under the assumption that late responders are similar to non-responders (Armstrong and Overton 1977). We identified early respondents and late respondents in each country separately because the data collection was completed at different times in each country. The comparison of early respondents and late respondents did not result in any significant differences in terms of firm size (the number of employees, p=0.417), business performance (return on investment, p=0.776; net profit, p=0.342), or respondent experience (years spent managing the purchase category, p=0.465). The industry distribution was also very similar in both samples. Finally, out of the 26 items from the questionnaire used in the analyses only two items displayed significant differences between early (E) and late (L)

respondents (CSUS1 = E: 2.80, L: 3.10; PDEL2 = E: 3.91, L: 4.23). These analyzes suggest that there should not be major concern regarding non-response bias and that we can continue with the cluster analysis and additional analyzes described in the next section.

2.4. DATA ANALYSIS AND RESULTS

To identify the different purchase category strategy groups based on the purchasing competitive priorities emphasized by firms, we used the cluster analysis technique – one of the most frequently used techniques for identifying taxonomies (Hair et al. 2010). Based on the results of the CFA, we used the averages of items for each of the five competitive priorities as taxons in our cluster analysis. First, we checked the correlations between the taxons because the results can be highly distorted by multicollinearity, in which some variables overweigh the others (Hair et al. 2010; Lattin et al. 2003). Table 2.5 indicates that the competitive priorities are indeed correlated, with coefficients of approximately 0.4-0.5. Therefore, instead of the Squared Euclidean distance commonly used for the measurement of similarity in hierarchical clustering, we used the Mahalanobis distance measure, which accounts for correlations among variables and makes it possible to weigh each variable equally (Hair et al. 2010). Although such a measure is desirable in many situations (Hair et al. 2010), the unavailability of the Mahalanobis distance measure in widely used statistical package programs (e.g., SPSS and SAS) appears to have prevented the consideration of this alternative in the operations management field. However, this measure has been used for a long time in other disciplines, such as biology (e.g., Chou an Elrod 1999; Williams and Heglund 2009).

We used the MATLAB program to calculate the similarity between data points based on the Mahalanobis distance and the complete linkage method, which has been found to generate the most compact clustering solutions (Hair et al. 2010). We did not use the Ward method because it tends to produce clusters with approximately equal numbers of observations, providing less of a chance for the smaller portions of the sample to be represented. Many taxonomy studies adopt a two-step procedure of first hierarchical clustering and then k-means clustering (e.g., Cagliano et al. 2005; Frohlich and Dixon 2001; Zhao et al. 2006); however, recent critiques suggest that k-means clustering might cause serious problems in distinguishing between response style and item content (Van Rosmalen et al. 2010). For instance, instead of indicating the true underlying structure in the data, the k-means clustering procedure is likely

to produce clusters of people rating everything high, moderate, or low. To avoid this problem, we used only hierarchical clustering.

To determine the appropriate number of clusters, we examined the dendrogram to identify a wide range of distances over which the number of clusters in the solution does not change (Lattin et al. 2003). We also examined the percentage change in the agglomeration coefficient (Ketchen and Shook 1996). Both measures indicated a five-cluster solution. Managerial interpretability was also the highest in the five-cluster solution, theoretically supporting our statistically driven decision regarding the number of clusters (Boyer and Frohlich 2006).

Table 2.5. Correlations

VAR.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) CCOS	**0.71**											
(2) CQUA	0.28**	**0.79**										
(3) CDEL	0.25**	0.48**	**0.85**									
(4) CINN	0.30**	0.57**	0.53**	**0.81**								
(5) CSUS	0.19**	0.33**	0.16**	0.36**	**0.88**							
(6) IMPA	0.20**	0.25**	0.20**	0.25**	0.09	**0.64**						
(7) RISK	0.09	0.28**	0.22**	0.31**	0.07	0.45**	**0.50**					
(8) PCOS	0.11*	0.08	0.08	0.08	0.13*	0.04	-0.02	**0.73**				
(9) PQUA	0.03	0.05	-0.01	0.01	0.17**	0.02	-0.01	0.36**	**0.81**			
(10) PDEL	0.02	0.07	-0.06	-0.01	0.19**	-0.01	0.03	0.33**	0.57**	**0.88**		
(11) PINN	-0.01	0.06	0.07	0.09	0.15**	0.04	0.10	0.22**	0.41**	0.51**	**0.71**	
(12) PSUS	-0.01	0.04	-0.07	0.03	0.34**	0.02	0.05	0.15**	0.29**	0.26**	0.34**	**0.85**

Note: Bold values on the diagonal are the square root of the Average Variance Extracted (AVE) values.
** $p < 0.01$, * $p < 0.05$ level.

2.4.1. Taxonomy of Purchase Category Strategies

Cluster 1: Emphasize All (N=144): In this cluster, all competitive priorities are emphasized more than the average. Although the three traditional competitive priorities – cost, quality, and delivery – appear to take the lead at comparable levels, innovation and sustainability are also emphasized moderately, with the latter even being emphasized the most

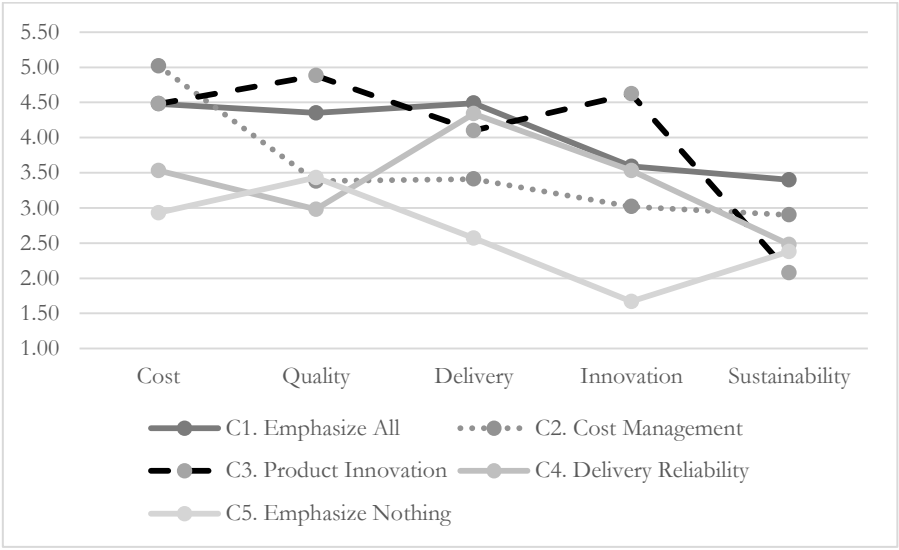
in this cluster in comparison with other clusters. All competitive priorities are deemed strategically important. We label this cluster "Emphasize All" because there does not appear to be a real trade-off and firms emphasize all competitive priorities simultaneously. This cluster is the largest one in our solution and contains various purchase categories such as raw materials, packaging, components, and non-product-related purchases and services.

Cluster 2: Cost Management (N=67): This cluster is marked by a strong focus on cost, as reflected by the significantly higher emphasis on this competitive priority in comparison with all other clusters. Cost is also the most emphasized competitive priority within the cluster, clearly outranking the next most emphasized competitive priorities, quality and delivery, which are emphasized less than average. Innovation competitive priority is characterized by the same lack of importance, which ranks fourth in this cluster. Sustainability is the least emphasized competitive priority, yet it is still comparable to the sample mean. We label this cluster "Cost Management" because the main focus is on obtaining products and services at lower prices and achieving lower total costs. Similarly to the Emphasize All cluster, this cluster contains different types of both direct and indirect purchases.

Table 2.6. Cluster analysis results

Competitive priority	**Mean**	**C1. Emphasize All**	**C2. Cost Management**	**C3. Product Innovation**	**C4. Delivery Reliability**	**C5. Emphasize Nothing**	**F-statistic**
Cost	4.31	4.48	5.02	4.48	3.53	2.93	51.77***
		(2,4,5)	(1,3,4,5)	(2,4,5)	(1,2,3,5)	(1,2,3,4)	
Quality	3.87	4.35	3.38	4.88	2.98	3.43	45.83***
		(2,4,5)	(1,3)	(2,4,5)	(1,3)	(1,3)	
Delivery	4.08	4.49	3.41	4.10	4.34	2.57	34.36***
		(2,5)	(1,3,4,5)	(2,5)	(2,5)	(1,2,3,4)	
Innovation	3.42	3.59	3.02	4.62	3.53	1.67	26.51***
		(2,3,5)	(1,3,5)	(1,2,4)	(3,5)	(1,2,3,4)	
Sustainability	2.95	3.40	2.90	2.08	2.48	2.38	12.81***
		(3,4,5)		(2)	(1)	(1)	
N		144	67	26	60	21	

Figure 2.1. Cluster analysis results



Cluster 3: Product Innovation (N=26): This cluster distinguishes itself from other clusters based on significantly higher emphases on quality and innovation. Within the cluster, cost and delivery competitive priorities are only considered after quality and innovation, and they are emphasized at levels similar to the sample mean. Sustainability is hardly considered. When managing purchase categories in this cluster, purchasing managers strive for high-quality products and services, improvement in the introduction rates of new products and services, and quick introduction of products and services to the market. We label this cluster "Product Innovation", for which product might refer to both a physical good and a service. This cluster is a relatively small one in our solution. Some of the purchase categories in this cluster are plastic components, metals, electronic boards, and robotics. There are no indirect purchase categories in this cluster (e.g., maintenance-repair-operations (MRO), services, etc.).

Cluster 4: Delivery Reliability (N=60): In the management of purchase categories in this cluster, delivery reliability appears to be of utmost importance. Delivery reliability is not only the most emphasized competitive priority within the cluster but is also emphasized significantly more in this cluster than in the Cost Management and Emphasize Nothing clusters. Cost is emphasized much less than average and is on par with the emphasis on innovation. What is most crucial for purchase categories in this cluster is that goods and

services be delivered on time and accurately. Emphasis on quality is quite low; this competitive priority ranks fourth and is followed by sustainability. We label this cluster "Delivery Reliability". The purchase categories observed in this cluster range from raw materials and ingredients to spare parts and packaging.

Cluster 5: Emphasize Nothing (N=21): We label this final cluster "Emphasize Nothing" because all competitive priorities are emphasized less than the overall average and significantly less than in many other clusters. There does not appear to be a strategic orientation for these purchase categories. If there is any strategic orientation, it is the quality competitive priority, which is the most emphasized competitive priority within the cluster, although it is still emphasized less than the overall average. This cluster is the smallest and contains not only direct purchase categories such as commodities but also indirect purchase categories, such as utilities, travel, and cleaning services.

2.4.2. Positioning Purchase Category Strategies in the Kraljic Matrix

We predicted that different purchasing strategies can be implemented for purchase categories in a particular Kraljic quadrant. However, we also predicted that within each quadrant of the Kraljic matrix, some purchase category strategies are more likely to be implemented than others.

First, to identify the quadrant of the Kraljic matrix in which a purchase category is located, we divided the observations into a 2 X 2 matrix by categorizing them as low/high purchase importance or low/high supply risk. We defined the cut-off value for purchase importance and supply risk based on the mid-point of the scales. This method resulted in the following purchase category distribution: 64 in the Non-critical, 16 in the Bottleneck, 110 in the Leverage, and 128 in the Strategic quadrant. Second, we performed cross-tabulation analyzes to determine the frequency of purchase category strategies in each Kraljic quadrant. Table 2.7 illustrates the results of this analysis.

Our findings suggest that indeed, all five purchase category strategies are implemented in each quadrant of the Kraljic matrix; however, there are differences from one quadrant to the next. When we compare the frequency of the purchase category strategies in the entire sample,

Table 2.7. Cluster representation in Kraljic matrix

	C1. Emphasize All	C2. Cost Management	C3. Product Innovation	C4. Delivery Reliability	C5. Emphasize Nothing	Total
Non-critical						
N	23	13	2	16	10	64
%	35.9% (L)	20.3%	3.1% (L)	25% (M)	15.6% (M)	
Bottleneck						
N	10	2	1	1	2	16
%	62.5% (M)	12.5% (L)	6.3% (L)	6.3% (L)	12.5% (M)	
Leverage						
N	54	24	5	19	8	110
%	49.1%	21.8%	4.5% (L)	17.3%	7.3%	
Strategic						
N	57	28	18	24	1	128
%	44.5%	21.9%	14.1% (M)	18.8%	0.8% (L)	
Total						
N	144	67	26	60	21	318
%	**45.3%**	**21.1%**	**8.2%**	**18.9%**	**6.6%**	**100%**

we find that 45.3% of the purchase categories are managed with "Emphasize All", 21.1% are managed with "Cost Management", 8.2.% are managed with "Product Innovation", 18.9% are managed with "Delivery Reliability", and 6.6% are managed with "Emphasize Nothing" strategies. If there were no difference between the Kraljic quadrants in terms of the purchase category strategies implemented, one would expect to observe a more or less similar distribution for each quadrant. Our results suggest that there is no such distribution.

In the Non-critical quadrant, Emphasize All and Product Innovation strategies are implemented less (L) than average, whereas Delivery Reliability and Emphasize Nothing strategies are implemented more (M) than average. In the Bottleneck quadrant, there are only 16 purchase categories, and most are managed using an Emphasize All strategy. Conversely, in this quadrant, Cost Management, Product Innovation, and Delivery Reliability strategies are implemented less than average. In the Leverage quadrant, there does not appear to be substantial deviation from the average strategy distribution, with the exception of the Product Innovation strategy, which is implemented slightly less than average. Finally, in the Strategic quadrant, the Product Innovation strategy is implemented substantially more than average.

Conversely, the Emphasize Nothing strategy is only observed in one out of 128 purchase categories in this quadrant.

2.4.3. Purchase Category Performance

As a final step, we compared purchase category performance across the five purchase category strategies and four quadrants of the Kraljic matrix (Table 2.8). As explained above, we assessed category performance perceptually and investigated the extent to which the targets had been achieved in the five areas of competitive priorities. To measure the overall purchase category performance, we calculated a weighted-average score as indicated below (W_i = emphasis on competitive priority i [i = 1, …, 5], P_i = performance in competitive priority i):

$$P_o = \frac{\sum_{i=1}^{5} Wi \times Pi}{\sum_{i=1}^{5} Wi}$$

Table 2.8. Purchase category performance

	C1. Emphasize All	C2. Cost Management	C3. Product Innovation	C4. Delivery Reliability	C5. Emphasize Nothing
Non-critical	4.36 (4)	4.38 (4)	n/a	3.94 (1,2,5)	4.31 (4)
Bottleneck	3.74	n/a	n/a	n/a	n/a
Leverage	4.32 (3)	4.35	3.88 (1)	4.11	4.07
Strategic	4.30 (2,4)	4.06 (1)	4.14	3.98 (1)	n/a

Note: Averages are based on a seven-point scale (1: much worse than target, 7: much better than target). The numbers in parentheses indicate the clusters from which this cluster is significantly different at the 0.10 level of significance (independent-sample t-tests). Performance means are not reported for cluster/Kraljic groups for which there are fewer than five observations.

As the number of observations in some of the groups is too small, we did not conduct an ANOVA test, but instead relied on independent sample t-tests and a more descriptive way of interpretation. Interestingly, we found very few significant performance differences between

the purchase category strategies in each quadrant. In the Non-critical quadrant, the Delivery Reliability strategy appears to be less effective than the Cost Management, Emphasize All, and Emphasize Nothing strategies. In the Bottleneck quadrant, we are not able to make any purchasing performance comparisons, as there are too few observations. In the Leverage quadrant, implementing Product Innovation strategy results in the lowest purchase category performance. The two most successful strategies in this quadrant are Emphasize All and Cost Management. Finally, in the Strategic quadrant, the most successful strategy is Emphasize All, followed by Product Innovation and Cost Management. The least effective strategy in this quadrant is Delivery Reliability strategy.

2.5. DISCUSSION

We uncovered purchase category strategies ranging from a lack of emphasis on any competitive priority to the emphasis of all competitive priorities. In this section, we elaborate on the purchase category strategies by first focusing on the competitive priorities, then examining extensions to the Kraljic matrix, and, finally, investigating performance implications. We also discuss other primary findings.

The *Emphasize All* cluster illustrates a purchase category strategy in which all purchasing competitive priorities are emphasized at very high levels. Such a strategy is highly consistent with the recent arguments regarding the increasingly strategic role of purchasing (Lawson et al. 2009; Schoenherr et al. 2012). Rather than focusing solely on the traditional cost objective, companies adopt a more holistic approach and strive for excellence in many competitive priorities. The number of observations in this cluster suggests that it is becoming a very popular purchasing strategy. A similar type of strategy has also frequently been noted in operations strategy taxonomies (e.g., Kathuria 2000; Martín-Peña and Díaz-Garrido 2008; Sum et al. 2000; Zhao et al. 2006). Although it is possible to implement this strategy for purchase categories in all quadrants of the Kraljic matrix, our results suggest that it is especially popular in the Bottleneck quadrant. When the purchase importance is low but supply risk is high, firms cannot afford to focus solely on the cost objective. In such cases, it is important to assure supply and survive the "lock-in" situation (Caniëls and Gelderman 2005; Van Weele 2000). Having to respond to a dynamic and complex environment might necessitate the adoption of a more aggressive approach in which all competitive priorities are

pursued (Martín-Peña and Díaz-Garrido 2008). However, implementing an Emphasize All strategy requires extensive resources and programs; therefore, as our results also illustrate, this strategy is not highly preferred for the management of non-critical items.

The *Cost Management* cluster appears to reflect the traditional method of purchasing, in which the main consideration is buying products at a low price and obtaining the lowest possible total cost (Narasimhan and Das 2001). As the main goal of purchasing organizations is to gain substantial cost savings, not surprisingly, this strategy is implemented in various purchase categories located in different Kraljic quadrants, with the exception of Bottleneck. As explained above, instead of a pure cost focus, firms need more nuanced purchasing strategies in Bottleneck situations.

In the *Product Innovation* cluster, there is a clear focus on the competitive priorities of innovation and quality. A much lower emphasis on the cost objective suggests that buying firms are willing to invest more to obtain more innovation from their suppliers. Product Innovation strategies are primarily implemented in the Strategic quadrant. If the firms are dependent on a few suppliers, it makes sense to pursue joint innovation projects with those suppliers, especially if technological uncertainty is also high and the suppliers provide unique access to resources (Petersen et al. 2005). Although to a much lesser extent, we also observe that Product Innovation is implemented in the Leverage quadrant, which would probably require a very different approach. As buying firms are more powerful than their suppliers in a leverage situation (Caniëls and Gelderman 2005), they are more likely to demand that their suppliers provide innovation without a great deal of commitment, whereas for more strategic products, it would be more beneficial to participate in joint innovation projects (Handfield et al. 1999).

In the *Delivery Reliability* strategy, the focus is on obtaining purchased products accurately and quickly, which is considered even more important than the cost objective. This strategy is quite popular in the Non-critical quadrant, in which both purchase importance and supply risk are low. As the financial value of the purchase is low, firms might not have the incentive to devote a great deal of effort into managing such categories, and the primary responsibility of purchasing managers becomes finding the right supplier that can deliver their products accurately and on time (even at higher costs). Conversely, this strategy is also implemented in Leverage and Strategic quadrants, which clearly necessitates the adoption of a different set of

purchasing practices. In our sample, the only purchase category managed using this strategy in the Bottleneck quadrant is spare parts.

Finally, the *Emphasize Nothing* strategy is quite similar to the Emphasize All strategy in that there is not a particular competitive priority that stands out. The major difference between the two strategies is that the absolute level of emphasis is quite low for all competitive priorities in the Emphasize Nothing cluster. Not surprisingly, such an approach is quite popular in the Non-critical quadrant, in which there is no need to develop strategies at all, but a focus on efficient processing is sufficient (Gelderman and Van Weele 2003). In our sample, there is only one purchase category in the Strategic quadrant that is managed with the Emphasize Nothing approach. Clearly, such a lack of focus under high-risk and high-purchase-importance conditions is more likely to result in lower performance; hence, the unpopularity of this strategy in the Strategic quadrant.

The Kraljic matrix has been a very popular tool in identifying different purchase situations. However, it has also been criticized because of its heavy reliance on only two dimensions and the possibility of adopting multiple purchasing strategies in the same purchase situation (Gelderman and Van Weele 2003). Our results also support this notion and suggest that as an additional, complementary layer, differences in competitive priorities must be examined when defining purchase category strategies.

In addition to examining the purchase category and supply market characteristics, we also compared the purchasing performance across clusters. We found hardly any significant differences, despite few preliminary indications of which purchase category strategies are more (less) effective in which situations. Although we did not have a priori assumptions that a particular purchasing strategy would outperform the others, it is common in contingency research to assess the predictive validity of identified strategy clusters by comparing performance differences. However, there has also been considerable debate in the literature regarding whether performance differences can be predicted with configurations (Ketchen et al. 1997; Fiss 2007). In addition, many of the operations strategy taxonomies do not indicate significant differences in operations and financial performance (e.g., Kathuria 2000; Martín-Peña and Díaz-Garrido 2008; Zhao et al. 2006). It is generally accepted that performance is affected by a multitude of external factors (González-Benito 2010). Additionally, because strategies are guidelines for organizations with regard to what they want to achieve, strategies

based on the competitive priorities of today predict future performance more successfully than past performance (Boyer and Pagell 2000). These notions can partially explain the small number of significant performance differences identified in this study. The Delivery Reliability strategy scores significantly lower in the Non-critical and Strategic quadrants, whereas the Emphasize All strategy scores significantly higher in the Strategic quadrant. However, the lack of significant differences also indicates that a number of purchasing strategies might be equally effective under similar conditions indicated in current purchasing portfolio models.

Krause et al. (2001) have suggested that the competitive priorities used in operations can also be used to identify purchasing strategies. The purchase category strategies we have identified strongly resemble those discovered in operations strategy taxonomy studies. Out of the six key operations strategies we identified in the Literature Review section, five also appear in our purchasing strategy taxonomy. These findings provide empirical evidence for the argument that the competitive priorities are also highly valid in the context of purchasing. In general, we indirectly illustrate that generic operations strategies are also identifiable at the purchase category level. The only strategy that was not identified in our purchasing strategy taxonomy was the Lean Management strategy. One explanation for this result might be the transformation of this strategy from a focus on only cost, quality, and delivery to an emphasis on innovation and sustainability as well in an Emphasize All strategy. Cagliano et al. (2005) and Frohlich and Dixon (2001) argue that operations strategies change over time and that, therefore, more replication studies are needed to assess such change. Because our purchasing strategy taxonomy based on competitive priorities is a first attempt in the literature, more studies are needed to support this conclusion.

This study includes an additional taxon, sustainability, which has only recently been suggested as a new competitive priority both in operations management (Pullman et al. 2009; Vázquez Bustelo and Avella Camarero 2010) and in purchasing (Krause et al. 2009; Pagell et al. 2010). Interestingly, we did not identify a separate sustainability strategy, and only in the Emphasize All strategy was sustainability emphasized at moderately higher levels. Recent studies suggest that sustainability and innovation are complementary objectives (Nidumolu et al., 2009), but our results illustrate that sustainability was emphasized the least in Product Innovation strategy. Although there is merit in the view that innovation and sustainability are related, one can also argue that not all innovations are related to sustainability and not all

sustainable practices in purchasing are innovative. It might be the case that in our data we did not have examples for this relatively niche innovation-sustainability purchasing strategy. Additionally, what was common in almost all purchasing strategies was the relatively low emphasis on the sustainability competitive priority. These results might support the notion that although the importance of sustainability issues has been increasing over the past decade, it is still primarily viewed as a marketing issue or as compliance with laws (Angell 2000) instead of a major competitive priority in purchasing.

2.6. CONCLUSIONS

Although there is on-going discussion regarding the extent to which operations competitive priorities are also valid in the context of purchasing, very little evidence for this proposition has been presented in the literature. In this exploratory study, we empirically validated that competitive priorities can be used to define purchase category strategies and found remarkable similarities between our purchasing strategy taxonomy and extant operations strategy taxonomies. By adopting a configurational approach that encompasses both the trade-off (Hayes and Wheelwright 1984; Skinner 1985) and combinative capabilities arguments (Kristal et al. 2010; Rosenzweig and Easton 2010), we found that firms pursue multiple competitive priorities simultaneously in some purchase category strategies but focus on one or a few key competitive priorities in others. Additionally, we emphasize that one of the recently suggested competitive priorities, sustainability, is not yet the top priority for purchasing professionals.

We have taken the first step in classifying purchasing strategies at the purchase category level and illustrated how the strategies differ in terms of purchase importance and supply risk. Our results should be considered not as an alternative to the Kraljic matrix but, rather, as a complement to this widely used portfolio model. We illustrated that many purchase category strategies can be implemented equally effectively in the same Kraljic quadrant but that some purchase category strategies are more likely to be implemented in certain quadrants. Future research should examine in detail the possible reasons for this choice and whether different purchasing practices and processes are required to deploy different purchase category strategies adopted in the same quadrant.

A further extension of this research should examine causal linkages. Longitudinal design approaches can better serve this purpose and enable researchers to discover more definitively the effects of competitive priorities on performance (Boyer and Pagell 2000). Future studies can also extend this research by investigating the purchasing practices adopted across different strategies in the same Kraljic quadrant, and across the different Kraljic quadrants where the same purchasing strategy is implemented. Another area of improvement would involve the development of objective performance measures, although this is quite challenging because firms do not yet use such measures at the category level. Additionally, there is a strong possibility that these measures might not capture all aspects of rather intangible performance dimensions such as quality, innovation, and sustainability (David et al. 2002) and that they would create complexities in comparisons across industries, firms, and even purchase categories. However, the drawbacks of not having objective performance measures can be partly overcome by including multiple respondents (Boyer et al. 2005). It is our belief that more research is needed in this area for a better understanding of how different purchase categories are very distinct from each other and how they are actually – and effectively – managed in practice.

APPENDIX: QUESTIONNAIRE ITEMS

Purchasing competitive priorities: Please indicate to what extent management has emphasized the following priorities for the chosen category over the past 2 years *(1=not at all, 6: completely):*
CCOS1. Reducing product/service unit prices
CCOS2. Reducing total cost of ownership of purchased inputs
CQUA1. Improving conformance quality of purchased inputs
CQUA2. Improving specifications and functionality of purchased inputs
CDEL1. Improving supplier lead-time
CDEL2. Improving supplier accuracy in delivery dates and quantities
CINN1. Improving time-to-market with suppliers
CINN2. Improving introduction rates of new/improved products and services
CSUS1. Reducing ecological impact for this category
CSUS2. Improving compliance with social and ethical guidelines for this category

Purchase category characteristics: Please rate the following indicators related to your chosen category *(1=extremely low, 6=extremely high):*
IMPA1. Category's impact on perceived quality of end products/services in the eyes of your customers
IMPA2. Category's impact on the cost of your products/services
IMPA3. Category's impact on the quality of your internal processes
RISK1. Level of concentration of the supply market for this category
RISK2. The cost of your organization to switch suppliers for this category
RISK3. The extent to which suppliers of this category provide access to unique assets or resources

Purchasing performance: Please consider current category performance – compared to management targets – for the following objectives *(1=much worse than target, 7=much better than target):*
PCOS1. The purchasing price
PCOS2. The cost of managing the procurement process
PQUA1. The level of supplier conformance to specifications
PQUA2. The level of supplier/product service quality
PDEL1. The level of product/service delivery speed from suppliers
PDEL2. The level of product/service delivery reliability from suppliers
PINN1. The supplier time-to-market for new/improved products/services
PINN2. The level of innovation in products/services from suppliers
PSUS1. The level of environmental compliance from suppliers
PSUS2. The level of social compliance from suppliers

Chapter 3

THE IMPACT OF PURCHASING STRATEGY-STRUCTURE (MIS)FIT ON PURCHASING COST AND INNOVATION PERFORMANCE

3.1. INTRODUCTION

The importance of the purchasing function in generating cost savings and increasing efficiencies in firms is self-evident (Ellram, 1995; Trent & Monczka, 1998; Zsidisin, Ellram, & Ogden, 2003), but its strategic role, for instance in relation to contributing to innovations, has become more prominent only in the past decade (Krause, Pagell, & Curkovic, 2001; Narasimhan & Das, 2001; Wynstra, Weggeman, & Van Weele, 2003; Baier, Hartmann, & Moser, 2008). Numerous studies highlight that this strategic role depends on the extent that purchasing strategies are aligned with business strategies and other functional strategies (Narasimhan & Das, 2001; González-Benito, 2007; Baier et al., 2008). When there is a greater fit between business strategies and purchasing strategies, firms achieve superior performance (González-Benito, 2007; Baier et al., 2008). Although this argument definitely has its merits, such an alignment is not possible if another type of fit is not achieved first within the purchasing function itself: the fit between purchasing strategy and purchasing structure (David, Hwang, Pei, & Reneau, 2002; Trautmann, Turkulainen, Hartmann, & Bals, 2009).

One major stream of research in organization studies started with the notion of "structure follows strategy" (Chandler, 1962). Following the tenets of contingency theory, there have

been many studies which examine the fit between strategy and structure, and its effect on firm performance (Porter, 1985; Miller, 1987; Galunic & Eisenhardt, 1994). The common finding in those studies is that the organizational design characteristics of a firm should enable its strategy in order to achieve sustainable superior performance (Burns & Stalker, 1961; Tushman & Nadler, 1978, Govindarajan, 1986). Although organization literature has greatly benefited from this line of argument, it has been hardly examined in the context of purchasing organizational design (David et al., 2002; Trautmann et al., 2009).

The objective of this study is to examine the impact of the (mis)fit between purchasing strategy and purchasing structure on purchasing performance. In doing so, we aim to contribute to the literature in three ways.

First of all, we investigate purchasing structure in a holistic way by considering its multiple dimensions. Research on organizational design in purchasing has been highly dominated by the centralization-decentralization debate (Trautmann et al., 2009). However, organizational design literature identifies additional dimensions, in particular formalization and cross-functionality (Burns & Stalker, 1961; Damanpour, 1991). In this study, we therefore examine three elements of purchasing structure: centralization, formalization, and cross-functionality.

Second, we examine purchasing strategy and purchasing structure at the level of the purchased item (purchase category). Studies examining purchasing organization design mostly focus on the overall purchasing function level (e.g. David et al., 2002; Johnson, Klassen, Leenders, & Fearon, 2002; Rozemeijer, van Weele, & Weggeman, 2003; Foerstl, Hartmann, Wynstra, & Moser, 2013). However, recent research suggests that purchasing structure is defined at a more micro level where firms have different purchasing structures for their various purchase categories managed with different purchasing strategies (Trautmann et al., 2009; Karjalainen, 2011).

Third, we do not only test whether a (mis)fit between strategy and structure results in (lower) higher purchasing performance, but we also aim to shed light on the mechanism for this effect. Specifically, we investigate the mediating role of purchasing proficiency on the relationship between strategy-structure misfit and purchasing performance. Purchasing proficiency can be defined as the quality in managing the purchasing processes due to the advancement of skills and knowledge (Millson & Wilemon, 2002; Feisel, Hartmann, & Giunipero, 2011). The extended sequential contingency model (Rodrigues, Stank, & Lynch,

2004; Zheng, Yang, & McLean, 2010) suggests that a (mis)fit between purchasing strategy and structure (negatively) positively impacts purchasing proficiency, thereby resulting in a (lower) higher purchasing performance.

The rest of the paper is structured as follows. In the Literature Review section we first briefly discuss two types of purchasing strategies: cost leadership and product innovation. Then, we elaborate on the theories regarding how strategy impacts structure in general, and subsequently discuss how purchasing strategy relates to each purchasing structure dimension. We finish the literature review by discussing the mediating role of purchasing proficiency. In the Research Design section, we explain our data collection and sample characteristics, measurement, and various checks for biases. After that, we present our findings in the Results section, while the Discussion section elaborates on the most intriguing findings. Finally, the Conclusion section reviews the theoretical and managerial implications, research limitations, and suggestions for future research.

3.2. LITERATURE REVIEW

Fit has been one of the most commonly adopted perspectives in operations management literature to examine various phenomena (Bozart & McDermott, 1998; Sousa & Voss, 2008). For instance, Skinner (1969) examined the fit between production systems and the priorities of organizations, Miller and Roth (1994) and Ward and Duray (2000) focused on the fit between manufacturing strategies and environmental factors, and Fisher (1997) and Qi, Boyer, and Zhao (2009) analyzed the fit between product characteristics and supply chain strategy. More specifically, the fit between strategy and structure has also attracted some attention in operations management. For instance, Stank and Traichal (1998) investigated the fit between logistics strategy and organizational design, and more recently Wagner, Grosse-Ruyken, and Erhun (2012) examined supply chain fit; the fit between supply/demand uncertainty and supply chain design.

Equivalents of these studies in purchasing are very few in number (one exception is David et al., 2002); however, the practical relevance of the topic warrants further investigation. As a response to this need, in this study we examine the impact of the purchasing strategy and purchasing structure fit on purchasing performance. Before investigating how purchasing

strategy and purchasing structure are related, in the next section we first define two main purchasing strategies: cost leadership and product innovation.

3.2.1. Purchasing Strategies

Cost management and cost reduction are traditionally argued to be the most prevalent priorities in purchasing (Carter & Narasimhan 1996; Zsidisin et al., 2003). This is not surprising considering that the purchased goods and services, components, and systems constitute the majority of the total cost of goods sold in firms in various industries (Dubois & Pedersen, 2002; Van Weele, 2010). Emphasizing this more traditional role of purchasing, the strategic relevance of cost management practices in purchasing has been rising in the past decade due to the growing amounts of outsourcing and global sourcing (Zsidisin et al., 2003; Trautmann et al., 2009). Therefore, a *Cost Leadership* strategy, where the focus is on decreasing the unit prices of purchased items, reducing total cost of ownership, improving efficiency, and increasing asset utilization (Narasimhan & Das, 2001; David et al., 2002; Zsidisin et al., 2003), is considered as a key purchasing strategy.

With the increased understanding of the strategic role that purchasing functions can play in contributing to competitive advantage (Carr & Pearson, 2002; Cousins, Lawson, & Squire, 2006), firms started to integrate more value-adding activities on their purchasing agenda such as supplier involvement in innovations (Narasimhan & Das, 2001; Carr & Pearson, 2002; Wynstra et al., 2003). Instead of relying on only internal research and development (R&D) capabilities, many firms approach their suppliers to get more innovative components and production/process technologies (Walter, Müller, Helfert, & Ritter, 2003), and actively involve them in joint new product development (NPD) projects (Bonaccorsi & Lipparini, 1994; Handfield, Ragatz, Petersen, & Monczka, 1999; Jean, Kim, & Sinkovics, 2012). As the purchasing function has the firsthand knowledge about suppliers and is responsible for successfully managing collaborative relationships with them, the necessity of translating these objectives into purchasing strategies is obvious. In line with this, firms pursue a *Product Innovation* strategy in their purchasing function where they aim to improve the introduction rates and timing of new products and services as well as achieve improvements in quality, specifications and functionality (Primo & Amundson, 2002; Baier et al., 2008).

Although we acknowledge that there can be other purchasing strategies than cost leadership and product innovation, usually these strategies are considered as the two most important ones (David et al., 2002; Baier et al., 2008; Terpend, Krause, & Dooley, 2011), and are associated with different levels of governance needs that require different types of organization structures (David et al., 2002).

We posit that while firms might have purchasing strategies at the overall function level, they also have purchasing strategies at a more micro level; at the purchase category level (Trautmann et al., 2009; Terpend et al., 2011; Luzzini, Caniato, Ronchi, & Spina, 2012). Firms have many different types of purchases ranging from office supplies to critical raw materials, and the competitive priorities and strategies change across purchase categories (Cousins, Lamming, Lawson, & Squire, 2008; Van Weele, 2010; Luzzini et al., 2012). For instance, while firms can focus on cost leadership strategy for purchasing office supplies or raw materials with low supply risk, they can pursue product innovation strategies for components with key functionalities for the final customers. We argue that the purchase category is a more meaningful level of analysis to examine the link between purchasing strategy and purchasing structure. Recent studies by Trautmann et al. (2009) and Karjalainen (2011) also support our claim that purchasing structure changes at the purchase category level.

3.2.2. The Fit between Strategy and Structure

The strategy process consists of two parts which need to be examined in relation to each other: strategy formulation and strategy implementation (Ginsberg & Venkatraman, 1985). After firms formulate their strategies and decide on which objectives to emphasize, they focus on the elements that impact the successful implementation of these strategies (Olson, Slater, & Hult, 2005). Among these implementation dimensions, one of the most germane is organization structure.

Various studies in the organization literature highlight the importance of having an organizational design that enables the chosen strategy and thereby results in superior performance outcomes (Chandler, 1962; Tushman & Nadler, 1978; Porter, 1985; Miller, 1987; Galunic & Eisenhardt, 1984). This view conveys that it is neither the strategy nor the structure that has a direct impact on performance, but instead the internal alignment between the two (Wasserman, 2008). The fit between strategy and structure creates internal efficiencies whereas

its absence hinders successful strategy implementation. The main underlying reason behind the detrimental performance effect of a misfit between strategy and structure is the mismatch between the information processing needs induced by a strategy and the information processing capabilities provided by a structure (Galbraith, 1973; Tushman & Nadler, 1978; David et al., 2002).

Organization structure can be considered as consisting of many different dimensions, but the three most discussed dimensions both in organization and innovation literatures are centralization, formalization, and cross-functionality (Aiken & Hage, 1971; Miller, Dröge, & Toulouse, 1988; Damanpour, 1991).

Centralization is defined as the degree to which decision making authority and power are concentrated at the top as opposed to delegating these to lower level management (Olson et al., 2005). A centralized structure is often argued to be associated with economies of scale, efficiency, and low coordination costs, and therefore is found to be more suitable for cost leadership strategies. On the other hand, centralization can narrow communication channels and decrease the incentives for the organization members in seeking innovative ideas (Damanpour, 1991), whereas decentralization provides an environment with more flexibility and speed required to manage higher coordination requirements (David et al., 2002). Therefore, in executing product innovation strategies, where there is more ambiguity and the need for more information processing capability to manage coordination, decentralized structures are argued to bring superior performance (Burns & Stalker, 1961; Damanpour, 1991).

Formalization is defined as the degree to which an organization emphasizes following rules and procedures (Zaltman, Duncan, & Holbeck, 1973). Formalization and routines allow standardizing routine activities efficiently (Tate & Ellram, 2012); however, increased reliance on rules and procedures hampers experimentation and a unit's variation-seeking behavior (Jansen, van den Bosch, & Volberda, 2006). On the contrary, low emphasis on formalization facilitates innovation through encouraging new ideas and actions (Burns & Stalker, 1961; Damanpour, 1991). Consequently, high levels of formalization are found to be more effective for cost leadership strategies and low formalization for product innovation strategies.

Cross-functionality is defined as the gathering of people from different functions of an organization for effective delivery of a common organizational objective (Holland, Gaston, &

Gomes, 2000). A product innovation strategy can be argued to function better when there is rapid cross-functional communication among the organization members which will help in creating distinct products and services (Burns & Stalker, 1961; Damanpour, 1991). On the other hand, the higher information processing capacity provided by cross-functional structures can result in higher coordination costs and thus have a negative effect for cost leadership strategies.

Burns and Stalker (1961) view these three dimensions in combination, and distinguish between two types of organization structures: mechanistic versus organic organizations. Organic structures are characterized by low levels of centralization and formalization and high levels of cross-functionality, and are argued to be more suitable for product innovation strategies. Mechanistic structures are the opposite of organic structures, and are found to be more effective to implement cost leadership strategies.

3.2.3. The Link between Purchasing Strategy and Purchasing Structure

Organizational design issues in purchasing have generated some attention; however, past research mostly adopted a fragmented approach where the effects of structure variables on purchasing performance have been examined individually (Trautmann et al., 2009). For instance, Rozemeijer et al. (2003) investigate the factors that impact the choice of centralized versus decentralized purchasing organizations, and Moses and Åhlström (2008) examine problems in cross-functional sourcing decision processes. Foerstl et al. (2013) compare the effects of centralization ("functional coordination") and cross-functional integration on purchasing performance at the firm level. Yet, there is still a need for a more holistic approach where multiple dimensions of the purchasing structure are analyzed (Schiele, 2010), and in relation to purchasing strategies - thereby enabling to assess the implications of the fit between strategy and structure.

As has been discussed in the previous section, organization and innovation literatures provide rather clear directions as to which type of organization structure is more suitable for cost leadership and product innovation strategies. Some initial evidence from the few studies examining purchasing structure also seems to support those arguments. Baier et al. (2008) and David et al. (2002) find that a centralized purchasing structure is better for cost leadership strategies, and Karjalainen (2011) states that with a centralized purchasing structure firms are

better off in obtaining lower prices. David et al. (2002) argue that in order to successfully implement differentiation strategies with innovation objective, having a purchasing structure that relies less on rigid rules and procedures is required, whereas to implement a cost leadership strategy a formalized purchasing structure emphasizing keeping costs at a minimum and budget controls is much more beneficial. Van Echtelt, Wynstra, van Weele, and Duysters (2008) propose that cross-functional integration between purchasing and R&D is an important enabling factor in new product development activities.

Combining the above arguments with the broader propositions from the organization and innovation literatures, we arrive at the following hypotheses to be tested in this study:

> ***H1:*** *When managing a purchase category with a cost leadership strategy, the higher the deviation from the ideal purchasing structure (high centralization, high formalization, low cross-functionality), the lower the purchasing cost performance.*
>
> ***H2:*** *When managing a purchase category with a product innovation strategy, the higher the deviation from the ideal purchasing structure (low centralization, low formalization, high cross-functionality), the lower the purchasing innovation performance.*

Different than the earlier studies examining the link between purchasing strategy and purchasing structure, we contribute to the literature by investigating these hypotheses at the purchase category level. It is suggested that increasingly firms adopt a hybrid purchasing organization structure, and the level of centralization for instance varies at the purchase category level (Trautmann et al.; Karjalainen, 2011).

This unit of analysis bears substantial similarities to the organizational buying behavior (OBB) literature of the 1970's (Spekman & Stern, 1979; Johnston & Bonoma, 1981; McCabe, 1987). In these studies, "buying center" structure dimensions were mostly examined in relation to some contextual characteristics such as importance and novelty of the purchase. However, this OBB literature did not examine the role of purchasing strategy in relation to purchasing structure, and only focused on the operational and tactical purchasing processes. We extend this stream of research by specifically investing the fit between purchasing strategy and purchasing structure, where we examine not only the operational and tactical, but also the strategic purchasing processes.

In the next section, we elaborate on the background for our final hypothesis: the mediating role of purchasing proficiency on the relationship between strategy-structure fit and purchasing performance.

3.2.4. Purchasing Proficiency as the Mediator

Next to organizational structure, another important strategy implementation dimension is argued to be operational processes (Galbraith & Nathanson, 1978; Miles, Snow, & Meyer, 1978). The extended contingency view proposes that the link between strategy and structure is followed by the processes, which in the end impact performance (Rodrigues et al., 2004; Zheng et al., 2010). Therefore, the processes, or the quality of executing the processes, are considered as a mediator between the strategy-structure fit and performance. In other words, processes constitute the mechanism through which the detrimental impact of misfit is actually exerted on performance.

In line with this, we propose that a misfit between purchasing strategy and purchasing structure decreases purchasing proficiency, which we define as the quality of executing various purchasing processes. On the other hand, higher levels of fit facilitates effectively implementing purchasing processes and the quality of managing the processes increases due to the advancement of skills and knowledge enabled by a purchasing structure that matches the purchasing strategy. Higher levels of purchasing proficiency, in turn, positively impact both cost and innovation performance. In conclusion, we propose the following hypotheses:

> ***H3:*** *Purchasing proficiency mediates the relationship between the deviation from the ideal purchasing structure and purchasing cost performance when pursuing a cost leadership strategy.*
>
> ***H4:*** *Purchasing proficiency mediates the relationship between the deviation from the ideal purchasing structure and purchasing innovation performance when pursuing a product innovation strategy.*

Earlier, purchasing processes were mostly considered as consisting of tactical and operational processes such as specification definition, supplier selection, and issuing of purchase orders (Laios & Xideas, 1994; Kotteaku, Laios, & Moschuris, 1995). However; there are many strategic purchasing processes in organizations today such as supplier development and supplier involvement in new product development (Handfield et al., 1999; Monczka,

2007; van Weele, 2010). While conceptualizing purchasing structure, we therefore examine not only the tactical and operational, but also the strategic purchasing processes.

3.3. RESEARCH DESIGN

3.3.1. Data Collection and Sample

We use data from an international survey project about business strategies, purchasing strategies and practices, and their effects on performance (Luzzini et al., 2012; Karjalainen & Salmi, 2013). Within this survey, there are two units of analysis. In the first part of the survey, informants answer questions about their purchasing strategies and practices at the overall organizational level, whereas in the second, and largest, part they focus on a certain purchase category. In line with our research goals, we focus on the latter unit of analysis in the current study.

We took various steps in this survey project to improve construct and measurement equivalence of responses between countries (Bensaou, Coyne, & Venkatraman, 1999; Hult, Ketchen, Griffith, Finnegan, Gonzalez-Padron, Harmancioglu, Huang, Talay, & Cavusgil, 2008). For instance, in order to improve face validity we relied on recently advocated approaches for survey development such as using balanced statements in the questions and avoiding a neutral middle category in scale options where possible (Saris & Gallhofer, 2007). After the survey was developed, we assured translation equivalence by using the TRAPD (Translation, Review, Adjudication, Pre-testing, and Documentation) procedure (Harkness, 2003), and pre-tested the survey with target respondents in each country. We relied on centrally established guidelines on sampling design requiring a minimum size of companies and certain ISIC codes (Lynn, Häder, Gabler, & Laaksonen, 2007). In addition to these pre-data collection measures to assure equivalence, we also tested for measurement equivalence post-data collection, which is discussed in detail in the following sections.

The data collection took place in ten countries in Europe and North America in 2009. In total data from 681 companies were gathered by means of an online survey with an overall response rate of 9.5%, which is comparable to most recent studies adopting such online and/or complex survey tools (e.g. Kristal, Huang, & Roth, 2010; Carey, Lawson, & Krause, 2011; Wu, Melnyk, & Swink, 2012).

The centralization construct used in this study concerns only the companies which have a corporate structure, and divisions or business units with multi-level purchasing functions. Therefore, the respondents were given the freedom to not answer this question if it was not relevant for them. After deleting these cases and some others with a substantial amount of missing data, we had 469 observations in our final sample. Table 3.1 illustrates the sample characteristics. All of our respondents were from the purchasing function and approximately 81% of them were purchasing managers or above with an average of 13.8 years of experience. This clearly indicates that our respondents had sufficient knowledge and were capable of answering the questions about purchasing strategies, purchasing structure, and purchasing performance. The majority of our sample consists of manufacturing firms, but service firms are represented as well. There is also a good spread over various firm sizes.

Table 3.1. Sample characteristics

Countries	**Frequency**	**%**
Canada	23	4.9%
Finland	30	6.4%
France	52	11.1%
Germany	43	9.2%
Italy	42	9.0%
Netherlands	39	8.3%
Spain	36	7.7%
Sweden	97	20.7%
United Kingdom	66	14.1%
United States	41	8.7%
Total	*469*	

Industries	**Frequency**	**%**
Manufacturing	286	61.0%
Service	178	38.0%
Not indicated	5	1.1%
Total	*469*	

Number of employees	**Frequency**	**%**
<100	67	14.3%
100-249	88	18.8%
250-999	118	25.2%
1000-5000	97	20.7%
> 5000	83	17.7%
Not indicated	16	3.4%
Total	*469*	

Respondent titles	**Frequency**	**%**
Chief Procurement Officer	65	13.9%
Purchasing director	94	20.0%
Purchasing manager	220	46.9%
Senior buyer, project buyer	36	7.7%
Buyer, purchasing agent	26	5.5%
Other	27	5.8%
Not indicated	1	0.2%
Total	*469*	

3.3.2. Measurement

The unit of analysis in this study is the purchase category. We define a purchase category as a homogenous set of products and services that are purchased from the same supply market

and have similar product and spend characteristics (Cousins et al., 2008; Van Weele, 2010; Luzzini et al., 2012). All of our constructs are measured at the purchase category level.

We list all the questions and measures used in this study in Appendix A. We measured cost leadership and product innovation strategies with four items each that are adopted from González-Benito (2007), Krause et al. (2001), and Pagell and Krause (2002). We asked the respondents to indicate the extent to which management has emphasized the cost and innovation objectives for the chosen purchase category on a 6-point Likert scale, ranging from "not at all" to "completely".

Considering the difficulty of obtaining objective performance data, especially at the purchase category level, we asked the respondents to rate their purchase category performance as compared to their targets on a 7-point Likert scale, ranging from "much worse than target" to "much better than target". Building on the conceptualization of our purchasing strategy constructs, we operationalized purchasing performance as the performance achieved in the cost and innovation objectives, which were measured with two and four items, respectively.

In order to operationalize purchasing structure dimensions (centralization, formalization, and cross-functionality) and purchasing proficiency at the purchase category level, we developed new scales. While the OBB literature suggests some measures for the purchasing structure constructs, that literature has a transactional view of purchasing which does not reflect purchasing's current strategic role. Nowadays firms have strategic, as well as operational and tactical purchasing processes (Monczka, 2005). Based on Monczka (2005), we defined three strategic (i.e. supplier development, supplier involvement into new product development, supplier integration in order fulfillment), three tactical (i.e. supply market analysis, spend analysis, sourcing strategy), and three operational (i.e. management of the order cycle, supplier selection and contracting, supplier evaluation) processes. We measured centralization, formalization, cross-functionality, and purchasing proficiency in each of these processes by adopting the definitions from Johnston and Bonoma (1981), Dawes, Lee, and Dawling (1998), Lau, Goh, and Phua (1999), Millson and Wilemon (2002).

We operationalized purchasing structure variables and purchasing proficiency as formative constructs. Reflective measurement requires that the indicators used to measure a construct are highly correlated and are caused by the latent construct they describe (Diamantopoulos & Winklhofer, 2001; Jarvis, MacKenzie, & Podsakoff, 2003). However, formative measurement

suggests that the indicators can be very different from each other and not necessarily correlate, yet in combination they form the latent construct (Diamantopoulos & Winklhofer, 2001; Diamantopoulos & Siguaw, 2006). We posit that there might be differences across purchasing processes regarding the purchasing structure, therefore the levels of centralization, formalization, and cross-functionality do not have to be the same or highly similar in each purchasing process. For instance, Stanley (1993) argues in his conceptual study that some purchasing activities should remain at a decentralized level, particularly those involved with day-to-day materials. The total level of centralization in a purchasing category, therefore, is composed of different levels of centralization/ decentralization in different purchasing processes. The same holds true for the other purchasing structure variables and purchasing proficiency.

In line with previous studies examining (firm) performance, we included country and industry as control variables (Huang, Kristal, & Schroeder, 2008; Wagner et al., 2012). In order to create the country control variable we used responses from Italy as the baseline, and included nine dummy variables for the remaining countries. We grouped industry as manufacturing and service firms; therefore, we had only one dummy variable for the industry control variable where manufacturing firms were used as the baseline. Finally, we also included purchase category experience as the third control variable, as the literature suggests that purchasing maturity and experience is highly related to purchasing performance (Schiele, 2007). We measured purchase category experience with a single item, adopted from McQuiston (1989).

3.3.3. Measurement Equivalence

The effect of cognitive or socio-cultural differences in response to a survey tool can heavily distort the results (Mullen, 1995). Therefore, we first checked for measurement equivalence across countries before pooling the data (Malhotra & Sharma, 2008). Multi-group confirmatory factor analysis (MGCFA) is arguably the most powerful approach for measurement equivalence tests (Steenkamp & Baumgartner, 1998); however, it requires large sample sizes per group. Instead of MGCFA, we used generalizability theory which has been suggested as the next best alternative for measurement equivalence testing when sub-sample sizes are smaller (Sharma & Weathers, 2003; Malhotra & Sharma, 2008).

Generalizability theory provides estimates of five types of variance: (i) item (low values indicate a well-developed scale, and very low values indicate item redundancy); (ii) groups, or in this study, countries (high values indicate differences in item scores across countries, thereby suggesting measurement inequivalence); (iii) subjects within countries (high values indicate that responses to the items vary across subjects, which is desirable and increases generalizability); (iv) group and item interaction (low values indicate that patterns of responses are the same across countries, which increases generalizability), and (v) error and other interactions (low variation enhances generalizability). The final source of variation stems from errors and interactions of different sources of variance (E).

We used the SPSS syntax provided by Mushquash and O'Connor (2006) to calculate the above mentioned variances and the generalizability coefficients (GE) for our reflective constructs. The results reported in Table 3.2 suggest that country, and country and item interaction constitute a very small portion of the variance, and the GC are at acceptable levels (Pagell, Wiengarten, & Fynes, 2013). Thus, there is no indication of measurement inequivalence, and from this we conclude that the data can be pooled.

Table 3.2. Measurement equivalence

	# of items	**Items**	**Countries**	**Subjects within countries**	**Country and item interaction**	**Error, interaction terms**	**GC**
Cost strategy	4	14.47%	0.12%	34.08%	1.92%	49.41%	0.73
Innovation strategy	4	4.65%	2.18%	48.82%	0.23%	44.12%	0.82
Cost performance	2	1.89%	0.38%	44.54%	1.33%	51.87%	0.63
Innovation performance	4	5.84%	1.82%	39.35%	0.02%	52.97%	0.76

3.3.4. Construct Validation

We assessed the validity of the formative constructs – *centralization, formalization, cross-functionality, and purchasing proficiency* – by ensuring that the measurement items conceptually capture a substantial part of the domain (Diamantopoulos & Winklhofer, 2001; Rossiter, 2002), and by examining the multi-collinearity among the measurement items (Diamantopoulos & Winklhofer, 2001; MacKenzie, Podsakoff, & Podsakoff, 2011). It should

be noted that conventional indicators of reliability, such as Cronbach's α and composite reliability, are not valid in the case of formative measures (Diamantopoulos & Siguaw, 2006).

In order to not miss any relevant purchasing process where the purchasing structure might be different, we developed scales based on an exhaustive set of purchasing processes including not only the traditional tactical and operational processes, but also more strategic purchasing processes. We measured multi-collinearity among measurement items by calculating the variance inflation factors (VIF). The VIF values for our formative constructs were between: 1.94–4.11 (formalization), 1.50–2.32 (cross-functionality), 1.45–2.72 (purchasing proficiency), and 4.99–8.26 (centralization), satisfying the most commonly accepted ceiling value of 10 (Diamantopoulos & Winklhofer, 2001; MacKenzie et al., 2011). As it is highly important in a formative measure to ensure that all dimensions are sufficiently covered (Diamantopoulos & Winklhofer 2001; MacKenzie et al., 2011), we did not delete any items from the centralization construct solely on the basis of relatively higher VIF values.

Table 3.3. Confirmatory factor analysis

Constructs	Item	Loading	t Value	AVE	Composite Reliability	Cronbach α
Cost	COSTS1	0.622	11.009	0.58	0.84	0.73
strategy	COSTS2	0.737	13.795			
	COSTS3	0.882	14.049			
	COSTS4	0.776	13.256			
Innovation	INNOS1	0.884	17.593	0.82	0.95	0.82
strategy	INNOS2	0.915	17.231			
	INNOS3	0.957	16.112			
	INNOS4	0.862	15.548			
Cost	COSTP1	0.772	12.095	0.57	0.73	[a]0.46***
performance	COSTP2	0.744	13.161			
Innovation	INNOP1	0.803	19.727	0.42	0.73	0.76
performance	INNOP2	0.823	19.906			
	INNOP3	0.466	11.345			
	INNOP4	0.383	8.749			

[a] Intra-class correlation.
*** Significant at $p<0.001$ level

We assessed the reliability of the reflective constructs – *cost leadership strategy, product innovation strategy, purchasing cost performance, and purchasing innovation performance* – by calculating Cronbach's α values and conducting a CFA using the R software (version 2.5.2). The CFA results reported in Table 3.3 indicate an acceptable model fit ($\chi 2=248.27$, $\chi 2/df=3.42$, goodness-of-fit index=0.891, RMSEA=0.097, SRMR=0.059) (Bollen, 1989; MacCallum, Browne, & Sugawara, 1996; Hair, Black, Babin, & Anderson, 2010). The reliability of each construct was satisfactory with a composite reliability value of at least 0.70 (Fornell & Larcker, 1981; O'Leary-Kelly & Vokurka, 1998). In order to evaluate convergent validity, we checked the standardized factor loadings and AVE values. All standardized factor loadings were significant at $p < 0.01$, and loadings for all but two items (INNOS3 and INNOS4) were above the suggested threshold value of 0.6 (Bagozzi, Yi, & Philips, 1991), thus indicating high construct reliability. Considering the conceptual definition of the respective construct and the sufficiently high Cronbach's α value (0.76), we decided to retain those two items. All constructs had AVE values higher than 0.5 (Fornell & Larcker, 1981), except innovation performance which had an AVE of 0.42 that is still considered to be within acceptable limits (Handley & Benton, 2012). Finally, we assessed discriminant validity by examining inter-construct correlations (Table 3.4). Discriminant validity was achieved since the square root of the AVE of the constructs was higher than their correlations with other constructs (Fornell & Larcker, 1981). Overall, the measurement model exhibits sufficient reliability and validity.

3.3.5. Common Method Bias

We collected our data from single informants using perceptual measures, therefore the threat of common method bias (CMB) needs to be evaluated. First of all, at the survey design stage we took several measures to minimize the effect of CMB (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). First, we assured full anonymity for the respondents. Second, we improved the credibility of the answers by targeting purchasing managers and above, and by specifically asking respondents to answer for a purchase category they are knowledgeable about (Narayanan, Jayaraman, Luo, & Swaminathan, 2010). Third, we distributed the questions over separate pages in the IPS online questionnaire, which decreases the item priming effects where the positioning of certain questions might suggest the respondent an association with other variables (Podsakoff et al., 2003). Finally, we varied scale formats and anchors according to what was most appropriate for each question (Klein, Rau, & Straub, 2007).

Table 3.4. Correlations

	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Cost strategy	3.79	0.89	1								
(2) Innovation strategy	3.52	1.02	.483**	1							
(3) Centralization	2.32	1.14	0.08	0.01	1						
(4) Formalization	3.72	1.03	.264**	.299**	.119**	1					
(5) Cross-functionality	2.47	0.66	0.09	.233**	0.06	.219**	1				
(6) Purchasing proficiency	4.30	0.67	.218**	.247**	.163**	.485**	.133**	1			
(7) Cost performance	4.59	0.98	0.09	0.02	0.06	.135**	0.01	.272**	1		
(8) Innovation performance	4.13	0.73	.098*	0.07	.145**	.212**	0.01	.294**	.461**	1	
(9) Category experience	4.64	0.85	.142**	0.07	.097*	.181**	-0.02	.303**	.149**	.159**	1
(10) Industry	0.39	0.49	-.094*	-0.06	.184**	0.02	.105*	0.05	0.01	0.08	-0.04
(11) Country Netherlands	0.08	0.28	-0.02	-0.04	.124**	-0.03	0.07	0.00	0.01	-0.01	0.02
(12) Country UK	0.14	0.35	-0.08	-0.06	-.120**	0.04	-.104*	0.05	-0.02	-0.01	0.00
(13) Country Germany	0.09	0.29	0.06	-0.02	.202**	0.09	0.04	.095*	0.00	0.09	.127**
(14) Country Spain	0.08	0.27	0.08	.128**	0.08	.186**	0.00	0.09	0.02	0.05	0.04
(15) Country Sweden	0.21	0.41	-0.07	-.129**	-.231**	-.130**	-0.09	-.128**	0.04	-.139**	-.098*
(16) Country Finland	0.06	0.24	0.09	-0.02	0.05	0.04	0.07	-0.06	-0.04	-0.08	0.08
(17) Country France	0.11	0.31	-0.02	0.05	-0.01	-.164**	-0.01	-0.08	0.03	.161**	-0.02
(18) Country United States	0.09	0.28	-0.03	-0.01	-0.04	-0.06	-0.01	-0.03	-0.04	0.02	-.206**
(19) Country Canada	0.05	0.22	0.06	0.08	-0.02	0.07	.142**	0.00	-.112*	-0.06	0.03

In addition to taking these remedies at the design stage, post-data collection we checked CMB with the single factor approach of Harman (1967) by using exploratory factor analysis (EFA). The EFA results indicated a solution with nine factors that accounted for 68.02% of the total variance, and the first factor accounted only for 22.75% of the variance in the data. Since we obtained neither a single-factor solution nor a first factor that captured much of the variance, CMB does not seem to be a threat in our study.

Table 3.4. Correlations (continued)

	Mean	SD	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) Cost strategy	3.79	0.89									
(2) Innovation strategy	3.52	1.02									
(3) Centralization	2.32	1.14									
(4) Formalization	3.72	1.03									
(5) Cross-functionality	2.47	0.66									
(6) Purchasing proficiency	4.30	0.67									
(7) Cost performance	4.59	0.98									
(8) Innovation performance	4.13	0.73									
(9) Category experience	4.64	0.85									
(10) Industry	0.39	0.49	1								
(11) Country Netherlands	0.08	0.28	-0.04	1							
(12) Country UK	0.14	0.35	.104*	-.122**	1						
(13) Country Germany	0.09	0.29	0.03	-.096*	-.129**	1					
(14) Country Spain	0.08	0.27	-0.02	-0.09	-.117*	-.092*	1				
(15) Country Sweden	0.21	0.41	-.214**	-.154**	-.207**	-.162**	-.147**	1			
(16) Country Finland	0.06	0.24	-0.05	-0.08	-.106*	-0.08	-0.08	-.133**	1		
(17) Country France	0.11	0.31	0.07	-.106*	-.143**	-.112*	-.102*	-.180**	-.092*	1	
(18) Country United States	0.09	0.28	.263**	-.093*	-.125**	-.098*	-0.09	-.158**	-0.08	-.109*	1
(19) Country Canada	0.05	0.22	-0.04	-0.07	-.092*	-0.07	-0.07	-.116*	-0.06	-0.08	-0.07

3.3.6. Non-response Bias

In order to assess whether there is any threat of non-response bias, we compared early respondents with late respondents under the assumption that late responders are similar to non-responders (Armstrong & Overton, 1977; Wagner & Kemmerling, 2010). Our online questionnaire tool allows us to know exactly when the respondents completed the questionnaire. Based on this information, we identified early and late respondents by dividing the sample into two. We compared early and late respondents both on our items of interest in this study, and also on some company characteristics. Out of the 51 items from the

questionnaire used in our analyses, only five items showed significant differences between early respondents (E) and late respondents (L) (INNOS1 = E: 3.92, L: 3.71; INNOS2 = E: 3.76, L: 3.52; CENTR6 = E: 2.13, L: 1.87; CENTR7 = E: 2.28, L: 1.98; COSTP1 = E: 4.86, L: 4.54). The two groups did not differ significantly in terms of firm size (the number of employees, p=0.582) and the industry distribution was also very similar in both samples (E= manufacturing: 58.6%, services: 39.7%; L= manufacturing 63.4%, services: 36.2%). These results suggest that there is not a major concern for non-response bias, and that we can continue with the OLS regression analyzes.

3.4. RESULTS

Before testing our hypotheses, we first identified which purchase categories are managed with cost leadership and product innovation strategies by calculating the relative emphasis. A similar approach has also been used in previous studies (Craighead, Hult, & Ketchen, 2009). If the respondents gave higher scores for cost objectives (Items: COSTS1-4) than innovation objectives (Items: INNOS1-4), these purchase categories were classified as being managed for cost leadership strategies, and vice versa. We discarded 61 purchase categories where there was equal emphasis on both objectives as the theory does not suggest an ideal structure for such combined strategies. This resulted in a final sample of 253 purchase categories managed with a cost leadership strategy and 155 purchase categories managed with a product innovation strategy.

In order to measure the strategy-structure misfit, we used the profile deviation analysis (Drazin & Van de Ven, 1985; Venkatraman, 1989; Hult, Boyer, & Ketchen, 2007). Fit can be examined in several ways (i.e. moderation, mediation, gestalts) (Venkatraman, 1989), yet the profile deviation analysis suits our research question the best. In the profile-deviation perspective, fit is defined as the degree of adherence to an externally specified profile (Venkatraman, 1989). When fit among multiple variables is considered simultaneously and the impact on performance is assessed, it is suggested to conceptualize fit as profile deviation (Venkatraman, 1989; Vorhies and Morgan, 2003). Another approach that can be used in case of fit between multiple variables is the gestalt perspective; however it is more suitable for exploratory research when there is not much theory about the relationship between the variables and their impact on a specific criterion (Venkatraman, 1989). Previous research

examining similar phenomena has also extensively relied on this technique (e.g. Xu, Cavusgil, White, 2006; Hult et al., 2007; Baier et al., 2008). Fit as profile deviation has been found to be especially useful when the link between strategy and structure is examined (cf. Vorhies and Morgan (2003) who investigate the impact of fit between marketing organizational structure – centralization, formalization, specialization – , and business strategy – prospector, defender, analyzer – on marketing effectiveness and efficiency).

To address Hypothesis 1, based on existing theory we identified ideal purchasing structure profiles that could be used as the benchmark against which the fit of all members of a strategy type could be examined (e.g., Doty et al., 1993, Ketchen et al., 1993, Vorhies and Morgan, 2003). Following the premise of profile deviation technique, we predicted that a deviation from an ideal purchasing structure consisting of multiple dimensions (centralization, formalization, and cross-functionality) results in a lower purchasing performance. As has been discussed in the previous sections, when implementing cost leadership strategies, high levels of centralization and formalization, and low levels of cross-functionality are required, and vice versa for product innovation strategies. We hypothesized that the ideal scores for the purchasing structure dimensions should be the relevant extreme points of the scales (i.e. for cost strategy the ideal scores are: centralization= 4, formalization=6, cross-functionality=1, and for innovation strategy the ideal scores are: centralization=1, formalization=1, cross-functionality=4, see questionnaire in Appendix A for scale formats). In order to remove the effects of different scale formats and potential multi-collinearity, we standardized the data first (Hult et al., 2007; Baier et al., 2008). We calculated the purchasing strategy-structure misfit in cost and innovation strategies separately based on the following formula:

$$Misfit = \sqrt{\sum_{j}^{N} (X_{sj} - X_{ij})^2},$$

where X_{sj} is the standardized score for a purchase category on the *j*th purchasing structure dimension, X_{ij} is the ideal score for the *j*th purchasing structure dimension for that purchasing strategy, and *j*, the number of purchasing structure dimensions (1=centralization, 2=formalization, 3= cross-functionality). For our hypotheses to be supported, the results should indicate that deviation from the ideal purchasing structure profile (from this point on referred to as "cost / innovation misfit" for reasons of simplicity) is negatively related to the

purchasing cost (innovation) performance when implementing purchasing cost leadership (product innovation) strategy (Drazin & Van de Ven, 1985; Venkatraman, 1989).

In order to test our hypotheses, we performed a series of OLS regression analyzes for both the cost and innovation models. Table 3.5 and Table 3.6 illustrate the results of these analyzes as well as the significant R^2 changes and the significance of the overall models. First, cost performance and innovation performance were regressed on the control variables, and then cost misfit and innovation misfit were entered into their respective models. The results show that cost misfit has a negative impact on cost performance (β= -0.184, p<0.01) and likewise, innovation misfit has a negative impact on innovation performance (β= -0.214, p<0.01), thereby supporting Hypotheses 1 and 2.

Table 3.5. Regression results – Cost model

	Dependent variables					
	Cost perf.	Cost perf.	Purchasing proficiency	Purchasing proficiency	Cost perf.	Cost perf.
Independent variables						
Cost misfit		-0.184**		-0.309***		-0.103
Purchasing proficiency					0.293**	0.265***
Control variables						
P. category experience	0.168*	0.139*	0.264***	0.215**	0.090	0.082
Industry (man vs. service)	0.062	0.045	0.011	-0.2	0.059	0.050
Country Netherlands	0.077	0.091	-0.031	-0.007	0.086	0.093
Country United Kingdom	0.028	0.059	-0.002	0.05	0.028	0.045
Country Germany	0.093	0.072	-0.001	-0.031	0.092	0.080
Country Spain	0.087	0.083	0.035	0.027	0.077	0.075
Country Sweden	0.165	0.211†	-0.129	-0.052	0.203†	0.225*
Country Finland	0.021	0.025	-0.076	-0.069	0.043	0.043
Country France	0.102	0.136	-0.071	-0.012	0.122	0.140
Country United States	0.019	0.059	-0.062	0.007	0.037	0.058
Country Canada	-0.129†	-0.101	-0.005	0.042	-0.127†	-0.112
R^2	0.078	0.105	0.099	0.178	0.155	0.163
Adj R^2	0.035	0.060	0.058	0.136	0.112	0.117
R^2 change	0.078†	0.028**	0.099**	0.078***	0.077**	0.058***
F	1.820†	2.321**	2.397**	4.288***	3.623**	3.531***

Significance levels: *** p<0.001, ** p< 0.01, * p<0.05, † p<0.1

In order to test the mediation hypotheses H3 and H4, we first conducted Baron and Kenny's (1986) test. According to this approach four conditions have to be met: (i) the independent variable must be significantly associated with the mediator; (ii) the mediator must be significantly associated with the dependent variable; (iii) the independent variable must be significantly associated with the dependent variable when the mediator is not in the model, and (iv) when the independent variable and the mediator are entered into the model simultaneously, the association between the independent variable and the dependent variable must be either reduced (partial mediation) or become non-significant (full mediation).

Table 3.6. Regression results – Innovation model

	Dependent variables					
	Innov. perf.	Innov. perf.	Purchasing proficiency	Purchasing proficiency	Innov. perf.	Innov. perf.
Independent variables						
Innovation misfit		-0.214**		-0.154*		-0.176*
Purchasing proficiency					0.284**	0.251**
Control variables						
P. category experience	0.241**	0.237**	0.416***	0.414***	0.123	0.134
Industry (man vs. service)	0.012	0.010	-0.015	-0.017	0.017	0.014
Country Netherlands	0.002	0.017	-0.138	-0.127	0.041	0.049
Country United Kingdom	-0.017	-0.019	0.033	0.032	-0.026	-0.027
Country Germany	0.108	0.084	0.056	0.039	0.092	0.074
Country Spain	-0.023	-0.056	0.012	-0.011	-0.027	-0.054
Country Sweden	0.073	0.089	-0.111	-0.100	0.105	0.114
Country Finland	-0.120	-0.118	-0.102	-0.101	-0.091	-0.093
Country France	0.198†	0.188†	-0.131	-0.139	0.236*	0.223*
Country United States	0.043	0.050	0.042	0.045	0.034	0.040
Country Canada	-0.002	0.008	-0.047	-0.040	0.012	0.018
R^2	0.122	0.165	0.247	0.269	0.183	0.211
Adj R^2	0.053	0.093	0.188	0.207	0.113	0.137
R^2 change	0.122†	0.043**	0.247***	0.022*	0.061**	0.089**
F	1.780†	2.304**	4.229***	4.323***	2.610**	2.859**

Significance levels: *** p<0.001, ** p< 0.01, * p<0.05, † p<0.1

For the cost model, cost misfit was negatively related to purchasing proficiency (β= -0.309, p<0.001), purchasing proficiency (mediator) was positively related to cost performance (β= 0.293, p<0.001), cost misfit was associated negatively with cost performance (β= -0.184, p<0.01), and the impact of cost misfit on cost performance became non-significant (β= -

0.103, *non-significant*) when entered into the regression model simultaneously with purchasing proficiency, which remained significant (β= 0.265, p<0.001). These results satisfy the conditions for full mediation of cost misfit by purchasing proficiency on its effect on purchasing cost performance. Hence Hypothesis 3 is supported.

For the innovation model, innovation misfit was negatively related to purchasing proficiency (β= -0.154, p<0.05), purchasing proficiency was positively related to innovation performance (β= 0.284, p<0.01), innovation misfit was associated negatively with innovation performance (β= -0.214, p<0.01), and the impact of innovation misfit on innovation performance was reduced (β= -0.176, p<0.05) when entered into the regression model simultaneously with purchasing proficiency, which remained significant (β= 0.251, p<0.01). These results indicate the partial mediation between innovation misfit, purchasing proficiency, and purchasing innovation performance. Hence Hypothesis 4 is supported.

Although the Baron and Kenny (1986) procedure is widely adopted, recent guidelines propose that the only condition that needs to be met to establish a mediating effect is the significance of the indirect effect of an independent variable on the dependent variable through the mediator (Zhao, Lynch, & Chen, 2010). Sobel (1982) test is one option to test this; however, it assumes that the indirect effect is normally distributed which is unlikely to hold in many cases (Zhao et al., 2010). Compared to the Sobel test, the bootstrapping approach proposed by Preacher and Hayes (2004, 2008) and Hayes (2009) is much more powerful. In bootstrapping, a random sample is drawn from the data set multiple times. In each random sample drawn, direct and indirect effects and their standard errors are estimated.

Thus, on the basis of 5,000 random samples, we estimated the direct and indirect effects of cost misfit on cost performance, and innovation misfit on innovation performance. We found that a 95% bootstrapping confidence interval for the indirect effect on cost performance lies between -0.161 and -0.033, and between -0.121 and -0.008 for the indirect effect on innovation performance. Because zero is not in the 95% confidence intervals in either model, the results confirm that the indirect effects we report above are indeed significantly different from zero (p<0.05, two-tailed tests) and that the mediation relationships hold.

3.5. DISCUSSION

In line with hypotheses 1 and 2, we empirically validated that if firms do not choose an appropriate purchasing structure matching their purchase category strategy, they experience less favorable outcomes. Our results show that while implementing a cost leadership purchasing strategy, firms are better off when they adopt a purchasing structure characterized by high centralization, high formalization, and low cross-functionality. A deviation from this ideal structure results in lower cost performance. Conversely, while implementing a product innovation purchasing strategy, firms are better off when they adopt a purchasing structure characterized by low centralization, low formalization, and high cross-functionality. Our results show that the higher the purchasing structure deviates from this ideal profile, the lower the innovation performance will be. These findings provide strong support for the notion that organizational design characteristics should enable the chosen strategy (Chandler, 1962; Tushman & Nadler, 1978; Porter, 1985; Wasserman, 2008); not only at the overall purchasing organization level as discussed in previous studies (David et al., 2002), but also at the purchase category level.

A unique contribution of our study stems from illustrating the mechanism of *how* a (mis)fit between purchasing strategy and purchasing structure actually impacts purchasing performance. Studies investigating the fit between strategy and structure usually test only a direct link between fit and performance, and at best conceptually discuss the underlying mechanisms. In this study, we posit that purchasing proficiency mediates the relationship between the purchasing strategy-structure misfit and purchasing performance. In other words, a misfit does not directly impact performance, but the incongruence between strategy and structure manifests itself in the form of inefficiencies and lower quality in internal processes, which in the end results in lower performance. Our results strongly support this line of argument, and also suggest an avenue for further investigation. We find that purchasing proficiency is a full mediator between cost misfit and cost performance, and a partial mediator between innovation misfit and innovation performance.

Statistically, the partial mediation found in the innovation model indicates either the existence of both a direct and indirect effect, or the omission of other mediators from the model (Zhao et al., 2010). Recent studies suggest that unless there are very strong theoretical reasons to support a true direct effect, it is more likely that there are other, non-observed

intervening variables, and researchers are urged to pay more attention to discussing these other variables (Zhao et al., 2010).

We also believe that the strategy-structure misfit does not have a direct impact on performance, but that it impacts actions and processes which subsequently have an effect on purchasing performance. It is rather straightforward to hypothesize that an *internal* misfit, the misfit between strategy and structure, has an impact on *internal* processes. But can this internal misfit also have consequences beyond the boundaries of the firm? It seems plausible to argue that incongruence between a product innovation purchasing strategy and purchasing structure not only impacts the actions of the *focal firm*, but also the actions of the *supplier firm(s)*. Suppliers may have a substantial impact on purchasing innovation performance (Petersen, Handfield, & Ragatz, 2005; Van Echtelt et al., 2008). In case of a misfit in product innovation strategies, we propose that adopting a mechanistic structure hampers suppliers' innovative capabilities, and their willingness and commitment to participate in joint new product development projects, which negatively impacts innovation performance.

For instance, Ragatz, Handfield, and Scannell (1997) found that cross-functional communication is the most extensively used technique in successful supplier integration into NPD. If there is a lack of cross-functional integration, different departments of a firm, such as purchasing and R&D, might convey different messages to the supplier, which hinders the collaboration and commitment of the suppliers (Van Echtelt et al., 2008). High levels of purchasing function centralization might make it difficult for suppliers to access the focal firms with their innovative ideas and projects. On the other hand, if there is a decentralized purchasing structure where local buyers hold the decision making authority to some extent, suppliers may more easily approach new product development teams with their new product development ideas. Similarly, high levels of formalization, where there are many rules and regulations, might deter suppliers. One way the focal firm can formalize its joint new product development processes is to have detailed procedures and prescribe these also to suppliers. Such prescribed procedures function as process or behavioral controls, and there is some evidence to suggest that suppliers find such types of control exercised in joint product development intrusive (Carson, 2007; Wynstra, Anderson, Narus, & Wouters, 2012).

In a nutshell, the above arguments suggest that innovation misfit may not only hamper the quality of purchasing processes, but also hamper suppliers' commitment and willingness to contribute to new product development projects, thereby decreasing innovation performance.

It is interesting to note that we do not find a similar result about cost misfit. Apparently, the negative impact of cost misfit on cost performance is fully mediated by purchasing proficiency, in other words, the quality of the focal firm's purchasing processes. However, these results do not necessarily mean that cost misfit does not have any impact on supplier behavior. It could be the case that even though supplier behavior is affected, this does not translate into a lower cost performance for the focal firm.

We should caution that as we have not measured supplier behavior in this study, we can only put forward informed speculations about these relationships at this stage. Certainly, these results warrant further research on the impact of purchasing strategy-purchasing structure misfit on supplier behavior.

3.6. CONCLUSION

The aim of this study was to contribute to both theory and practice regarding purchasing organizational design issues by testing the extended contingency framework (strategy-structure- process- performance) at the purchase category level. More specifically, we predicted that a (mis)fit between purchasing strategy and purchasing structure has a (negative) positive impact on purchasing performance, and that this impact is actually mediated through purchasing proficiency. Our findings illustrate strong support for our hypotheses.

3.6.1. Contributions to Theory

This research makes several noteworthy contributions to the existing literature. First of all, extending the much emphasized centralization-decentralization debate in the purchasing organization design context, we examine multiple dimensions of purchasing structure. Second, while the majority of previous work on purchasing design is conducted at the overall purchasing function level, we investigate purchasing structure at the purchase category level. Third, in order to examine the link between purchasing strategy and purchasing structure, we specifically adopt the "fit" perspective, which has been used to a high extent in organization

studies, but remarkably less so in the purchasing context. Finally, by investigating the mediating role of purchasing proficiency we also shed light on the mechanism of how a (mist)fit actually impacts performance.

We conducted cross-disciplinary research by combining organization studies, innovation, and purchasing literatures. Recently, there has been increasing debate about the necessity of conducting cross-disciplinary research in the operations management field as such settings do not only foster the scholarly development of operations management field, but also more clearly represent the multi-faceted decision-making challenges organizations face in real life (Linderman & Chandrasekaran, 2010; Singhal & Singhal, 2012).

3.6.2. Implications for Practice

Our findings provide useful guidelines for managerial decision-making in the area of purchase category management. Purchase category management is a very common practice among firms, and its importance and adoption are expected to increase even more in the near future (Trent, 2004; Monczka & Peterson, 2008). The significant impact of the congruence between purchasing strategy and purchasing structure on purchasing performance in implementing both cost leadership and product innovation category strategies highlights the necessity of giving priority to organizational design issues. Although firms might have an overall purchasing structure, decision makers should not underestimate the importance of adapting the purchasing structure to the different purchase category strategies.

The additional insights gained by the mediation analysis help managers understand the impact organizational design problems can have on the execution of internal processes. A misfit between purchasing strategy and purchasing structure negatively impacts the quality of internal processes in implementing both cost leadership and product innovation strategies, which in turn decrease purchasing performance. However, we urge purchase category managers to be even more cautious about innovation misfit as our results suggest that the detrimental effects of it do not only impact internal processes, but possibly extend beyond the boundaries of the firm and impact supplier behavior as well.

To sum up, when faced with unsatisfactory performance outcomes, purchasing managers should not have a one-sided view and only consider how the purchasing processes might be creating this negative outcome. As our findings illustrate, what might be causing lower

purchasing proficiency in the first place can relate to organizational design problems rather than implementation of the wrong purchasing processes.

3.6.3. Limitations and Suggestions for Future Research

Evidently, the implications discussed in this research should be interpreted in light of several limitations inherent in this study. First of all, the cross-sectional nature of the data prevents us from making strong assumptions about causality. Future studies could employ longitudinal settings, which also help uncover the dynamic relationship between strategy and structure. Second, as a result of having a very large survey project we had to rely on single informants. Although our analyses indicate that there is not an obvious threat of common method bias, future studies would benefit from incorporating multiple informants and data sources to triangulate data. One option could be to approach multiple respondents from the purchasing function, but a better option could be to also approach for instance R&D managers, in relation to evaluating innovation performance. Third, we relied on perceptual measures to evaluate purchase category performance. It is often argued in the literature that using objective data is a better choice when assessing performance, especially when relying on single-informants (Ketokivi & Schroeder, 2004). However, our unit of analysis at the purchase category level prevents us to define purchasing performance measures that are consistent and available across firms and across purchase categories, especially in relation to innovation performance.

Notwithstanding these limitations, we hope that this study with its attention to multiple dimensions of organizational structure in purchasing and its choice of purchase categories as the unit of analysis will help inspire further research on the impact of strategy-structure (mis)fit on performance and the underlying mechanisms.

APPENDIX: QUESTIONNAIRE ITEMS

1. Purchase category strategies:
Please indicate to what extent management has emphasized the following priorities for the chosen category over the past 2 years (1=not at all, 6= completely):

Items:
COSTS1. Reducing product/service unit prices
COSTS2. Reducing total cost of ownership of purchased inputs
COSTS3. Reducing (internal) purchasing process cost (e.g. e-procurement)
COSTS4. Reducing asset utilization for this category (e.g. headcount, inventory)
INNOS1. Improving time-to-market with suppliers
INNOS2. Improving introduction rates of new/improved products and services
INNOS3. Improving conformance quality of purchased inputs
INNOS4. Improving specifications and functionality of purchased inputs

2. Purchasing function structure and purchasing proficiency:

2.1. Purchasing processes
Please first indicate which processes below the purchasing department is involved in for the chosen purchase category (1= Purchasing is involved, 2= Purchasing is not involved, 3= Not executed for this category):

1. Supply market analysis *(The process of analyzing the supply market for the chosen category - e.g. searching for new suppliers, supply market structure, technological developments)*
2. Spend analysis *(The process of analyzing the purchasing spend of the chosen category)*
3. Sourcing strategy *(The process of formulating a sourcing strategy for the chosen category*
4. Supplier selection and contracting *(The process of sending out request for quotations, tendering/negotiating, and selecting suppliers for the chosen category)*
5. Supplier development *(The process of assisting suppliers in quality and cost improvement programs for the chosen category)*
6. Management of the order cycle *(The process of processing purchase orders for the chosen category, checking order status, and expediting later orders and rush orders)*
7. Supplier involvement into new product development *(The process of managing the involvement of suppliers in the development of new products/services/processes/technologies for the chosen category)*
8. Supplier integration in order fulfillment *(The process of integrating suppliers for the chosen category in operations - e.g. joint production or inventory planning) and/or in the order fulfillment process)*
9. Supplier evaluation *(The process of measuring supplier performance for the chosen category and the overall relation, and evaluating this performance against performance targets or benchmarks)*

2.2. Centralization
Please indicate the level of centralization (i.e. the organizational level that is in charge of the process) for the chosen category for the purchasing processes stated above (1= Executed locally without corporate involvement, 2= Corporate provides

voluntary templates for local execution, 3= Corporate provides mandatory templates for local execution, and 4= Executed at the corporate centre):
Items: *(CENTR1-CENTR9)*

2.3. Formalization
Please indicate the level of formalization (i.e. how much the process is guided by written rules and procedures) for the chose category for the purchasing processes stated above (1= Extremely low, 6= Extremely high):
Items: *(FORML1-FORML9)*

2.4. Cross-functionality *(reverse-coded)*
Please indicate for the chosen category whether the decision making in the purchasing processes stated above was done in a cross-functional way (i.e. more than one function is involved) or by one function only (1= Always cross-functional, 2= Mostly cross-functional, 3= Mostly performed by one-function, and 4= Always performed by one function):
Items: *(CROSS1-CROSS9)*

2.5. Purchasing proficiency
Please indicate the level of proficiency of the purchasing process stated above (i.e. the level of quality in executing each process) for the chosen category (1= Extremely low, 6= Extremely high):
Items: *(PROFC1-PROFC9)*

3. Purchase category performance:
Please consider current category performance – compared to management targets – for the following objectives (1= Much worse than target, 7= Much better than target):

Items:
COSTP1. The purchasing price
COSTP2. The cost of managing the procurement process
INNOP1. The supplier time-to-market for new or improved products/services
INNOP2. The level of innovation in products/services from suppliers
INNOP3. The level of supplier conformance to specifications
INNOP4. The level of supplier product/service quality

4. Purchase category experience:
Item: EXPER: Please indicate the level of experience of your purchasing function with this supply market (1= Extremely low, 6= Extremely high)

Chapter 4

MEASUREMENT EQUIVALENCE IN THE OPERATIONS AND SUPPLY MANAGEMENT LITERATURE: A COMPREHENSIVE FRAMEWORK AND REVIEW

4.1. INTRODUCTION

Over the past two decades, Operations and Supply Management (OSM) has seen rapid growth in the use of survey research (Malhotra and Sharma, 2008; Shah and Goldstein, 2006). Within this development we observe two related trends. First, survey research is increasingly developed through collaboration amongst research institutions, where researchers jointly develop the research model, survey instrument and data collection procedures, while each institution is responsible for a part of the data collection, possibly adapting data collection to local circumstances. It is common practice to subsequently pool the sub-sets of data to create a larger data set for statistical manipulations and analyzes. Examples of such collaborative survey studies in OSM are the International Manufacturing Strategy Survey (IMSS), the High Performance Manufacturing (HPM) project, the International Purchasing Survey (IPS) and the Global Manufacturing Research Group (GMRG).

Second, studies increasingly aim to compare means and causal relationships across groups from apparently different settings, defined for instance by different cultures, languages, respondent demographics, firm size, sector, or moments in time (Nye and Drasgow, 2011). For instance, do companies in the US have lower levels of trust in their suppliers than

companies in Japan (Bensaou, Coyne and Venkatraman, 1999)? Is the impact of a firm's global operating strategy on its global supply chain structure less for small firms than for larger firms (Prater and Ghosh, 2006)? Does the correlation between JIT purchasing and inventory turnover shift over time (Haynak and Hartley, 2006)?

In such multi-group survey studies, operationalization and measurement issues are at least as critical as in survey studies based upon a more homogeneous sample. Given that many concepts used in OSM are unobservable, their measurement quality highly depends on the researcher´s capability to adequately translate each theoretical concept into survey indicators. Poor construct representations will result in poor correlation estimates and consequently in a lack of construct and predictive validity (Harkness, Van de Vijver and Mohler, 2003). Multiple groups induce heterogeneity and increase the likelihood of poor construct representations across the groups (Alwin, 2007; Douglas and Craig, 2006). Consequently, data from different groups cannot be pooled or compared without further methodological considerations.

Rungtusanatham, Ng, Zhao and Lee (2008) demonstrate in that regard that simply pooling data from transparently different groups – in this case data from top management versus middle management echelons – leads to conclusions that ignore inherent differences between the groups and leads to insights that are very different from those drawn from a procedure that acknowledges the potential differences in measurement across groups. Therefore, measurement equivalence or invariance across groups is a condition that should be met or controlled for in order to meaningfully pool and/or compare data.

A measurement procedure is equivalent when the relations between the observed variables and the latent variables are identical across groups that operate in apparently different settings; i.e. when individuals with the same standing on a trait but sampled from different groups, have equal observed scores (Drasgow, 1984). We cannot assume that answers to survey questions are given without any cognitive processing by the respondents. Questions have to be interpreted, experiences have to be reflected upon, and subsequently, answers have to be selected. Each of these processes is likely to be influenced by particular frames of reference (Vandenberg and Lance, 2000). Without the assessment of equivalence, it is hard to know if findings reflect 'true' similarities and differences between selected groups rather than the spurious effect of cognitive or socio-cultural differences in response to a survey (Mullen, 1995).

Measurement equivalence has been discussed since the early 1960´s and the dominant approach to test for equivalence since the early 1990´s is multi-group confirmatory factor analysis (MGCFA) (Byrne, Shavelson and Muthén, 1989; Cheung and Rensvold, 1999; Vandenberg and Lance, 2000). A growing stream within the MGCFA framework of equivalence distinguishes two processes within measurement: a cognitive and a response process (Saris and Gallhofer, 2007; Van der Veld, 2006). The cognitive process relates to how respondents *understand* a question, while the response process relates to how respondents *express* themselves. Equivalence issues can arise in either of the two processes. This distinction is not present in the traditional MGCFA approaches to equivalence, but is relevant for several reasons. First, the distinction between a cognitive and a response process facilitates, in an early stage of research, identification of potential threats to equivalence in either of the two processes and subsequently taking design decisions that minimize the risk of violating measurement equivalence. Second, once data have been collected, it allows correcting for error in the response process, implying a less restrictive test and thus more productive use of survey data (Saris and Gallhofer, 2007).

Consider in that regard the example of the causal impact of X on Y, measured in two heterogeneous groups. Suppose that the real impact is 0.40 in both groups. The measurement errors of x and y are 0.00 and 0.50 respectively in the first group (i.e., the estimated loadings are 1.00 and 0.71 respectively), but are 0.00 and 0.84 in the second group (i.e., the estimated loadings are 1.00 and 0.40 respectively). Consequently, despite the fact that the real impact is equivalent across groups, the estimated regression coefficients are significantly different: 0.28 and 0.16 for group 1 and group 2 respectively[5]. According to the traditional MGCFA approach, the researcher would conclude that data are not equivalent. When respondents *understand* the question in a similar way, however, the researcher has the possibility to correct for errors that occur during the response process when respondents have to *express* themselves, as described in section 3.3. According to this novel approach, the researcher controls equivalence of response processes, and uses the data in a more productive way.

Guidelines on empirical assessment of measurement equivalence abound in the general survey methods literature and are increasingly present in the organizational research methods

[5] Calculated by the product of the loading of X on x, the real impact of X on Y, and the loading of Y on y.

literature (e.g., Cheung and Lau, 2012). Consideration of equivalence, however, has to go beyond the testing of equivalence post data collection (Douglas and Craig, 2006) to include actions in all stages of survey research, ranging from: (a) the identification of sources of heterogeneity that constitute a threat to equivalence; (b) maximization of equivalence during the design stage of surveys; (c) testing of measurement equivalence; and (d) dealing with partial- and nonequivalence. Nonetheless, guidelines on this broader process are scarce and fragmented, both in the methods literature and in applied fields, such as consumer research, strategy or OSM. We have identified seven reference studies that focus on providing guidelines or best practices for dealing with equivalence. Table 4.1 summarizes their contributions per stage of multi-group survey research and highlights the lack of a comprehensive view connecting best practices across the different stages.

Consequently, a first aim of this paper is to develop a comprehensive framework of how to consider equivalence issues in the various stages of a survey project. Distinguishing between cognitive and response processes of measurement aids in connecting the different stages. The framework has to be considered as an extra layer of methodological considerations for survey research, on top of traditional considerations of good survey research (Harkness et al., 2003).

Once we have such a framework, it is worthwhile to review the OSM literature in order to understand to what extent studies adopt practices to deal with equivalence. Within the OSM discipline, there have been a number of review studies highlighting the need to improve the quality of survey research, shifting the focus from encouraging the development of reliable and valid measures (Filippini, 1997; Hensley, 1999) to more refined methods for data collection and analysis, with respect to sampling frames, data triangulation, missing data, and response bias (Malhotra and Grover, 1998, Rungtusanatham, Choi, Hollingworth, Wu and Forza, 2003; Tsikriktsis, 2005). A review of equivalence application in OSM seems opportune, given the growing awareness of the negative consequences of violating measurement equivalence in other fields; the complex trade-offs between equivalence maximization and pragmatic considerations in survey design; and the opportunities for more advanced equivalence testing through Structural Equations Modeling (SEM). However, as far as we know there are no studies that review the consideration of equivalence issues in OSM research.

Table 4.1. Contributions and gaps of studies that provide guidelines for consideration of equivalence

	a) Identification of threats to equivalence	**b) Maximization of equivalence in the design stage**	**c) Empirical assessment of measurement equivalence**	**d) Dealing with partial- and non-equivalence**
Steenkamp and Baumgartner (1998)	Cross-cultural / cross-country differences.	Not discussed.	MGCFA procedure presented (no distinction between cognitive and response processes).	Suggestions on how to deal with data that does not pass all the equivalence tests.
Bensaou et al. (1999)	Cross-cultural / cross-country differences.	Various techniques presented.	MGCFA procedure presented (not including scalar equivalence; no distinction between cognitive and response processes)	No suggestions.
Cheung and Rensvold (1999)	Mainly cross-cultural / cross-country differences.	Only translation equivalence is discussed.	MGCFA procedure presented (no distinction between cognitive and response processes).	Suggestions on how to deal with data that does not pass all the equivalence tests.
Vandenberg and Lance (2000)	Cross-cultural / cross-country differences, gender, age, race, data collection and time differences.	Not discussed.	MGCFA procedure presented (no distinction between cognitive and response processes).	Suggestions on how to deal with data that does not pass all the equivalence tests.
Douglas and Craig (2006)	Cross-cultural / cross-country differences.	Various techniques presented.	No suggestions	No suggestions
Hult et al. (2008)	Cross-cultural / cross-country differences.	Various techniques presented.	MGCFA and other procedures presented (no distinction between cognitive and response processes).	No suggestions.
Rungtusanatham et al. (2008)	Any difference due to transparently different demographics.	Only summarily discussed.	MGCFA procedure presented (no distinction between cognitive and response processes).	Suggestions on how to deal with data that does not pass all the equivalence tests.
This paper	Discussion of nature of differences due to cognitive and response processes.	Various techniques presented.	MGCFA procedure presented, distinguishing between cognitive and response processes.	Suggestions on how to deal with data that does not pass all the equivalence tests.

Hence, our second aim is to review OSM literature in terms of the developed framework, detecting current best practice and pragmatic decision issues, and refine our suggested framework in light of these findings. To this end, we review survey articles from six leading empirical OSM journals covering the period 2006-2011.

The structure of the paper is as follows. First, we point out our alternative view on measurement equivalence. Then, we present our comprehensive framework of how to deal with equivalence, grounded in the methodological literature. After that, we discuss the method for the review of OSM literature and present the literature review in terms of the framework. We finalize with a discussion of the findings, our conclusions, and suggestions for future research.

4.2. AN ALTERNATIVE VIEW ON MEASUREMENT EQUIVALENCE

Measurement error has strong effects on the results of research and is likely to be different across respondents that operate in different settings (Alwin, 2007). Consequently, it becomes quite challenging to pool or compare data from different groups. Consideration of equivalence is closely tied to the researcher´s view on measurement and the process of translating concepts into a measurement instrument. Therefore, in this section we introduce our view regarding the different types of measurement error, the moments in the measurement process when those errors may occur, and the implications for operationalization.

4.2.1. Measurement Error

Measurement represents the link between theory and the analysis of empirical data. This link is viewed as more difficult in the social sciences, when compared to the physical sciences, as the phenomena of interest are often abstract and difficult or impossible to observe directly (Alwin, 2007). Central to measurement is the acknowledgement of measurement error. There are three different types of measurement error: random error, method effect and unique component. The first type of error, *random error*, is an error that can be described as being sampled from a normal distribution with mean zero, and was central to the classical model of random error (Lord and Novick, 1968). The classical model states that the true score is the observed variable corrected for random measurement error:

$$y = t + e \quad (1)$$

where y = observed variable; t = true score; e = random error.

For simple observable variables this signifies that the observed mean is equal to the true mean. For latent variables, however, this is overly simplified (Saris, 1988). The observed mean may differ from the mean of the latent variable because systematic error may occur besides random error. Systematic errors may take the form of "method effect" and "unique component".

The method effect is due to factors such as differential response style (i.e., social acquiescence and extreme ratings), differential familiarity with response formats or stimuli, and interviewer effect (Harkness et al., 2003; Douglas and Craig, 2006). A well-known example is the method effect induced by the use of "batteries" of survey indicators (i.e. series of subsequent, similarly formatted questions and response scales).

Systematic error in the form of a unique component stems from the fact that complex latent variables (from now on called complex concepts, and when testing with factor analysis called second-order factors) require translation into more intuitive latent variables (from now on called intuitive concepts, and when testing with factor analysis called first-order factors). Intuitive concepts refer to simple concepts whose meaning is immediately obvious, including judgments, feelings, evaluations, norms and behaviors, while complex concepts refer to constructs, or less obvious concepts that require a definition (Saris and Gallhofer, 2007). What some authors consider a complex concept may be an intuitive concept for others; there remains a subjective element of judgment. In any case, it is important to critically reflect upon the nature of concepts used. We limit our discussion to concepts with reflective rather than formative measurement models (Edwards and Bagozzi, 2000) and come back to this issue in section 2.3.

Examples of intuitive concepts in the OSM domain are, according to our judgment, price, inventory level, and throughput time. Examples of complex concepts in the OSM domain are, according to our judgment, "supplier process integration" (Koufteros, Vonderembse, and Jayaram, 2005), "knowledge scanning" (Tu, Vonderembse, Ragu-Nathan and Sharkey, 2006), and "supplier trust of a purchasing agent" (Zhang, Viswanathan and Henke Jr., 2011). A shift of the conceptual domain (the unique component) may be introduced when the researcher translated complex concepts into more intuitive concepts.

"Knowledge scanning" for instance, may be translated, according to our judgment and after critically reflecting upon the indicators used by Tu et al. (2006), into intuitive concepts related to "searching for best practices", "experimentation", and "learning with selected buyers or suppliers". A respondent's score on "learning with selected buyers or suppliers", for instance, may be influenced not only by the degree of "knowledge scanning" by a focal company, but also by exogenous factors, such as power balance between the respondent and its buyers or suppliers. Consequently, variance in "learning with selected buyers or suppliers" stems not only from variance in "knowledge scanning" but also from variance in "power balance". The latter part of the variance of the intuitive concept is called unique component. In other words, the conceptual domains of the complex concept and the related intuitive concept are not completely overlapping and a systematic bias is introduced in the cognitive process of understanding "knowledge scanning".

In order to further understand the nature of these different kinds of error and consequently mitigate the threat to equivalence, we distinguish between cognitive and response processes within measurement.

4.2.2 Cognitive and Response Processes

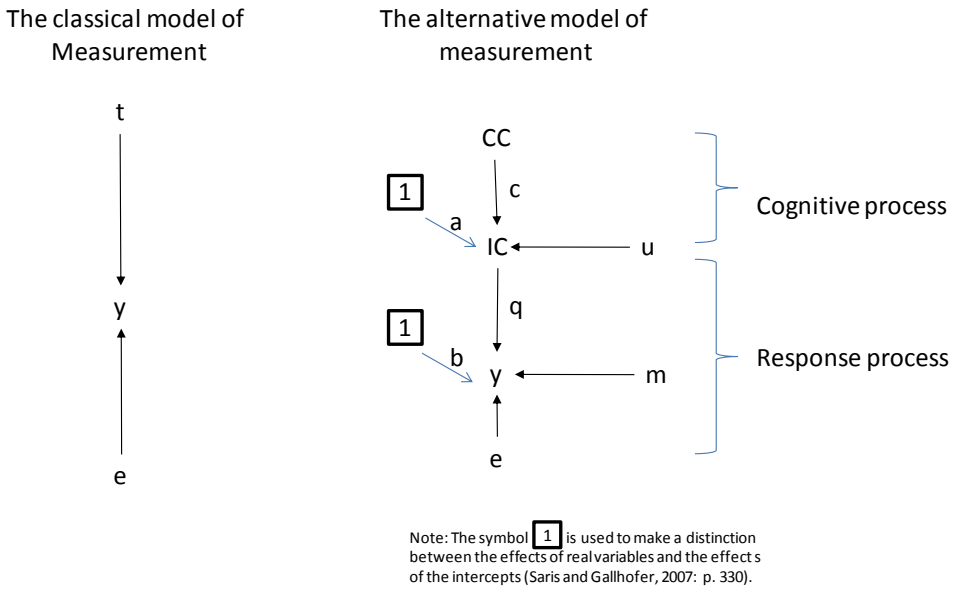
Latent variables cannot be observed directly but are supposed to pre-exist in the mind of the respondent, or alternatively to be created in the mind when confronted with the respective survey question (Zaller and Feldman, 1992). This is true for variables with reflective rather than formative measurement models, which are the focus of this paper. Two processes take place when researchers measure latent variables through one or more survey indicators, where every indicator is constituted by a request for an answer and a response scale.

Firstly, a stimulus posed by the request for an answer triggers a *cognitive* process in the brain of the respondent. This process finishes with a preliminary reaction not yet expressed in the requested form (Van der Veld, 2006). In other words, the cognitive process relates the complex concept to the intuitive concept (Saris and Gallhofer, 2007: p. 282). Assuming a linear relationship between the latent variable in the mind of the respondent and the preliminary reaction, the formal expression is:

$$IC = a + c*CC + u \quad (2)$$

where IC = preliminary reaction to the request related to the intuitive concept, a= intercept of the cognitive function, c= consistency coefficient or the relationship between the complex concept and the intuitive concept, CC= complex concept, and u= unique component (see Figure 4.1).

Figure 4.1. The classical and the alternative models of measurement, for considering equivalence



It is thus possible that intuitive concepts stand on themselves; i.e. there is no complex concept behind the intuitive concept: this is the case when the consistency coefficient (c) is 1; the intercept (a) is zero; and the unique component (u) is zero. It is also possible that the conceptual domain of the complex concept and intuitive concept are not completely overlapping; i.e. a systematic bias called the unique component occurs during the cognitive processing of the request for an answer. The unique component is absent in Multitrait-multimethod (MTMM) experiments that use two or more identical requests for an answer in combination with different methods, for example different response scales. Consequently, this kind of experiments facilitates relating the observed differences to method effect and random error.

Secondly, respondents have to express their preliminary reaction to the request in a certain format (the format of the scale in the questionnaire). The *response* process thus starts with the

preliminary reaction regarding the intuitive concept and finishes with an observed score on the provided scale. The response process is also called the communicative process (Sudman, Bradburn and Schwarz, 1996). Assuming again a linear relationship, this can be formulated as follows:

$$y = b + q*IC + m + e \quad (3)$$

where y= observed variable, b= intercept of the response function, q= slope of the response function, IC= preliminary reaction to the request related to the intuitive concept, m= method effect, and e= random error (see Figure 4.1). It is thus possible that the mean of the observed variable equals the mean of the intuitive concept: this is the case when the intercept (b) is zero; the slope (q) is 1; and the method effect (m) is zero.

In summary, during the cognitive process, error in the form of "unique component" can take place. During the response process, error in the form of "method effect" and "random error" can take place. Most authors do not make the distinction between both processes and join all three types of measurement error under one and the same heading (Saris and Gallhofer, 2007). In other words, they substitute equation (2) into equation (3):

$$y = b + q^* (a + c*CC + u) + m + e$$

or

$$y = (b + q*a) + q*c*CC + (u + m + e) \quad (4)$$

where

$$b + q*a = \text{the intercept} \quad (4a)$$

$$q*c = \text{the slope} \quad (4b)$$

$$u + m + e = \text{error} \quad (4c)$$

Not distinguishing the three types of errors is problematic in multi-group research, as the different error components are likely to differ across groups (Alwin, 2007). Acknowledgement of the different nature of measurement error also helps to optimize operationalization and equivalence.

4.2.3 Operationalization

The distinction between complex concepts and intuitive concepts, and the related cognitive and response processes of measurement, has two key implications for operationalization.

First, the distinction is vital in order to create a measurement instrument that measures what is supposed to be measured (Blalock, 1990; Northrop, 1947; Saris and Gallhofer, 2007; Scherpenzeel and Saris, 1997; Van der Veld, 2006). Thus, rather than directly translating complex concepts into indicators, it is recommendable to critically reflect upon the concepts used. Complex concepts have to be translated into intuitive concepts, and indicators have to be defined relative to the intuitive concepts. For each intuitive concept, one direct question may be formulated, or alternatively, multiple indicators may be used when individual indicators are considered imperfect (Alwin, 2007). Researchers, however, often think in terms of questions without a clear awareness of the intuitive concept represented by the questions (Saris and Gallhofer, 2007) leading to a gap between theory and observations (Blalock, 1990).

Revilla, Sáenz and Knoppen (2013), for example, initially judged that "assimilation" (i.e., a learning process that combines new knowledge with already existing knowledge in a firm) was an intuitive concept and introduced an existing scale from literature in their survey instrument. Empirical observations followed up by additional theoretical reasoning, however, showed that assimilation was a complex concept, reflected by two intuitive concepts: one related to attitudinal aspects of assimilation and one related to behavioral aspects of assimilation. Alternatively, studies might dedicate more attention to reflection upon the nature of concepts prior to data gathering, when operationalizing, in order to develop a survey instrument that closes the gap between theory and observations. Paying close attention to the translation of complex concepts into intuitive concepts, before developing indicators associated to the intuitive concepts avoids cross-loadings, correlations between concepts that are close to and greater than 1, and contaminated factor scores (Saris, Knoppen and Schwartz, 2013).

Second, researchers have to anticipate requirements for equivalence testing, while operationalizing. The distinction between cognitive and response processes implies that within MGCFA, which is the dominant approach for equivalence testing, a second-order factor model will be specified. In factor analysis the term factor rather than concept is used: the second-order factor represents the complex concept, and the first-order factor represents the intuitive concept. And, the higher level in the factor structure corresponds to the cognitive process and the lower level to the response process (Saris and Gallhofer, 2007), as shown in Figure 4.1.

Estimation and testing will only be possible if the specified model has one or more degrees of freedom (Bollen, 1989); i.e. there are more knowns than unknowns and the model is overidentified. Introducing extra layers in the factor model implies introducing additional parameters to estimate and test, consequently reducing the degrees of freedom given a same set of indicators and assumptions (i.e. restrictions imposed on the model). Therefore, the researcher has to reflect upon the number of indicators required per first-order factor in order to have an identified model (Shah and Goldstein, 2006).

Take the example of a measurement model of a complex concept, translated into three intuitive concepts, where each intuitive concept is represented by two indicators with the same response scale. This model has three degrees of freedom. Alternatively, when joining several correlated complex concepts in the analysis of the factor structure, fewer intuitive concepts are required in order to have an identified model. Take for example two correlated complex concepts; each translated into two intuitive concepts that in turn are measured each by two indicators each. This model has 11 degrees of freedom[6]. Other combinations of complex concepts, intuitive concepts and indicators may also provide sufficient degrees of freedom for testing. The assumptions behind the model further determine the degrees of freedom. Some basic rules of thumb are: (a) the model of an intuitive concept with three indicators is just identified; (b) the model with two intuitive concepts, each with two indicators is overidentified; (c) models that expand or combine the structures of (a) and (b) are identified (Saris and Gallhofer, 2007). Thus, requirements for testing, and more precisely requirements regarding identification of a measurement model that acknowledges cognitive and response processes, have to be anticipated during operationalization.

In summary, consideration of equivalence has to be preceded by reflection upon measurement error and operationalization. The distinction between cognitive and response processes of measurement aids to further insights in that regard. According to our judgment, many concepts studied in the OSM literature are complex concepts, and although multi-indicator (reflective) measurement is commonplace, the thinking outlined here in terms of complex concepts consisting of lower-level intuitive concepts is novel. This way of thinking is

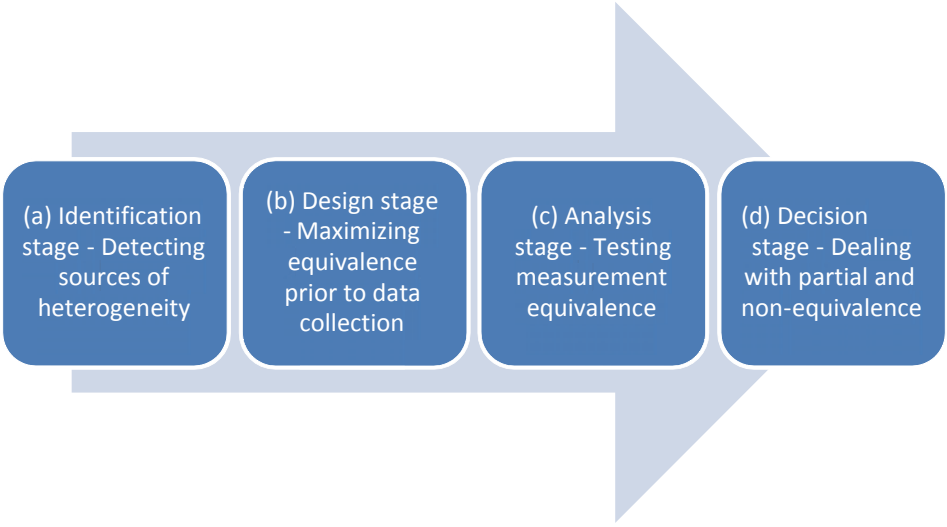
[6] The model has 8 indicators and counts therefore with 36 correlations. The total number of parameter estimates is 25 and is the sum of: 8 random error terms; 8 loadings relative to the indicators; 4 loadings relative to the intuitive concepts; 4 unique components relative to the intuitive concepts; and 1 correlation between the complex concepts. Consequently, the degrees of freedom are: 36-25=11.

important throughout the whole survey research process, not only during the overly emphasized testing stage, as will be elaborated in the next section.

4.3. A FRAMEWORK FOR CONSIDERING MEASUREMENT EQUIVALENCE

In line with our view on measurement, our discussion of equivalence issues acknowledges cognitive and response processes and is organized into four main sections: (a) identifying sources of heterogeneity; (b) maximizing equivalence prior to data collection; (c) testing measurement equivalence; and (d) dealing with partial-and non-equivalence (see Figure 4.2).

Figure 4.2. Four key stages in multi-group survey research



4.3.1. Identifying Possible Sources of Heterogeneity – the Identification Stage

The point of departure in considering equivalence is the identification of possible sources of heterogeneity between groups of respondents, and hence an increased likelihood of violated assumptions regarding identical measurement models of survey respondents.

There is no consensus in the literature as to what specific sources may affect measurement equivalence. Rather than consulting a pre-established list of potential sources, researchers should ask themselves two questions for every new study that involves multiple groups (Saris and Gallhofer, 2007; Van der Veld, 2006). First, is there a reason to suspect that respondents

from the different groups *understand* a survey question in a different way? If so, cognitive processes may be non-equivalent. Second, is there a reason to suspect that respondents from the different groups *express* themselves in a different way? If so, response processes may be non-equivalent. Both processes can differ between groups, but the differences may reside also only within one of the two processes. In the following we will ask these two key questions for the sources of heterogeneity most commonly mentioned in literature. Table 4.2 summarizes the findings.

Table 4.2. Identification of threats to equivalence

Sources of heterogeneity	**Is there a reason to suspect that respondents from the different groups *understand* the question in a different way?**	**Is there a reason to suspect that respondents from the different groups *express* themselves in a different way?**
Different countries, cultures or languages	Yes (Bensaou et al., 1999; Cheung and Rensvold, 1999; Rungtusanatham et al., 2005)	Yes (Saris, 1988; Steenkamp and Baumgartner, 1998)
Different types of respondents with transparently different demographics	Yes (Smith, 2002)	No evidence
Different data collection methods	Yes (Saris and Gallhofer, 2007)	Yes (Mick, 1996)
Different data collection moments	Yes (Xu et al., 2010)	No evidence
Other …	?	?

Different countries/languages/cultures

The most commonly identified threat to equivalence arises when groups come from different countries, cultures or languages (Hult et al., 2008; Jowell, Kaase, Fitzgerald and Eva, 2007). With respect to cognitive processes, groups of respondents from different countries, cultures or languages may *understand* questions differently. The statement "I am a person of worth, at least as good as other people", may indicate a healthy level of self-esteem to an American, but a grandiose, socially unacceptable sense of self-importance to a Chinese (Cheung and Rensvold, 1999). Or, the meaning of indicators related to trust such as "How comfortable do you feel about sharing sensitive information with the supplier?" may differ between Japan and

the US (Bensaou et al., 1999). Likewise, countries will have different degrees of familiarity with more specific OSM terminology, such as the Deming-based Total Quality Management constructs (Rungtusanatham et al., 2005). As such, it can be difficult to know if differences or similarities between groups are real or simply caused by cognitive or socio-cultural differences in interpretation of a request.

With respect to response processes, respondents from different countries, cultures or languages may *express* themselves differently. For example, given the same preliminary reaction to a request, some cultures in Latin America tend to use extreme end points of a scale, whereas Asian cultures tend to favor neutral middle points of scales. In other words, the response processes of these two groups are fundamentally different (Saris, 1988; Steenkamp and Baumgartner, 1998).

It is also worth noting that pooling data from groups from different regions in a single country could generate as many threats to equivalence as cross-country research where cultures are very similar. For example, using Hofstede's (2001) cultural dimensions theory, we see that Sweden and Norway have very similar national cultures in relation to *power distance*, *individualism* and *masculinity*. As such, the threats to equivalence posed by pooling data from these two countries may be relatively low; i.e. the different groups are expected to understand the questions in a similar way and to respond in a similar way. Conversely, pooling data from French-speaking and English-speaking Canada may carry significant threats to equivalence, as the regional cultures of these two areas are significantly different (Cannon, Doney, Mullen and Petersen, 2010). This may lead to fundamentally different cognitive and response processes between these groups when completing surveys.

Different types of respondents

Another key source of heterogeneity arises when groups represent different types of respondents with transparently different demographics (Rungtusanatham et al., 2008). In social psychology, examples often refer to differences due to race, gender, or age (Nye and Drasgow, 2011). In OSM, examples defined by individual traits include groups of senior managers versus lower level employees; sales managers versus purchasing managers; and experienced versus non-experienced respondents. Furthermore, groups defined by company traits, such as state-owned versus private companies, or multinationals versus SMEs, might also be heterogeneous.

Regarding the first question related to the understanding of survey questions by respondents, these sub-samples have different experiences, perspectives and frames of reference and consequently may have non-equivalent *cognitive* processes. Social psychology refers to this phenomenon as differential item functioning (Smith, 2002). Regarding the second question related to the expression of respondents, and in contrast to country/culture/language differences, extant literature does not suggest any threats to equivalence of the *response* processes of these groups.

Different data collection methods

Another source of heterogeneity arises when different methods will be used to collect data from different groups. This is far from ideal but sometimes necessary because of pragmatic reasons; i.e. the availability of resources across different research settings (Kish, 1994). Data collection involves the choice of a sampling frame, the choice of sampling methods, and the choice of a certain administration mode. The sampling frames from the Council of Supply Chain Management Professionals (CSCMP) and from the Institute of Supply Management (ISM), for example, might refer to different populations of companies (Hult et al., 2006). The use of different sampling methods (i.e. random versus stratified) might also constitute a threat to equivalence (Boyer and Hult, 2006). There is no evidence, however, of how different sampling frames or sampling methods impact cognitive or response processes of measurement.

The choice of an administration mode, finally, should ideally also be consistent across groups. Administration modes range from paper-and-pencil or telephone interviewing, to mail surveys and Web-based surveys, each with potentially different psychometric properties (Cole, Bedeian and Feild, 2006). Visual and verbal stimuli vary across the different administration modes impacting the overall measurement process (Douglas and Craig, 2006). Regarding the *cognitive* process, the presence of an interviewer may shift the cognitive model and introduce error in the form of a unique component, as additional explanations to the survey questions may be provided by the interviewer (Saris and Gallhofer, 2007). Such explanations may be useful in helping the respondent to *understand* the question but also makes the answers incomparable if the question asked or the explanation given is not always the same. Regarding the *response* process, the presence of an interviewer may introduce a social desirability bias and hence induce a method effect and shift the response process (Mick, 1996).

Different data collection moments

Another source of heterogeneity arises when timing of data collection varies for different groups. Take for example a survey of two different groups of supply chain mangers, one completing a questionnaire on supply risk just before the March 2011 Great East Japan Earthquake and one shortly after. Another example stems from Xu et al. (2010) who study hardware and software platform migration intention, before and after introduction of the third generation (3G) mobile data services in Hong Kong. The authors argue that the introduction of 3G influences the consumer´s understanding of platforms and thus *cognitive* processes during measurement. They cannot avoid the source of heterogeneity however, since the comparison is central to their research aim. Other studies might consider eliminating the threat to equivalence constituted by different moments in time, by deciding to collect data at just one moment in time.

Additional sources of heterogeneity

The list of key potential sources we presented so far is not exhaustive, and additional sources of heterogeneity could be thought of. Depending on the specific study, the researcher may identify latent differences between groups that may pose threats to equivalence, either of cognitive and/or response processes of the measurement model. Explicitly considering the questions: "Do respondents understand the question in the same way?" and "Do respondents express themselves in the same way?" helps in that regard. On the other hand, researchers may also expect different groups to be similar in their cognitive and response processes, after a critical reflection on the topic.

For example, Koufteros and Marcoulides (2006) reflect upon potential differences between high and middle-level executives who will respond to their survey. The authors do not distinguish between cognitive and response processes but implicitly point to cognitive processes when they state that both groups are expected to have comparable knowledge of product development practices and competitive environments. Differences in respondent profile therefore do not constitute a threat to equivalence. According to our approach, these reflections might be complemented with reflections on the response process.

In general, studies that identify control variables – or state to follow a contingency approach (e.g. Flynn et al., 2010) - may evaluate if the groups related to their control variables

(i.e. contingencies) have potentially different cognitive and/or response processes before proceeding to compare path model coefficients of the respective groups. In a study of product development, Koufteros et al. (2005) for example, identify subgroups based on differing degrees of uncertainty, equivocality, and platform strategy and suspect that these groups might have different measurement models. Consequently, they test measurement equivalence before examining the contingent effect of group membership as part of the path model used in their study. Other examples of contingencies stem from firm level characteristics, such as: firm size; public versus private sector organizations; and buying versus supplying firms; and the performance levels of firms. All these contingencies may impact in the way firms understand and respond to surveys.

In sum, extant literature provides clues as to whether certain groups are prone to non-equivalent measurement models. But, we invite researchers to go beyond this list of pre-established sources and critically address potential heterogeneity, by reflecting upon how respondents *understand* the issue and how they *express* themselves. Table 4.2 suggests that the relationship between sources of heterogeneity and cognitive versus response process is still not fully understood. But, even without fully understanding this relationship, reflection upon differences of *understanding* and *expressing* helps identifying sources which otherwise might remain unknown and cause problems in subsequent stages.

This first stage implies an explicit decision point in the process of research: the researcher may decide to avoid the source of heterogeneity (for instance, gather data in one rather than more countries), or on the other hand, when this is not desired (for instance, when the research aim is to compare heterogeneous groups) or practically not possible, the researcher may decide to mitigate the detrimental effects of the identified sources of potential heterogeneity, building upon the design actions suggested in the following section. The next section highlights design actions that in some cases address equivalence, regardless if the threat is related to cognitive or response level, and in other cases can be clearly linked to one of both processes of measurement.

4.3.2 Maximizing Equivalence Prior to Data Collection – the Design Stage

There are different means to minimize the heterogeneity of the measurement process across groups of respondents and thus to maximize equivalence prior to data collection. In the

design stage, one can strive to maximize construct equivalence, translation equivalence, and data collection equivalence. All three means are important, but the emphasis shifts, depending on whether equivalence is threatened in the cognitive or the response process, as will be pointed out below and as summarized in Table 4.3.

Construct equivalence

The relevance and meaning of concepts, especially those related to attitudes or behaviors, may differ across groups leading to differences in cognitive processing of survey indicators (Douglas and Craig, 2006). When researchers detect a possible threat to equivalence in respect to the cognitive process of measurement, maximizing *construct* equivalence prior to data collection thus gains relative importance. Construct equivalence relates to whether an object, concept, or behavior is the same (i.e., serves the same purpose and achieves the same salience) across the different groups, and can be evaluated pre-data collection in relation to three aspects: functional, conceptual and category equivalence (Craig and Douglas, 2000; Hult et al., 2008).

Conceptual equivalence is the extent to which individuals across different groups interpret and express a given object, concept or behavior in the same way. In other words, it is the extent to which the domains of the concept/behavior are the same across groups (Hult et al., 2008). For example, Kaynak and Hartley (2006) evaluate if the domain of the just in time purchasing construct has remained the same over time. Another example refers to the domain of trust: trust in a salesperson may be a function of the seller´s company reputation or creditworthiness in China, but it may be a function of the seller´s individual expertise and product knowledge in the US (Douglas and Craig, 2006).

Category equivalence is the extent to which the same classification scheme can be used for a given concept across different groups. For example, are the meanings of job categories consistent across groups (Bensaou et al., 1999)? Another example is related to marketing research and how products are assigned to categories: beer may be an alcoholic beverage in some countries, but a soft drink in other countries (Craig and Carter, 2000).

Functional equivalence is the extent to which a given object, concept or behavior has the same *role* or *function* across different groups. For example, a bicycle serves a different function in China (means of transport) than in the USA (means of recreation). Or the concepts asset

Table 4.3. Maximization of equivalence during design

Design action	**Does it mitigate the threat of heterogeneous cognitive processes?**	**Does it mitigate the threat of heterogeneous response processes?**
Construct equivalence	Yes (Bensaou et al., 1999; Craig and Douglas, 2000; Douglas and Craig, 2006; Hult et al., 2008)	No evidence
Translation equivalence: content	Yes (Douglas and Craig, 2006; Harkness et al., 2007; Jowell et al., 2007)	Yes (Douglas and Craig, 2006; Harkness et al., 2007; Jowell et al., 2007)
Translation equivalence: form	No evidence	Yes (Saris and Gallhofer, 2007)
Data collection equivalence	Yes (Douglas and Craig, 2006; Hult et al., 2008)	Yes (Douglas and Craig, 2006; Hult et al., 2008)

asset specificity and reciprocal investments, studied by Bensaou et al. (1999) in the auto industry context in Japan and the US, may serve different functions in Japan versus the US. Therefore, one researcher of the latter study performed exploratory fieldwork in both countries to reveal potential differences in the functioning of these concepts. No differences were found which the authors related to the globalization of the auto industry and its associated best practices (Bensaou et al., 1999).

Construct equivalence is maximized through the application of established practices of good survey research, but application should be at the level of each predefined group. Critical evaluation of construct equivalence prior to data collection, however, is still an exception rather than a rule in multi-group studies (Hult et al., 2008). Douglas and Craig (2006) state it as follows: "*There is often a tendency, particularly in replication studies, to adopt research instruments used in the original, or base, study, appropriately translated when necessary into the language of the other research context. If the instrument "works" and exhibits acceptable levels of internal reliability, it is considered to provide an adequate measure. Typically, little attention is given to its appropriateness in another setting or to whether it covers all aspects of the construct to be measured*" (p. 10). Thus, it is vital to review literature that identifies similar groups; to adopt validated survey instruments used earlier for the same groups; and, to conduct qualitative fieldwork such as interviews, focus groups, pre-tests and pilot groups in each respondent group, prior to the actual survey.

Fundamentally, distinguishing complex concepts from intuitive concepts greatly aids in optimizing construct equivalence (Saris and Gallhofer, 2007). Returning to the example of "knowledge scanning", this complex concept has a well-functioning scale for the manufacturing sector (Tu et al., 2006). The related intuitive concept "learning with selected buyers or suppliers", however, although perfectly understandable in the manufacturing sector, may be less well understood by informants from the service sector, where there is less tradition of buyer-supplier collaboration and joint learning. Consequently, the concept knowledge scanning operationalized as per Tu et al. (2006) may by non-equivalent across manufacturing and service sectors.

Translation equivalence

Although good translation does not assure the success of a survey, a bad translation ensures that an otherwise good project fails because of non-equivalent data across different language groups. Translation equivalence is demonstrated when the wording of indicators in a survey have been correctly translated to ensure that they tap into the same concept in different groups. Until recently, translation/back-translation was considered as the most appropriate method for translating source questionnaires. An alternative approach is a team approach to translation that involves different roles (two independent translators, one reviewer, and one adjudicator) (Harkness et al., 2007). In this approach, the independent translators develop in parallel local versions of the same source questionnaire. At a reconciliation meeting, the translators and the reviewer go through the entire questionnaire discussing versions and errors of meaning and agreeing on a final version. The adjudicator, who has the broadest set of capabilities related to translation and content, has the final vote in case of disagreement. This approach is increasingly seen as both theoretically and practically superior to the traditional translation/back-translation method (Douglas and Craig, 2006; Harkness et al., 2007; Jowell et al., 2007).

Besides translation of *content*, which is normally the focus, translation of *form* is important but is only more recently being considered. While content refers both to the request for an answer and the response scale, form overly refers to the response scale or the set of possible responses the respondent has to use. Researchers make many decisions – consciously or unconsciously – when specifying survey indicators. The decisions made for response scales are especially prone to different interpretations by the translators (Saris and Gallhofer, 2007).

Therefore, it is important to work with a checklist of key choices regarding the *form* in order to maximize coherence between the source scale and the translated scales. More specifically, the source scale and the translated scales should be coherent regarding: correspondence between the labels and the numbers of the categories; symmetry of the labels; agreement between the unipolar or bipolar nature of the concept and the scale; the use or avoidance of a neutral or middle category; the use of "don´t know" options; the avoidance of vague quantifiers or numeric categories; the use of reference points; the use of fixed reference points; and, the measurement level (Saris and Gallhofer, 2007: 119).

Equivalent translation of *content* of both the request for an answer and the response scale mitigates the threat of heterogeneity in both cognitive and response processes. Equivalent translation of *form* of the response scale mitigates the threat of heterogeneity in response processes.

Data collection equivalence

Researchers should consider *data collection equivalence* in the design stage (Douglas and Craig, 2006). This consideration is important regardless whether the threat stems from the cognitive versus the response level (Mick, 1996; Saris and Gallhofer, 2007). Hult et al. (2008) detail data collection equivalence in three aspects: sampling frame comparability (whether samples from groups are the same), administration equivalence (consistent data collection procedures, coverage comparability, and timing of data collection) and sampling methods equivalence (matching of probability versus non-probability techniques). These aspects should be consistent across the identified groups.

Differences in researcher resources available across respondent groups (e.g., countries) may require flexibility in the sampling and data collection approaches (Kish, 1994) and may have led to early identification (in stage 1) of a threat to equivalence due to data collection. In these studies, maximizing data collection equivalence during design (stage 2) is less of a possibility, and researchers rather proceed to testing for equivalence across the different groups post data collection (stage 3).

4.3.3. Testing Measurement Equivalence – the Analysis Stage

Whilst equivalence thus can be and should be maximized prior to data collection, avoiding all threats to equivalence is not always pragmatic or even feasible (Rungtusanatham et al., 2008). Either way, measurement equivalence needs to be assessed after data collection, before pooling or comparing data.

A variety of methods have been developed for examining measurement equivalence. Initially, studies suggested *t* tests, analysis of variance (ANOVA), multiple analysis of variance (MANOVA), exploratory factor analysis (EFA), or other statistical tests of observed score differences across groups (Nye and Drasgow, 2011). Rungtusanatham et al. (2005) for instance, relied on visual inspection of similarity of factor configurations, Cronbach's alphas, and regressors as well as comparison of means by MANOVA. These initial approaches do not take into account the different types of measurement error and assume that the means of the factor scores are the same as the means of the latent variables (i.e. they are grounded upon the classical model of measurement rather than the alternative model of measurement as visualized in Figure 4.1). This is not necessarily the case and may lead to incorrect conclusions (Rungtusanatham et al., 2008) or unproductive use of survey data (Saris and Gallhofer, 2007). MGCFA on the other hand, allows consideration of all kinds of measurement error (Bollen, 1989), and has consequently become the standard for testing equivalence.

Within MGCFA, the measurement model is specified through confirmatory factor analytic (CFA) models, for each concept in each individual group. CFA models generally refer to concepts that are perceptually based, comprised of multiple manifest indicators, which are reflective (Vandenberg and Lance 2000). CFA models increasingly consider an extra layer in line with our discussion on complex and intuitive concepts (i.e. second-order models) (Koufteros, Babbar and Kaighobadi, 2009). A baseline step of CFA in general is the test of unidimensionality, validity, and reliability for each of the selected concepts. These analyzes may be performed per group as part of the configural equivalence test described hereafter, or additionally, and as a preparatory step, to the entire data set collectively (Bensaou et al., 1999; Koufteros and Marcoulides, 2006).

Within the MGCFA approach, measurement equivalence can be expressed on a continuum, with many steps ranging from non-restrictive to very restrictive (Bollen, 1989), but

is most commonly tested in three steps. These steps are testing for configural equivalence, testing for metric equivalence and testing for scalar equivalence (De Jong, Steenkamp and Fox, 2007; Horn et al., 1983; Nye and Drasgow, 2011; Meredith, 1993; Steenkamp and Baumgartner, 1998). Focusing on these three tests avoids getting lost in "the bewildering array of types of measurement invariance that can be found in the literature" (Steenkamp and Baumgartner, 1998: 79).

Firstly, the weakest constraint refers to *configural* equivalence. Configural equivalence implies that in the different groups, the same measurement model fits the data. This is established when indicators load significantly on the same factors across groups (also called same-form equivalence, Bensaou et al., 1999) and the correlations between the latent variables are significantly less than one, guaranteeing discriminant validity (Steenkamp and Baumgartner, 1998).

Secondly, metric equivalence is tested. Metric equivalence implies that relationships between the evaluated concepts can be compared across groups. This is established when the factor loadings across the different groups are the same (also called factorial equivalence, Bensaou et al., 1999). Factor loadings refer to the slopes of the cognitive and response processes, which are joined in a first-order factor model (c*q, see equation 4(b)), or separated in a second-order factor model (c is the slope of the upper layer of the factor model as in equation 2, and q is the slope of the lower layer of the factor model as in equation 3). The test is performed by constraining factor loadings to be equal across groups and testing the fit of the constrained model against the fit of a model in which the factor loadings are freely estimated (Smith, 2002).

Thirdly, the most severe constraint refers to scalar equivalence. Scalar equivalence implies that *means* for the concepts of interest can be compared across groups. This is established when slopes and intercepts of the response functions are the same across groups. Intercepts are joined in a first-order factor model (b + q*a, see equation 4(a)), or separated in a second-order factor model (a is the slope of the upper layer of the factor model as in equation 2, and b is the slope of the lower layer of the factor model as in equation 3). It assesses the extent to which systematic upward or downward bias exist in the responses across different groups (Rungtusanatham et al., 2008). The test is performed by constraining factor loadings and

intercepts to be equal across groups and testing the fit of the constrained model against the fit of a model in which the intercepts are freely estimated.

The three steps are most commonly executed using MGCFA in a bottom-to-top approach, starting with the weakest constraint and finishing with the most severe constraint. In the different steps, the standard fit indices (χ^2, χ^2/DF, RMSEA, NFI, CFI, SRMR) may be assessed to establish the quality of the overall model and the change in quality from one step to another (Hu and Bentler, 1998). Just as for any SEM model, it is good practice to complement the standard fit indices with a procedure that iterates between the test of misspecifications and subsequent partial – theoretically justified - modifications of the model evaluating the change in parameter values (expected parameter change, EPC) and improvement of fit (modification index, MI) (Saris et al., 2009).

Some researchers have suggested testing equivalence of covariance matrices; i.e. when equivalent covariance matrices are established the researcher may skip the configural and metric equivalence tests before proceeding with substantive analysis based on comparison of relationships between concepts (e.g. Vandenberg and Lance, 2000). Other authors however have questioned the importance and rationale underlying this omnibus test, because it does not provide insight regarding sources of the differences (Byrne et al., 1989: 457).

The equivalence tests are ideally based on a second-order model that permits to correct for differences in the response processes and consequently isolate cognitive processes within measurement. In other words, they test for equivalence of the consistency coefficient (c) as well as the slope of the response process (q) in the metric equivalence test, and they test for equivalence of each of both intercepts in the scalar equivalence test. In practical terms, this can be done by simultaneously estimating and testing the slopes and the intercepts of the response process, assuming equality of the consistency coefficients and of the intercepts of the cognitive process (i.e. constraining them to be the same) over the different groups (Saris and Gallhofer, 2007: p. 336-338). As a result, the test may indicate that cognitive processes are equivalent (the response processes were already corrected to become equivalent), when based on a first-order factor model the outcome could be that groups are non-equivalent. This is important because, "*cognitive equivalence of measurement instruments should be required, that is invariance after correction for differences in the measurement* (read: response) *process.*" (Saris and Gallhofer, 2007:

p. 336). This procedure thus allows a more productive use of survey data, given that the test is less restrictive and chances are higher to establish equivalence.

A condition is identification of the model which is, given a same set of indicators, more difficult for second-order models than for first-order models (see section 2.3)[7].If a second-order model is not identified, equivalence can only be tested using a first-order model. A metric equivalence test with a first-order model tests equivalence of the product of c and q. If that holds (i.e. c*q is equivalent across groups), chances are small that either c or q are non-equivalent across groups (i.e. the chance is small that one of both deviates in a positive direction and the other one in the negative direction and that these deviations compensate each other). Researchers may then claim to have established metric equivalence (Saris and Gallhofer, 2007). Koufteros et al. (2005) for instance, established metric equivalence based on first-order factor models of what in our judgment are complex concepts and could therefore proceed to the comparison of path models.

A scalar equivalence test with a first-order model tests equivalence of the intercepts of the cognitive and response function jointly. If that holds (i.e., b + q*a is equivalent across groups), chances are small that either a or b are non-equivalent across groups (i.e. the chance is small that one of both deviates in a positive direction and the other one in the negative direction and that these deviations compensate each other) (Saris and Gallhofer, 2007). As said before, testing complex concepts with first-order factor models is more restrictive and has consequently lower chances of establishing equivalence, than testing based on second-order factor models. The degrees of freedom available for testing and estimation determine if the researcher can work with a second-order versus a first-order model.

Small sample sizes per subgroup and violations of data assumptions may limit the applicability of MGCFA. How large the sample size should be is "*deceptively difficult to determine*" (Shah and Goldstein, 2006: p. 154), because it depends on a set of characteristics such as the number of observed variables per latent variable, the degree of multivariate normality and the estimation method. Moreover, it depends on the quality of the questions (Saris, Satorra and

[7] An option which facilitates identification because it does not require more than one indicator per intuitive concept is to obtain the quality estimators from the Survey Quality Predictor (SQP) which is available for free at http://www.upf.edu/survey/ and explained in Saris and Gallhofer (2007: chapter 13). SQP provides a specific estimate for the random errors, based on a meta-analysis of Multi Trait Multi Method (MTMM)-experiments. These quality estimates have to be inputted into the CFA model.

Sörbom, 1987). A minimum sample size is required to achieve a given level of power (MacCallum, Browne and Sugawara, 1996). When the sample size does not meet the condition for applying CFA, generalizability-theory, which builds upon ANOVA, has been suggested as an alternative for equivalence testing across small groups (Malhotra and Sharma, 2008).

When the normality assumption is not fulfilled, the Multiple Likelihood (ML) estimator within MGCFA is recommended because of its robustness (Saris et al., 1987). When the assumption of the continuous nature of data is not fulfilled (for example, for Likert scales with less than five response categories), Mplus-software is recommended within MGCFA. Alternatively, item-response theory (IRT) may be used (De Jong et al., 2007). We refer to these respective papers for more detail on these alternative approaches.

So far, our discussion of equivalence testing has been reduced to equivalence as a yes/no issue, but it is possible that test outcomes indicate partial or non-equivalence. This is elaborated in the next section.

4.3.4. Dealing with Partial and Non-Equivalence – the Decision Stage

The general criticisms to statistical tests – i.e. they turn a decision continuum into a dichotomous reject/do not reject decision, ignoring the practical significance of a difference (Nye and Drasgow, 2011; Schwab, Abrahamson, Starbuck and Fidler, 2011) – also apply to equivalence tests. The tests described so far are omnibus tests whether equivalence is established or not at a certain step in the test sequence. The impact of the outcome that equivalence is established is straightforward: configural equivalence alone does not permit further use of the concept across groups; metric equivalence permits to use the concept in comparisons of relationships; and scalar equivalence permits to use the concept in comparisons of means. The impact of non-equivalence, which in practice is likely to occur, is not as clear-cut however. Therefore, in this section we highlight three potential actions to take in case of non-equivalence: (1) Assess to what extent partial equivalence exists and execute substantive analyzes that are acceptable with partially equivalent data, (2) make sense of non-equivalence, or (3) exclude the non-equivalent group(s) from substantive analyzes.

First and most important, the researcher may assess whether there is at least partial equivalence (Steenkamp and Baumgartner, 1998). Table 4.4 summarizes the sequence of tests

related to full and partial equivalence and the ways in which data can be used when it passes certain equivalence tests.

The logic behind the partial equivalence test is relaxing equivalence constraints where they do not hold. In other words, a parameter that is not equivalent across groups is allowed to be estimated for each group separately, increasing the probability that equivalence holds for the reduced set of indicators. A condition for evaluation of partial equivalence is that factors are configurally equivalent, and the problem first emerges when metric or scalar equivalence is imposed on the model (Byrne et al., 1989). Moreover, constraints should be relaxed one at a time, and only for those parameters for which it makes theoretical sense. Equivalence constraints should only be relaxed when modification indices (MIs) are highly significant (both in absolute magnitude and in comparison with the majority of other MIs) and expected parameter changes (EPCs) are substantial. In general, the number of model modifications should be kept low, and capitalization on chance should be minimized. In other words, we should avoid the practice of "*repeat it as often as needed until the problem disappears*" (Vandenberg and Lance, 2000: p. 56).

Table 4.4. Established measurement equivalence and implications for possible comparisons

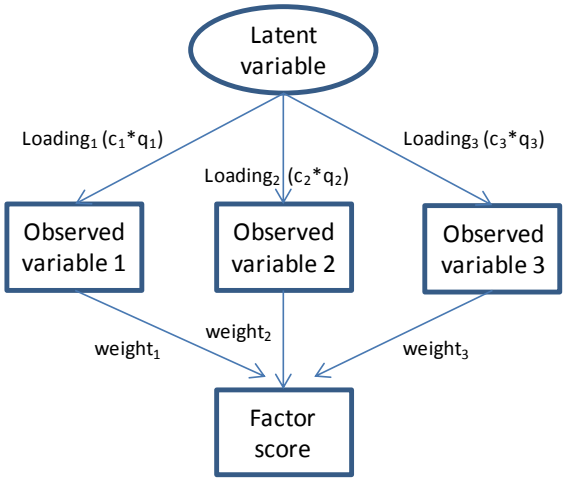
Highest level of equivalence established	Comparison of relationships		Comparison of means and pooling of data	
	Using latent variables	Using factor scores	Using latent variables	Using factor scores
Configural	-	-	-	-
Partial metric	√	-	-	-
Full metric	√	√	-	-
Partial scalar	√	√	√	-
Full scalar	√	√	√	√

There are no straightforward guidelines regarding the minimum number of equivalent indicators that are required per concept. Steenkamp and Baumgartner (1998) suggested that ideally a majority of factor loadings and intercepts should be equivalent across groups. De Jong et al. (2007: p. 262) state that formally only one equivalent indicator is required but this implies exact identification of the CFA model (i.e. no degrees of freedom left for testing), and therefore, an additional equivalent indicator is required. However, if the number of equivalent

indicators does not allow identification and testing of the model, the researcher could evaluate the practical impact of retaining a non-equivalent indicator along a set of equivalent indicators. In other words, what effect does the non-equivalence of one indicator have on the mean and variance of the factor score? A factor score is a weighted average of its indicators and when the impact of one non-equivalent indicator is relatively low (i.e. the indicator has a relatively low weight), the researcher may decide to keep the indicator in order to be able to test the model. Further detail on this procedure can be found in Coromina and Saris (2009) and Nye and Drasgow (2011).

The lack of straightforward guidelines in literature can be traced back to the different types of variables used in further substantive analysis: factor scores versus latent concepts (see Figure 4.3).

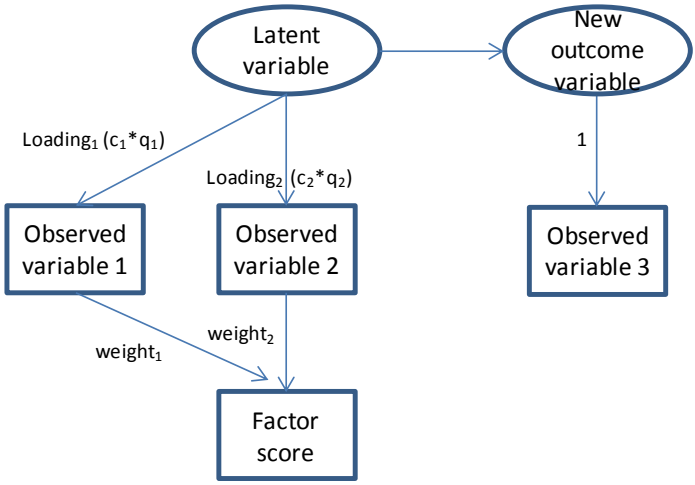
Figure 4.3. Latent variables versus factor scores



This is a decision the researcher has to take. The advantages of working with factor scores are twofold: the model is simplified, which is desirable when testing measurement models and structural models simultaneously (Saris and Gallhofer, 2007), and, the number of parameter estimates is reduced, thus improving the sample size-to-estimator ratio leading to more robust

testing (Shah and Goldstein, 2006)[8]. When partial equivalence is established, the researcher has to choose between dropping the non-equivalent indicator(s) from further analysis, keeping the non-equivalent indicator together with a set of equivalent indicators for identification purposes, or working with latent concepts. In the latter case, the non-equivalent indicator is no longer part of the set of indicators that reflect the latent variable, but has become a separate effect variable of the latent concept (see Figure 4.4). Thus, the use of latent variables versus factor scores avoids the choice of omitting non-equivalent indicators and permits to build a model upon more data (Saris and Gallhofer, 2007).

Figure 4.4. Modeling the non-equivalent indicator as outcome variable



When a researcher feels that there is no justification for partial equivalence, a second course of action is to make sense of non-equivalence: i.e. interpreting non-equivalence as meaningful information (Cheung and Rensvold, 1999). The distinction between cognitive and response processes in that regard, allowed by a second-order factor model test, permits to focus on cognitive differences between groups, which are generally of more interest to

[8] This procedure still permits to correct for measurement error: one way is to reduce the variances on the diagonal of the correlation matrix to the quality coefficient squared, and to specify in the program that the matrix is a covariance matrix and that one would like to analyze the correlation matrix (Saris and Gallhofer, 2007: 314).

researchers than response differences (Saris and Gallhofer, 2007). The differences between the groups can then produce relevant insights into the nature of the concept of which the indicator is reflective (Smith, 2002).

A third option is to exclude non-equivalent data from further substantive analysis: the non-equivalent group, for instance one country from a pool of 20 countries in cross-cultural research; the non-equivalent concept, for instance one human value from a set of ten basic human values; or, one wave in longitudinal research that gathers data in multiple waves (see Davidov, Schmidt and Schwartz, 2008). In sum, the researcher has various options for substantive data analysis, even if full equivalence is not established.

Having developed our framework of equivalence issues, we now turn to our review of prior OSM survey research. This review is structured around the stages of the same framework (Figure 4.2). This review is used to detect current best practice in OSM research, to uncover pragmatic decision issues, and to refine our proposed guidelines.

4.4. A REVIEW OF OSM SURVEY RESEARCH: METHOD

In this section we detail the criteria for selecting the papers to review, and the procedure for the coding of the selected papers.

4.4.1. Article Selection

We considered a number of leading journals publishing high quality empirical research for our review of equivalence in OSM. Based on several reviews (e.g. Saladin, 1985; Barman, Tersine and Buckley, 1991; Vokurka, 1996; Goh, Holsapple, Johnson and Tanner, 1997; Soteriou, Hadijinicola and Patsia, 1998; Rungtusanatham et al., 2003; Shah and Goldstein, 2006), we identified six leading OSM journals: *Journal of Operations Management* (*JOM*), *Management Science* (*MS*), *Decision Sciences* (*DS*), *International Journal of Operations & Production Management* (*IJOPM*), *Production and Operations Management* (*POM*), and *International Journal of Production Research* (*IJPR*). We decided to focus on the six-year period from 2006 to 2011, given that the first papers on the issue of equivalence have only emerged very recently in the OSM community (Rungtusanatham et al., 2008).

Our initial assumption was that consideration of equivalence is not yet common practice in the field. In addition, we expected that in some cases where equivalence is tested, it may not have been explicitly described as such. Therefore, rather than using specific search terms for article selection, we manually checked all survey articles in the six journals. Whilst this approach was relatively time-consuming, it improved coverage compared with a keyword search. Starting from 4006 research papers published in *JOM, MS, DS, IJOPM, POM,* and *IJPR* between 2006 and 2011, we identified 465 studies that used a survey method. Of these, the majority came from *JOM* (144), *IJOPM* (131*), IJPR* (83)*,* and *DS* (60). Overall, fewer empirical papers are published in the other two journals; hence the relatively low number of survey articles in *MS* (29) and *POM* (18).

4.4.2. Coding the Articles

For each of the 465 survey-based articles, we noted basic descriptives such as title, authors, volume and issue, population and sample characteristics, unit of analysis, number and type of respondents, and the type of data analysis methods used. Three independent raters (members of the author team) then coded the articles based on the key issues concerning equivalence. First, we coded articles regarding the four key sources of heterogeneity emphasized in literature, as well as any additional source of heterogeneity indicated in the studies such as industry (stage A in Figure 4.2). Second, we coded the extent to which equivalence is designed and tested for (stages B and C in Figure 4.2). For all of these aspects, except for the additional sources of heterogeneity, we used binary codes (present/absent). For the additional sources of heterogeneity, we used text coding. Finally, for the short list of papers that actually performed equivalence tests, we used open coding in order to capture best practices related to dealing with partial and non-equivalence (stage D in Figure 4.2).

Two pilot studies were conducted to maximize inter-rater agreement on the coding. First, all three raters coded the survey articles published in the 2006 issues of JOM (volume 24). This resulted in an acceptable but not optimal inter-rater agreement; 80% of papers were consistently classified by all three raters (percentage method; Boyer and Verma, 2000). In a subsequent meeting with the three coders and the other co-authors, we discussed points of confusion or disagreement in the coding process. A second pilot was then carried out in which all three raters coded the survey articles published in the 2008 issues of JOM (volume

26). The inter-rater agreement in this round was over 90% (96% if only considering the crucial classifications (1) sources of heterogeneity and (2) presence and type of equivalence tests). Based on this high inter-rater agreement, the remaining articles from all three journals were assigned to and coded by one individual rater. Any remaining doubts were adjudicated on a case-by-case basis in a discussion between the three raters. Moreover, after finalizing the coding, random tests were done by other two members of the author-team only leading to minor changes.

4.5. PRIOR OSM SURVEY RESEARCH AND THEIR CONSIDERATION OF MEASUREMENT EQUIVALENCE

Our discussion of data equivalence issues as addressed by extant OSM survey research is organized around the four main stages of our framework.

4.5.1. Sources of Heterogeneity in the OSM Literature

A summary of the main possible sources of heterogeneity in the 465 OSM survey articles in *JOM, IJOPM, IJPR, DS, MS,* and *POM*, published between 2006 and 2011, is presented in Table 4.5.

We used information from the (at times very short) sections on data collection and information about author affiliation to deduce from which country/ies the data was collected. It is striking that 59 survey articles did not report explicitly from which country/ies the data was collected. Of the total sample of 465 survey articles, 88 studies (18.9%) pooled data from two or more countries/languages.

When multi-country surveys are carried out, there may be significant differences in cognitive and/or response processes between groups. Therefore, it is advisable to maximize equivalence prior to data collection and test for equivalence before data is pooled. This is particularly salient when countries exhibit very different cultural orientations.

Of the total sample of 465 survey studies, 221 studies (47.5%) pooled data from two or more respondent types. If we consider papers that did not explicitly state the number of respondent types, but where it is clear that there were respondents from different types of functional areas, we need to add another 177 studies to the list.

Table 4.5. Sources of heterogeneity in OSM survey research

	JOM	IJOPM	IJPR	DS	MS	POM	Total	% survey papers
Total number of survey papers	144	131	83	60	29	18	465	
Multiple countries/languages	26	32	16	6	5	3	88	18.90%
Multiple respondent profiles	72	42	52	35	15	5	221	47.50%
Multiple data collection methods	28	18	27	18	8	2	101	21.70%
Multiple sampling moments	4	4	0	4	3	0	15	3.20%
At least one source of heterogeneity	98	68	59	41	19	8	293	63.00%
At least two sources of heterogeneity	26	19	28	19	10	2	104	22.40%

Of the total sample of 465 survey studies, 221 studies (47.5%) pooled data from two or more respondent types. If we consider papers that did not explicitly state the number of respondent types, but where it is clear that there were respondents from different types of functional areas, we need to add another 177 studies to the list. Of the total sample of 465 surveys, 101 studies (21.7%) had data that came from more than one method of data collection and, 15 studies (3.2%) had data that came from multiple data collection moments. In sum, of the total sample of 465 survey studies, 293 (63%)— more than half—were found to have at least one of the four key types of potential data heterogeneity, and 104 (22.4%) had at least two forms of potential heterogeneity. The latter group of papers clearly represents a particularly high risk of non-equivalence when sub-group data is pooled for data analysis. Overall, the conclusion is that within OSM survey research, potential data heterogeneity is a widespread issue.

In addition, nearly all studies had one or more other sources of potential heterogeneity besides the main sources we have discussed. These sources include pooling data from different regions or provinces, different industries, and different organizational sizes. Moreover, studies with a contingency approach identified potential moderating variables, such as production process types, degree of technology turbulence, and ownership structures that might impact the causal relationships (i.e. the path model) discussed by the study. The same contingencies or control variables might point to non-equivalent measurement models. The studies differ in how far they considered measurement model equivalence prior to considering path model equivalence. We will come back to this point later.

Many of these additional potential sources of heterogeneity do not necessarily threaten measurement equivalence. Differences between sub-groups are often the subject of explicit

research interest and therefore not in themselves a problem, provided that sub-groups understand the questions in a similar way and respond to the questions in a similar way. It is up to the individual researcher(s) to identify any sources of heterogeneity that may threaten equivalence and consider ways to subsequently (1) minimize these threats prior to data collection and/or (2) test for equivalence across groups after data have been collected. We now examine the first of these two elements.

4.5.2. Maximizing Equivalence in the OSM Literature

During the design stage of the survey, researchers should actively try to maximize equivalence across the previously identified sub-groups in order to safely compare or pool data. In line with our developed framework, we focus on construct equivalence, translation equivalence, and data collection equivalence. The extent to which these issues are considered in the reviewed OSM articles with at least one source of heterogeneity is presented in Table 4.6. Not every study with one or several potential sources of data heterogeneity should have addressed each of these design issues, but the low number of papers addressing any of these issues (except regarding translation equivalence, which received more attention) strongly suggests that equivalence issues were not considered to a great extent in the survey design stage.

Table 4.6. Consideration of equivalence in the design stage of OSM survey research

Equivalence issues in design stage	Measures	JOM	IJOPM	IJPR	DS	MS	POM	Total
Construct equivalence	Literature review, use of validated surveys, focus groups and/or pre-tests in each respondent group	1	2	0	0	0	0	3
Translation equivalence	Back translation, Team approach	11	16	8	2	0	1	38
Data collection equivalence	Similar/systematic selection of samples, data collection procedures, timing of data collection	5	0	0	0	0	0	5

Note: The numbers in the cells refer to the number of papers that addressed a specific issue; one paper may therefore appear in more than one cell.

Of the 293 OSM survey articles with at least one of the four key forms of potential heterogeneity, only three articles reported on specific design steps for *construct equivalence* across groups, although not all did so very explicitly. In one of these three, Tan (2006) describes checking the consistency of indicators across the types of respondents and across data collection formats in the pre-test. Although similar discussions regarding pre-tests were evident in some papers, none discussed this issue in relation to respondent groups within the sample. In other words, maximizing construct equivalence across different countries or cultures, respondent types, data collection methods or times of data collection was almost universally ignored within the articles reviewed.

The issue of *translation equivalence* is most applicable to OSM researchers undertaking cross-country work. Where we identified 88 survey studies that collected data from multiple countries/languages, only 38 addressed translation equivalence[9]. Translation equivalence issues thus seem to be better addressed in OSM survey research than construct equivalence issues. We also found examples of "translations" within one language in order to reflect regional differences (e.g., Kull and Wacker, 2010). We did not identify any example of survey instruments translated for different respondent types, i.e. adapted to for instance service firms versus manufacturing firms, or private versus public organizations.

Only five articles discussed *data collection equivalence*, while we identified 101 survey studies with data collection method heterogeneity. Thus, the explicit attention of OSM survey researchers to data collection equivalence issues is very limited.

In the theoretical section we have reasoned that the identification of certain sources of heterogeneity requires attention to certain design decisions. For example, heterogeneity due to multiple data collection moments increases the need to pay attention to construct equivalence. In Table 4.7 we relate the main sources of heterogeneity of the reviewed studies to the design action(s) taken.

Having examined issues relating to equivalence in the design stage of reviewed OSM surveys, we now turn to the analysis stage. Here the focus is on testing for equivalence among

[9] We have to note here that 22 of these papers did not explicitly state that they addressed translation equivalence, but these papers use data collected through multi-country research collaborations for which translation equivalence actions have been described, *in casu* IMSS (Yang, Hong and Modi, 2011), HPM (Hallgren, Olhager and Schroeder, 2011) and GMRG (Kull and Wacker, 2010).

sub-groups to determine whether pooling of data or comparison of sub-groups is appropriate or not.

Table 4.7. Threats to equivalence and design actions taken

	Construct equivalence	Translation equivalence	Data collection equivalence
Multiple countries	0	38	0
Multiple respondent profiles	2	18	2
Multiple data collection methods	2	8	3
Multiple sampling moments	0	3	0

Note: The numbers in the cells refer to the number of papers that identified a specific threat and adopted certain design actions; one paper may therefore appear in more than one cell.

4.5.3. Testing Measurement Equivalence in the OSM Literature

Testing for measurement equivalence was highly uncommon in the OSM papers we reviewed. Of the 293 survey articles that had at least one source of data heterogeneity, only 17 tested for at least one type of measurement equivalence. Table 4.8 shows the types of tests performed by journal.

Table 4.8. Measurement equivalence tests performed per journal

Measurement equivalence tests	JOM	IJOPM	IJPR	DS	MS	POM	Total
Only configural	3	1	1	0	1	0	6
Only configural and metric	6	2	0	0	0	0	8
Configural, metric, and scalar	1	0	0	1	1	0	3
Total	10	3	1	1	2	0	17

Of the 17 papers, six papers performed only configural equivalence tests (using MGCFA or visual inspection of factor structures). We did not code *t* tests and ANOVA as evidence of a configural equivalence test, because these tests evaluate individual indicators and not consistency of factor structures across sub-groups. A positive outcome of the configural equivalence test still does not indicate that researchers may use the data for subsequent statistical data manipulation. In line with this latter argument, eight papers performed metric tests on top of the configural tests (Boyer and Hult, 2006; Kaynak and Hartley, 2006; Bou-

Llusar et al., 2009; Hult et al., 2006; Kaufmann and Carter, 2006; Cannon et al., 2010; Birou et al., 2011; Peng et al., 2011). These papers specifically aimed to contrast path models, and it is not necessary to proceed to the scalar equivalence test. Finally, three papers performed scalar tests on top of the metric and configural tests (Allred et al., 2011; Nyaga et al., 2010; Bagozzi and Dholakia, 2006). These papers aimed to pool data or compare means in addition to comparison of causal relationships.

Table 4.9. Sources of heterogeneity and measurement equivalence tests performed per journal

	JOM	IJOPM	IJPR	DS	MS
Multiple countries/cultures/ languages	Kaufmann and Carter (2006); Cannon et al. (2010); Power et al. (2010)		Schroeder et al. (2011)		
Multiple respondent types (individual traits)	Wouters et al. (2009); Nyaga et al. (2010)	Johnston and Kristal (2008)	Albadvi et al. (2007); Pagell et al. (2007)		Bagozzi and Dholakia (2006)
Multiple data collection methods	Boyer and Hult (2006); Hult et al. (2006)				
Multiple data collection moments	Kaynak and Hartley (2006)	Peng et al. (2011)		Allred et al. (2011)	Xu et al. (2010)
Multiple company types (company traits)	Boyer and Hult (2006); Hult et al. (2006); Prater and Ghosh (2006); Bou-Llusar et al. (2009); Zhang et al. (2011)	Birou et al. (2011)	Dowlatshahi (2011); Schroeder et al. (2011)		

Table 4.9 shows the same 17 studies but now in terms of the source of heterogeneity identified. Two studies (Boyer and Hult, 2006; Hult et al., 2006) appear twice in the table; they have performed equivalence tests in relation to two different sources of heterogeneity. There are other papers that also identify multiple potential sources of heterogeneity, but they perform only equivalence tests related to one criterion. Xu et al. (2010), for example, gather data before and after a critical event (the introduction of 3G technology) and point out that

understanding of key concepts of the study will be different before and after that moment. Nonetheless, they only test for equivalence across different respondent profiles.

Two studies adopted measurement equivalence tests due to cross-country data. Cannon et al. (2010) examined buyer-supplier relationships in the United States, Canada and Mexico. They clearly related the type of required equivalence (i.e. metric) with their research aim (i.e. compare causal relationships across countries). In a similar vein, Kaufmann and Carter (2006) compared path analyzes related to international supply relationships in Germany versus the USA, after establishing metric equivalence.

Five studies performed measurement equivalence tests because they involved different respondent types. Johnston and Kristal (2008) and Nyaga et al. (2010) compared causal relationships across different functions within the supply chain (buyers versus suppliers). The former study established configural equivalence and the latter study metric equivalence in that regard. Wouters, Anderson, Narus and Wynstra (2009) predicted differences between project leaders and cost analysts and conducted MGCFA, after which they found that they are indeed not able to pool the data. Bagozzi and Dholakia (2006) identified "level of experience" as a moderator of the relationship between Linux user groups´ social influence and its impact on the user´s participation. They went beyond the required metric equivalence test and established scalar equivalence before evaluating the moderating impact. Finally, Xu et al. (2010) tested configural equivalence across three different types of consumers in terms of the use of mobile platforms.

Three studies performed equivalence tests because of multiple data collection approaches. Hult et al. (2006) gathered data from two sampling frames (CSCMP and IMS) and established metric equivalence for 44 out of 58 indicators. They dropped the non-equivalent indicators from further analysis. Boyer and Hult (2006) varied both the sample selection (stratified versus random) as well as the administration mode (web based versus paper-and-pencil), and tested metric equivalence before pooling the data. Allred et al. (2011) pooled data gathered through different sampling frames, after establishing scalar equivalence.

Two studies performed equivalence tests because of multiple data gathering moments. Kaynak and Hartley (2006) gathered data on JIT purchasing in 1995 and 2000 in order to evaluate potential shifts in validity, reliability, unidimensionality, and equivalence of factor structure. Peng et al. (2010) collected data in two waves, and multiple countries, and

established metric equivalence of the sub-groups defined by the two moments of data collection.

Finally, seven studies performed equivalence tests because of multiple company types. Configural equivalence was tested for sub-groups based on firm size (Prater and Gosh, 2006); ISO-certification (yes/no) (Dowlatshahi, 2011); and industry (Zhang et al, 2011). Metric equivalence was tested across groups from manufacturing and service industries (Bou-Llusar et al., 2009), and groups based on strategy types (Boyer and Hult, 2006; Hult et al., 2006). Finally, scalar equivalence was tested by Birou et al. (2011) for Make-to-Order versus Make-to-Stock companies. These studies suggest that based on the research aim and setting, there can be specific sources of heterogeneity that go beyond the key sources already identified by extant literature. However, researchers should always provide sufficient specific reasoning as to why these sources might create differences in response functions of different groups for the particular concepts at hand.

4.5.4. Dealing with Partial and Non-equivalence in the OSM Literature

Overall, the reviewed studies present limited evidence of how researchers had dealt with results pointing out non-equivalence. There were three exceptions. Hult et al. (2006) dropped the non-equivalent indicators (14 out of a total of 58 indicators). Albadvi et al. (2007), on the other hand, evaluated the number of non-equivalent indicators versus the total number of indicators (6 versus 89) and concluded that the non-equivalent portion was small. Consequently, they retained the non-equivalent indicators. The latter study was not included in Tables 4.8 and 4.9, however, given that it used ANOVA to test for configural equivalence – an approach we do not recommend. Finally, Wouters et al. (2009) decided to not pool data because of configural non-equivalence, and proceeded with separate analyzes for each group.

4.5.5. Conclusions of the Literature Review

Our review indicates that while many survey studies in the OSM literature have at least one key source of heterogeneity in the data, the explicit attention to maximization of equivalence in the design stage and testing for equivalence in the analysis stage is minimal (with the exception of translation equivalence). Even in cases where some steps have been taken to test for data equivalence, studies rarely described how and why these tests have been carried out.

Our review also indicates that the most frequent source of heterogeneity in OSM research stems from company characteristics (e.g., firm size, industry, position in the supply chain), and deviates in that sense from other bodies of literature that emphasize sources due to different countries, personal demographics (e.g., gender, age), data collection methods and data collection moments.

From the reviewed studies we also distill some best practices that further refine our framework. First, it is good practice to perform multiple equivalence tests, when multiple threats to equivalence are detected (Hult et al., 2006; Buyer and Hult, 2006; Schroeder et al., 2011). Second, it is good practice to perform measurement equivalence tests for those sub-groups that are also expected to have different path models (Bagozzi and Dholakia, 2006). Third, it is desirable to be explicit on the type of analysis performed and why (comparison of causal relationships versus means). Cannon et al. (2010) provided an excellent example in that regard. Many OSM studies aim to compare relationships (in path models) and not means, and the most strict scalar equivalence test is therefore not required. Related to this issue is that readability increases greatly when researchers provide test statistics for each consecutive step, as in Kaufmann and Carter (2006). Fourth, few studies explicitly include a discussion on the operationalization of complex concepts, through intuitive concepts and then into indicators, and the induced "unique component". Kaynak (2006) is a valuable exception in that regard. They uncover (unfortunately only after data collection) that the error terms of training and employee relations are correlated (p. 884) and consequently suggest that including more specific indicators could avoid the conceptual shift inherent to the "unique component". Finally, a good practice in dealing with non-equivalence is to repeat the substantial analysis per group, present the results per group, and discuss inferences from a within-group perspective (Rungtusanatham et al., 2008, Wouters et al., 2009).

4.6. DISCUSSION AND CONCLUSIONS

This paper aims to foster awareness of the importance of measurement equivalence among Operations and Supply Management scholars undertaking survey research. Surveys now represent a widely used form of research in our discipline and consequently it is important to continually explore ways to improve the quality of this form of empirical work.

In many survey studies, the dataset contains data from distinct groups, often defined by differences in country/culture/language, respondent type, methods of data collection or times of data collection (Hult et al., 2008; Rungtusanatham et al., 2008; Vandenberg and Lance, 2000). If individuals within different groups have fundamentally different mental models and thus understand a survey and respond to a survey in systematically different ways, data from such groups is not equivalent and should not be compared or pooled, and differences/similarities across groups may be illusory.

The importance of paying close attention to measurement and measurement equivalence issues is strongly increasing, mainly because the risk of data heterogeneity is growing. This is due to the increased tendency of researchers to compare or at least combine in their studies different countries, different sectors, different firm sizes or different types of respondents. Sometimes the motivation for doing so is to indeed compare and contrast; at other times the motivation is to extend the potential external validity of a study. It is also due to the growing international collaboration between researchers in data collection. For survey analysis to have high power and build upon techniques such as SEM and CFA, the sample size required is often so large as to make it impractical for an individual researcher to undertake a study (Bollen, 1989; Schmidt, 1996). This has led to significant growth in collaborative multi-institution survey studies, where each institution is responsible for a proportion of the total data collection effort. These multi-institution studies thus may introduce additional potential sources of heterogeneity across groups, which should be considered carefully during research design and data analysis.

Another, more pragmatic reason why the importance of paying close attention to measurement and measurement equivalence issues is strongly increasing, is the growing awareness of the negative consequences of non-equivalence in other management research fields. Operations and Supply Management research will have to catch up, in that respect. This is not easy, given the complex trade-offs between equivalence maximization and pragmatic considerations in survey design, but the tools are becoming more and more accessible, such as the opportunities for more advanced equivalence testing through SEM.

In the context of these challenges, our paper makes two contributions. First, based on a review of the recent OSM literature, it demonstrates the current limited attention to equivalence issues when researchers pool or compare data from transparently different

groups. More precisely, the coding of 465 survey research articles in six leading OSM journals over the six-year period 2006-2011, showed that 63% of these articles were found to have at least one type of potential data heterogeneity and 22.4% had at least two forms of heterogeneity. The coding also showed that only three studies considered maximization of construct equivalence, 38 studies considered maximization of translation equivalence and five studies considered maximization of data collection equivalence prior to data collection. The coding also indicated that not more than 17 studies analyzed equivalence once data were collected.

Initial attempts to test for equivalence have been based on EFA rather than on the superior CFA. Only recently has the OSM community started to appreciate and use the CFA method (Shah and Goldstein, 2006). It is interesting to note that OSM researchers especially perform equivalence tests when heterogeneity is detected based on different company traits (e.g. different groups based on the degree of environmental uncertainty, as in Koufteros et al. (2005)). Other academic disciplines have rather focused on heterogeneity due to different individual traits, countries/languages, data collection methods, or data collection moments. Finally, there were only three studies that indicated how they dealt with non-equivalent and/or partial equivalent test outcomes.

As a second contribution, and to help those OSM academics looking to improve the quality of their research in relation to equivalence, we provide a comprehensive framework showing ways to identify possible sources of heterogeneity, maximize equivalence during design; test for equivalence post data collection; and deal with partial or non-equivalence. The acknowledgements of three kinds of measurement error and the related distinction between cognitive and response processes constitutes the thread throughout the outlined stages of our framework.

Within the identification stage of survey research, we recommend researchers to ask two questions. First, is there a reason to suspect that respondents from the different groups *understand* a survey question in a different way? If so, cognitive processes may be non-equivalent. Second, is there a reason to suspect that respondents from the different groups *express* themselves in a different way? If so, response processes may be non-equivalent.

Within the design stage of survey research, we emphasized the importance of construct equivalence, translation equivalence of content as well as form, and data collection

equivalence. Most design actions mitigate the threat to equivalence of both cognitive and response processes. But, we reason that construct equivalence especially maximizes equivalence of cognitive processes, and that translation of form equivalence especially maximizes equivalence of response processes. Construct equivalence should be considered and maximized for each of the identified groups. This is only done exceptionally (Douglas and Craig, 2006). Moreover, we invite researchers to critically reflect upon the used complex concepts and their translation into intuitive concepts (Blalock, 1990; Northrop, 1947; Saris and Gallhofer, 2007; Scherpenzeel and Saris, 1997; Van der Veld, 2006) before thinking in terms of indicators. This practice does not only apply for newly developed concepts but also for those concepts that are already circulating in published studies. Several concepts are portrayed as intuitive, while in our opinion they are complex, as exemplified by the example of knowledge scanning in section 2.1. Consequently, the indicators proposed to reflect the concept are rather heterogeneous with a higher risk of decreased construct validity in any survey study (Saris et al., 2013) but even more so in multi-group survey studies (Alwin, 2007). Translation equivalence may be maximized by a team approach to translation (Douglas and Craig, 2006; Harkness et al., 2007; Jowell et al., 2007) versus the more commonly used translation/back-translation approach. Once the source document has been centrally developed, the local versions should pay attention to the translated *form* (e.g. the use of fixed reference points of the response scale, Saris and Gallhofer, 2007) besides the translated *content*. Data collection equivalence should be maximized in the design stage, but when practical restrictions induce heterogeneity in this regard (Kish, 1994), equivalence should be tested after data collection.

Within the testing stage we recommend a bottom-to-top approach of the three key tests: configural, metric and scalar equivalence (De Jong et al., 2007; Horn et al., 1983; Nye and Drasgow, 2011; Meredith, 1993; Steenkamp and Baumgartner, 1998). In order to acknowledge cognitive and response processes within the measurement model, we recommend a second-order factor structure and provide clues regarding identification issues (Saris and Gallhofer, 2007). When response processes are nonequivalent, the researcher can control for this aspect and still compare cognitive processes; i.e. perform a less restrictive test and use the data more productively. When cognitive processes are nonequivalent, on the other hand, the data cannot be used across groups.

Within the decision stage, we outline three potential actions to take in case of non-equivalence: (1) Assess to what extent partial equivalence exists and how to deal with non-equivalence indicators, (2) Make sense of non-equivalence, or (3) Exclude the non-equivalent group(s) from substantive analyzes.

In the face of the increased risk of data heterogeneity and the growing awareness of the importance of measurement equivalence, we hope this proposed framework and our review of the literature will help to raise the awareness of the importance of measurement equivalence, and to further increase the methodological rigor of OSM research.

Chapter 5

AN EXPLORATORY ANALYSIS OF THE RELATONSHIP BETWEEN PURCHASE CATEGORY STRATEGIES AND SUPPLY BASE STRUCTURE

5.1. INTRODUCTION

The importance of successful supply base management as a strategic tool to achieve competitive advantage is widely acknowledged both in practice and research (Monczka et al., 1993; Gadde and Håkansson, 1994; Tan et al., 1998; Choi and Krause, 2006; Holmen and Pedersen, 2007). The changing role of purchasing from a clerical function to a more strategic function (Watts et al., 1992, Carter and Narasimhan, 1996; González-Benito, 2007; Schoenherr et al., 2012) contributed to a great extent to the increased emphasis on supply base management. A supply base can be defined as "the total number of suppliers that are actively managed by the focal firm, through contracts and purchase of parts, materials and services" (Choi and Krause, 2006, p.639). One of the most important strategic choices in purchasing is developing a supply base that supports the purchasing strategy (Gadde and Håkansson, 1994, Monczka et al., 1998). Das and Narasimhan (2000) call this "purchasing competence" which they define as "the capability to structure the supply base in alignment with the manufacturing and business priorities of the firm".

Supply base structure can be defined by examining several characteristics of the supply base such as the number of suppliers, the degree of differentiation of suppliers, and the degree to which they relate to one another (Gadde and Håkansson, 1994, Choi and Krause, 2006; Holmen and Pedersen, 2007). Among these dimensions, the size of the supply base has been investigated the most, often under the topic of 'supply base reduction/rationalization' (e.g. Cousins, 1999; Narasimhan et al., 2001; Ogden, 2006). Interestingly, there have not been many studies which examine multiple dimensions of the supply base structure, especially in relation to purchasing strategies and purchasing performance. Being among these few studies, in their conceptual paper Choi and Krause (2006) discuss how supply base structure/complexity might have consequences for various dimensions of purchasing performance such as transaction costs, responsiveness, and innovation. However, there is a dearth of empirical evidence about whether purchasing managers explicitly consider supply base structure in a holistic way (Choi and Krause, 2006), and more importantly, in what ways the focus on different purchasing objectives, such as cost versus innovation, have an impact on the supply base structure. There is also a scarcity of empirical research that investigates the performance implications of different supply base structures.

As firms have a huge variety of purchased products and services ranging from critical raw materials to office supplies, from spare parts to transportation services, they have many suppliers which form their overall supply base. However, it seems plausible to argue that in line with the variety and different volumes of purchase categories firms have, they also have different supply base structures for each of these purchase categories (Homburg and Kuester, 2001; Trautmann et al., 2009; Luzzini et al., 2012). Although many purchasing portfolio models have been developed to investigate the variety in purchase categories (e.g. Kraljic, 1983; Olsen and Ellram, 1997; Bensau, 1999), such models mostly focus on generic purchasing strategies – such as assurance of supply for bottleneck items and developing strategic relationships with suppliers for strategic items – and do not provide detailed recommendations regarding the various supply base structure dimensions for successful management of the various types of purchase categories.

According to Monczka's well-known strategic purchasing processes model (Monczka, 2005) structuring the supply base is the next step after developing commodity (purchase category) strategies. One way to classify purchasing strategies is to focus on the emphasized

competitive priorities such as cost, quality, delivery, flexibility, and innovation (Watts et al., 1992; Krause et al., 2001; González-Benito, 2007, 2010). Although firms might have an overall purchasing strategy, purchasing objectives differ across the different types of purchases (Cousins et al., 2007; Terpend et al., 2011; Luzzini et al., 2012). Whereas some purchase categories are managed for lower costs, others are managed for differentiation and innovation, which impacts the firms' supplier selection, and thus the structure of the supply base. For instance, while a firm pursues cost-efficiency in buying a certain type of raw material and searches for multiple suppliers offering the lowest price, for another purchase category which is critical to the technology of the end product the firm might be willing to pay extra for the suppliers who provide the most innovative products, or have a smaller supply base for that purchase category in order to foster more intense collaboration. There have been some studies investigating the link between cost objectives and the number of suppliers (e.g. Berger et al., 2004; Burke et al., 2007), but to the best of our knowledge neither the other purchasing objectives nor the other supply base structure dimensions have been examined in a comprehensive way, and in relation to each other.

We acknowledge that based on competitive priorities, there can be many purchasing strategies; however, cost leadership and product innovation strategies have been cited by many as the two key purchasing strategy types that are usually associated with different governance needs and purchasing practices (David et al., 2002; Baier et al., 2008; Terpend et al., 2011). As the traditional focus of purchasing was on cost reduction (Carter and Narasimhan, 1996; Zsidisin et al., 2003), it can be stated that firms are more experienced in structuring their supply base for cost leadership purchasing strategy. Therefore, it is especially interesting to examine how a purchasing strategy focused on innovation impacts the supply base structure. Despite the vast number of studies about supplier involvement in innovation, the unit of analysis was mostly on the new product development project level (Corsten and Felde, 2005; Handfield et al., 1999; Ragatz et al., 1997, 2002), and the literature currently lacks an understanding of what is an effective supply base structure for a purchase category managed with a product innovation strategy.

As a response to the research gaps identified above, in this study we examine the link between purchasing strategies, supply base structure, and purchasing performance at the purchase category level. In the first study of this thesis, we had found that the same purchase

category strategy can be effectively implemented under different supply market conditions, suggesting the need to investigate these two concepts in combination. For instance, we found that product innovation strategy is implemented not only in the strategic (high supply risk, high importance), but also in leverage (low supply risk, high importance) and bottleneck (high supply risk, low importance) items. Additionally, it can be argued that the supply base structure is also highly related to the overall supply market structure (e.g. availability of suppliers). Therefore, we also investigate supply market characteristics in order to control for the effects of this alternative mechanism explaining the variation in supply base structures. In line with these, we define three research questions to be examined:

- In what ways does a focus on cost leadership or product innovation purchase category strategy impact the supply base structure?
- Which supply base structure dimensions affect purchase category performance when implementing a cost leadership or a product innovation strategy?
- What is the effect of supply market characteristics on the relationship between purchase category strategy, supply base structure, and purchase category performance?

In the next section, we first discuss the different dimensions of the supply base structure concept, and where available we refer to the previous studies that suggest links between these dimensions, cost leadership or product innovation strategies, and purchasing performance. There is hardly any research on this topic, the supply base structure concept is not very well developed, and we are more interested in understanding "why" and "how" the investigated concepts are related or not. Therefore, we adopt an exploratory approach and use the multiple case study method (Yin, 1994; Voss et al., 2002; Barratt et al., 2011). In the Research Methods section, we elaborate on the case selection criteria, data collection details, how we handled the validity and reliability issues, and the case study protocol and measurement. We analyze the results by means of both a within-case and a cross-case analysis. We finish the paper by discussing the results, arriving at some propositions, and suggesting avenues for future research.

5.2. DEVELOPING THE SUPPLY BASE STRUCTURE CONCEPT

Supply base structure was first coined as a term by Gadde and Håkansson (1994) who discussed it as one of the three most strategic issues in purchasing (i.e. make-or-buy, supply base structure, customer-supplier relationships). They stated that "[The] issues regarding the supply-base structure can be divided into two strategic aspects: one has to do with the number of suppliers, the other with the way suppliers are organized" (p. 29). Later, in their conceptual paper, Choi and Krause (2006) broadened this definition, suggested a slightly different name for the construct (i.e. supply base complexity instead of supply base structure), and provided the following definition: [T]he degree of differentiation of the focal firm's suppliers, their overall number, and the degree to which they interrelate" (p.637). They argued that "[w]hether contemporary supply managers explicitly think in terms of supply base complexity, or not, we propose that it affects transaction costs, supply risk, supplier responsiveness, and supplier innovation" (p.638). The majority of the studies which we build on investigate the overall supply base structure. However, we should stress once more that different than those studies, we investigate supply base structure at the purchase category level.

It has been argued that the size and shape of the supply base are becoming increasingly important issues (Holmen and Pedersen, 2007), but the main focus has been on the number of suppliers. However, as the above definitions suggest, there are other attributes of the supply base structure. In the next sub-sections, we will comment on each of these dimensions.

5.2.1. The Number of Suppliers and the Sourcing Mode

Having the right number of suppliers in the supply base has been a major consideration of firms for a long time (Richardsson, 1993; Gadde and Håkansson, 1994), and "reducing the supply base" was on the agenda of many firms due to some advantages it is argued to offer such as volume discounts, lower administration costs, and improved quality and coordination (Lemke et al., 2000).

Choi and Krause (2006) argue that even though decreasing the number of suppliers may be beneficial in terms of transaction costs, it may result in lower supplier innovation. They state that having many suppliers is more beneficial in terms of innovation for two reasons. First of all, each additional node a firm has access to can serve as an information-processing

mechanism to identify innovative solutions. Second, a low number of suppliers mean increased reliance on suppliers and this can lock the buying company into these certain suppliers and their technologies. On the other hand, Koufteros et al. (2007) argue that a smaller supply base enables more collaborative relationships with suppliers and closer ties that lower doubts about opportunistic behavior and increase sharing of valuable information. They add that as a smaller supply base means increased volumes for the remaining suppliers, this might increase the motivation of suppliers and their willingness to invest in technologies and get involved in new product development activities. Interestingly, they find that a smaller supply base has a positive impact on joint development projects (grey-box integration), but has no effect on projects where suppliers carry out their own development of components for the customer (black-box integration).

An important strategic purchasing decision is the selection of an appropriate number of suppliers for each product purchased (Faes and Matthyssens, 2009; Svahn and Westerlund, 2009). Richardsson (1993) states that there are several types of sourcing modes such as single sourcing, dual and parallel sourcing, and multiple sourcing. Firms mostly consider cost while choosing a particular sourcing mode (Choi and Krause, 2006). However, selection of a sourcing mode also impacts innovation performance (Sako, 1994; Corsten and Felde, 2005).

Single sourcing, where there is only one supplier for a particular good or service, might create an environment in which it is easier to exchange ideas (Cousins et al., 2007). Additionally, it enables the buying firms to invest in a collaborative relationship with the supplier, which encourages more commitment and innovation from the supplier's side (Gadde and Snehota, 2000). Faes and Matthyssens (2009) argue that single sourcing is the best sourcing strategy in innovative technology contexts where expertise is required. On the other hand, it might also restrict the buyer's flexibility to acquire new technologies and innovations existing in the wider supply network (Cousins et al., 2007). Greater dependence of a buyer onto a single supplier ties up the buyer's resources (Walter et al., 2003) and diminishes its capabilities to develop, specify, and evaluate new technologies, a dynamic which may eventually deteriorate a buyer's innovativeness (Sako, 1994; Corsten and Felde, 2005; Nordin, 2008).

There seems to be some sort of consensus that in multiple sourcing the focus is on costs and it is suitable for low levels of technological competence (Cousins et al., 2007). The

objective is to create bargaining power in order to drive down prices (Homburg and Kuester, 2001). Multiple sourcing is also useful as a hedge against the supply disruption risk (Homburg and Kuester, 2001). However, Newman (1989) warns that price is only one of the costs affected by competition, and that there can be more indirect costs associated with multiple sourcing. In order to balance the counter-effects of both single and multiple sourcing, an alternative is to do dual sourcing. Another related sourcing mode suggested in the literature is parallel sourcing where the components are single-sourced, but the buyer maintains at least two suppliers that are capable of delivering the same component (Dubois and Frederiksson, 2008). Such settings increase the competition between the suppliers, but Cabral et al. (2006) warns against too much competition which might negatively impact innovations by reducing the incentives to innovate, as in the case of a leading supplier which has a strong advantage on other suppliers.

5.2.2. Heterogeneity of the Suppliers

Choi and Krause (2006) define differentiation of suppliers as "the degree of different characteristics such as organizational cultures, operational practices, technical capabilities, and geographical separation that exist among the suppliers in the supply base" (p.642). We prefer to call this characteristic of the supply base the heterogeneity of suppliers which basically indicates how dissimilar the suppliers in the supply base are. Choi and Krause (2006) state that a high level of supply base heterogeneity negatively impacts cost performance as it brings extra coordination costs and operational burden to manage very different suppliers.

While supply base heterogeneity can be detrimental to cost strategies and cost performance, suppliers having similar capabilities and operating in similar industries and environments might lack the diversity of knowledge required for innovation (Choi and Krause, 2006). Even the different locations of suppliers need to be considered as a heterogeneity factor impacting innovation. Whereas suppliers in the proximity of the buyer might be more advantageous in terms of easier communication and sharing of sticky knowledge (Roy et al., 2004; Schiele, 2007), global suppliers might also contribute positively to innovations with their diverse backgrounds, especially when they interact with each other. Relative size and type of the suppliers can be another factor impacting the heterogeneity in the supply base. Whereas some firms prefer to have large suppliers in order to benefit from their

technical capabilities and infrastructure, there are also cases where small, minority-owned businesses help firms to develop cutting-edge products. On the other hand, firms might have coordination and control problems with a heterogeneous supply base where there are many companies with different culture and work norms (Choi and Krause, 2006), which might also impact success of collaborative innovation generation processes.

5.2.3. Interaction between the Suppliers: Competition versus Collaboration

The last supply base structure mentioned by Choi and Krause (2006) is the interaction between the suppliers. Wynstra et al. (2003) point out that relationships between two firms cannot be considered in isolation from relationships with and between other firms. Two ways of interaction between suppliers can be specified: cooperation and competition. The traditional view in purchasing is that there should be a high level of competition between the suppliers, which results in more advantageous prices (Gadde and Håkansson, 1994). Competition between the suppliers is not only believed to result in a higher cost performance for the buying firms, but it can also contribute to the innovation performance. Cabral et al. (2006) argue that if past procurement was not very competitive, this could work; but if procurement is already highly competitive and the leading supplier has a strong advantage on followers, a further increase in competition may reduce other suppliers' incentives to innovate.

Competition is not the only form of interaction between suppliers. Increasingly, more and more collaboration between suppliers takes place with or without the intervention of the buying firms (Dubois and Gadde, 2000, Choi and Krause, 2006). Sobrero and Roberts (2002) argue that in product development projects if two suppliers supplying the same focal company exchange technological information and commit their resources for joint activities, the likelihood of achieving innovation increases. However, Choi and Krause (2006) state that after some point, the interrelationships that occur between suppliers without the intervention of the focal company would result in a high autonomy of the suppliers which in turn may lead to anarchy and disintegration of coherent activities and harm innovative thoughts.

5.2.4. Relationship and Contract Duration

In addition to the three supply base structures discussed by Choi and Krause (2006), we also investigate relationship and contract duration as a fourth dimension. In their overall portfolio

firms have short-, medium-, and long-term relationships with their suppliers. It is argued that short-term relationships are most suitable for low value, small volume purchase items, usually implemented together with multiple sourcing (Gadde and Snehota, 2000). Short-term relationships are also often associated with cost and price reduction strategies (Cousins, 2002).

Long term relationships, on the other hand, are often associated with product innovation strategies. It has been extensively discussed in literature that firms should engage in long-term relationships with their suppliers enabled by trust and commitment in order to increase suppliers' collaboration with the buying firm for innovation (Handfield et al., 1999; Sobrero and Roberts, 2001; Corsten and Felde, 2005). There have been opposing views as well which argue that new suppliers are needed to boost innovation performance, as a supplier already "inside" the company may not have the incentives to innovate (Handfield et al, 1999) or firms might need new suppliers in conditions of technological uncertainty, i.e. radical innovation (Primo and Amundson, 2002).

We should note that there is a difference between relationship and contract duration. Although there is a long term relationship between the buying firm and the supplier, it could be the case that short-term contracts are used for different reasons (Gadde and Snehota, 2000). Some reasons for that are supply market conditions or the intention to "keep the suppliers on their toes". Short-term contracts are based on price-driven negotiations, and the uncertainty about future business is likely to decrease supplier commitment in more value-adding activities such as innovations (Speakman, 1988). While short-term contracts are used mostly for price reduction, long-term contracts are also argued to be beneficial for cost objectives as they substantially reduce the cost uncertainties and provide an incentive for the supplier to lower prices so as to secure the sale (Peleg et al., 2002).

5.2.5. The Level of Supplier Information Sharing

The final supply base structure dimension we examine in this study is the level of supplier information sharing. Supplier information sharing is defined as "the extent to which the supplier openly shares information about the future that may be useful to the customer relationship" (Cannon and Homburg, 2001, p. 32). Swink et al. (2007) consider three types of supplier information sharing: financial, operational, and technical.

Cannon and Homburg (2001) predicted that more information sharing of the suppliers would decrease the costs of the focal firm, but they failed to find empirical support for this proposition in their study. Kamath and Liker (1994) argue that in joint innovations with the suppliers, the buying firms should encourage two-way information sharing. In order to secure the continuity of information exchange, purchasing managers should arrange periodical meetings with important suppliers to evaluate on-going business and discuss potential future developments in terms of new technologies (Wynstra et al., 2003). Although the benefits of the level of supplier information sharing can be accumulated in both cost leadership and product innovation strategies, currently there is not a lot of research on this topic.

5.3. THE ROLE OF SUPPLY MARKET AND CATEGORY CHARACTERISTICS

Understanding the supply market from which the purchases are made is amongst the most important tasks of purchasing professionals. Therefore, many purchasing portfolio models have been developed in the literature with the aim to classify various purchases of firms with different supply market characteristics[10] (Caniëls and Gelderman 2007; Terpend et al., 2011, Luzzini et al., 2012). Among these portfolio models, the most influential one was proposed by Kraljic (1983), and this model classifies purchase categories based on two factors: supply risk and purchase importance. Based on these two dimensions, he defined four types of purchases: non-critical (low risk, low importance), bottleneck (high risk, low importance), leverage (low risk, high importance), and strategic (high risk, high importance). He suggested a focus on efficiency for non-critical items, the assurance of supply for bottleneck items, competitive bidding for leverage items, and strategic partnership for strategic items. His model also inspired many other, similar portfolio models (e.g., Caniëls and Gelderman 2007; Olsen and Ellram, 1997) that are widely adopted in practice (Gelderman and van Weele 2005; Pagell et al. 2010).

In Chapter 2, we investigated how our purchasing strategy taxonomy developed based on competitive priorities (i.e. cost, quality, delivery, innovation, and sustainability) relates to the Kraljic (1983) matrix. We found that multiple purchase category strategies can be effectively

[10] When assessing supply market characteristics and the impact of supply market on purchasing strategies and practices, we build on the "risk" perspective adopted in several earlier studies (e.g. Gelderman and van Weele 2005; Zsidisin et al., 2004).

implemented within the same quadrant, and the same purchase category strategies can also be effectively implemented in various quadrants of the portfolio model. These results suggested that neither an analysis solely based on supply risk and purchase importance nor an analysis based on competitive priorities is sufficient to examine purchase category strategies, and that they have to be examined in tandem. Supply risk does not only relate to the purchase category strategies, but it also affects to some extent the supply base structure. For example, although a firm might prefer to engage in multiple sourcing when implementing cost leadership strategies, a limited number of available suppliers might make this impossible. In sum, supply market and category characteristics can be considered as an alternative mechanism explaining the variability in supply base structures. Therefore, in order to investigate the link between purchase category strategies and supply base structure, we also examine supply risk and purchase importance as mentioned by Kraljic (1983).

5.4. RESEARCH DESIGN

5.4.1. Case Study Methodology

In this study, we use detailed case studies of 13 purchase categories from two international food and beverages companies to build theory on the relationship between purchase category strategies, supply base structure, and purchase category performance. Barratt et al. (2011, p.329) define case studies as "an empirical research that primarily uses contextually rich data from bounded real-world settings to investigate a focused phenomenon". Multiple case studies is the preferred research strategy when there is little theory available about the investigated phenomena and also when the definition of the concepts are not clear (Yin, 1994; Voss et al., 2002). As the concept of supply base structure is not very well developed and there is a lack of research investigating the relationship between purchasing strategies and supply base structure at the purchase category level, the use of case studies in this research seems more appropriate than using other research methods such as surveys. Additionally, we are not interested in merely finding a relationship between these concepts, but also understanding "why" such a link exists, which is best explained by the richness of detailed case studies (Yin, 1994; Voss et al., 2002; Barratt et al., 2011). In the next sections, we elaborate more on case selection, data collection, validity and reliability issues, and measurement.

5.4.2. Case Selection Criteria

Before discussing the case selection criteria, it is useful to emphasize once more the unit of analysis in this study (Yin, 1994; Barratt et al., 2011). Our unit of analysis is the purchase category, which we define as "a homogenous set of products and services that are purchased from the same supply market and have similar product and spend characteristics" (Cousins et al., 2007; Van Weele, 2010). Organizations have various purchase categories that might range from raw materials to services, from indirect materials to capital expenditures.

As the purpose of our case studies is not achieving statistical replication, defining a representative sample out of a population is neither required nor desired (Eisenhardt, 1989; Meredith, 1998, Barratt et al., 2011). Considering the huge variety in purchase categories across organizations, in order to control for industry effects we decided to focus on a single industry and chose the food and beverages industry as our context. Additionally, in order to control for the impact of possible unobserved variables at the organization level, we decided to collect data at more than one company. We contacted three companies operating in the food and beverages industry globally, with a case study protocol indicating the purpose of the study, research questions, deliverables, and data collection tool. Two of them accepted to be part of the study, and the third one kindly declined our proposal due to lack of time at their organization and some major changes they were going through.

In our sampling approach we aimed for both theoretical and literal replication (Miles and Huberman, 1994, Yin, 1994; Sousa and Voss, 2001; Stuart et al., 2002). In line with our research question of whether different supply base structures are required for successfully managing different purchase category strategies, first of all we identified four "polar type cases" based on two dimensions: i) purchase category strategy (cost leadership versus product innovation), and ii) purchase category performance (successful versus less successful cases). We examined all four types in our study in order to verify whether contrasting results occur across contexts, thus allowing for theoretical replication. Additionally, we examined multiple cases for each configuration in order to verify whether similar results occur for multiple cases in each configuration, thus allowing for literal replication. As ingredients and packaging purchase categories constitute the majority of the purchasing spend in a food and beverage company, we focused on these purchase categories in our data collection. In each but one combination of strategy type and success, we had both ingredients and packaging purchase

categories. Two companies were represented equally in each but one strategy type and success combination.

We chose the cases based on detailed discussions in our initial meetings with the main contact person (the Procurement Director) in both case study companies. We first gave the main contact persons a document listing the main purchasing objectives for cost leadership and product innovation strategies. This document also included information about how to assess purchase category performance (See Appendix). After 60-90 minutes discussions, the contact persons proposed purchase categories which are managed with a cost leadership or product innovation strategy. We acknowledge that both strategies can be implemented in some purchase categories; therefore, we also requested the contact persons to select purchase categories where there is clearly more emphasis on one of these purchase category strategies. They also distinguished between successful and less successful projects, defined as success in achieving the purchasing objectives of that particular purchasing strategy. In the end, we identified 13 purchase categories to be examined in this study, which are illustrated in Table 5.1. For each purchase category, the contact person identified an informant with knowledge of how that category is managed. These informants were typically category managers/leaders, and in a few cases category buyers.

Table 5.1. Cases examined in this study

	Successful	**Less successful**
Cost leadership strategy	LIQPACK (P) PET (P) PHOSPHATES (I) ADJUNCTS (I)	GLASS (P) INDPACK (P)
Product innovation strategy	CARTONS (P) FLAVORS (I) COMPOUNDS (I)	CANS (P) MULTIPACKS (P) COCOA (I) CULTURES (I)

(P): Packaging, (I): Ingredients

We validated the above classification by also asking each informant questions about their purchase category strategy and purchase category performance (both in the questionnaire and in the interviews). The answers of the informants were highly in line with the original classification. However, it became clear that in two purchase categories that were originally classified as being managed with a product innovation strategy – CARTONS and CANS – cost leadership strategy objectives were also as heavily exercised, therefore somewhat differentiating these purchase categories from the others classified as being managed with mostly an innovation focus. We did not discard these purchase categories from our analysis as they provide interesting insights which we discuss in detail in later parts of this paper.

5.4.3. Data Collection, Validity and Reliability

We conducted 19 interviews, mostly during the period of March-July 2012. Appendix C indicates the details about the interviews such as the interviewee information, interview date, and interview types. Some of these interviews were initial meetings with the main contact persons in the case companies, and some of them were meetings to discuss the preliminary findings.

We relied on single informants for each purchase category. Combining multiple perspectives is argued to be a superior approach (Voss et al., 2002; Gibbert et al., 2008); however, it was not feasible in our study due to limited available time of the purchasing personnel in the case companies. Additionally, some of the purchase categories were only managed by one person. In order to overcome the effects of potential respondent bias, we paid special attention to the wording of the questions and avoided personal questions (Cui et al., 2011). Furthermore, we triangulated our data. We first sent an online questionnaire, then conducted semi-structured interviews not just to answer "why" and "how" questions, but also to check for if there is any inconsistencies. This also allowed us to combine both qualitative and quantitative data. Where possible we relied on company documents (e.g. presentations about supply market analyzes, spend trees). Additionally, the majority of our interviewees were purchase category leaders and managers, thus indicating that the interviewees were highly knowledgeable about the purchase categories.

Just like any other type of research strategy, case studies should also be conducted with rigor, and highest levels of validity and reliability must be assured (Stuart et al., 2002, Voss et

al., 2002; Gibbert et al., 2008; Barratt et al., 2011). Following the suggestions of Stuart et al. (2002), Voss et al. (2002), Gibbert et al. (2008), Yin (2009), and Barratt et al. (2011), we took various measures to improve the validity and reliability of our case studies. Table 5.2 provides both definitions of validity and reliability types, and also the measures we took in this study.

Table 5.2. Validity and reliability measures undertaken in this study

Validity and reliability types	**Measures**
Construct validity: *"the extent to which correct operational measures are established for the concepts being studied"*	• Data triangulation using multiple sources of evidence: semi-structured interview and questionnaire data • Pre-testing the interview questions with company research project leaders • Having key informants review the interview transcripts • Presentation of the initial findings to company research project leaders, and implementing changes if necessary after feedback
Internal validity: *"the extent to which causal relationships can be established whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships"*	• Use of conceptual framework • Testing rival explanations
External validity: *"the extent to which the findings of a study can be generalized to a bigger population"*	• Use of multiple case studies by theoretical and literal replication
Reliability: *"the extent to which the operations of a study can be repeated with the same results"*	• Developing a detailed case study protocol indicating the study purpose, main constructs and definitions, interview questions, and the questionnaire. • Transcribing the interview data • Developing a case study database indicating the case descriptions and key information, and summary of within-case and cross-case analyzes

Adapted from: Yin (2009)

5.4.4. Measurement

In this study we used two types of data collection tools: an online questionnaire and semi-structured, face-to-face interviews. The purpose of the questionnaire was to gather initial information about the key concepts whereas the interviews were mostly dedicated to "why/how" questions. The sequential data collection approach also allowed us to focus more on unexpected answers and seek for explanations for confusing and/or intriguing observations.

We investigated two main concepts in our data collection: supply market characteristics and supply base structure for the chosen purchase categories. We define a supply base as "the portion of a supply network that is actively managed by a buying company (Choi and Krause, 2006, p. 637)". Supply market characteristics and supply base structure are therefore related, but not the same concepts. While the main focus of our study is on "supply base structure", examining it independently from the overall supply market characteristics would have been misleading. Additionally, we also assessed the original classification of the cases by also asking the respondents questions about the purchase category strategy and purchase category performance.

We measured these concepts in both a quantitative (questionnaire) and a qualitative (interviews) way. In the next sub-sections, we elaborate more on the measurement.

Supply risk and purchase importance

One of the highly used purchase category classification systems by many companies is the Kraljic (1983) matrix. In his seminal paper, Kraljic (1983) proposed a purchasing portfolio model based on two contingencies, purchase importance and supply risk, and defined four types of purchase categories: strategic, leverage, bottleneck, and non-critical. He suggested a focus on efficiency for non-critical items, the assurance of supply for bottleneck items, competitive bidding for leverage items, and strategic partnership for strategic items. His model also inspired many other, similar portfolio models (e.g., Caniëls and Gelderman 2007; Olsen and Ellram, 1997) that are widely adopted in practice (Gelderman and van Weele 2005; Pagell et al. 2010).

In order to compare the supply market characteristics of the various purchase categories examined in this study, we relied on the Kraljic (1983) portfolio. Instead of only asking the

interviewees where they would locate the purchase categories on this matrix, we also asked several questions to assess supply risk and purchase importance. Appendix B illustrates the questions included in both the online questionnaire and the semi-structured interviews to measure supply risk and purchase importance. Based on Kraljic (1983), Zsidisin et al. (2004), and Luzzini et al. (2012), we operationalized supply risk in five dimensions:

- Supplier scarcity (limited number of suppliers), entry barriers for new suppliers,
- Supply continuity risk
- Product customization
- Product customization
- Supplier power

We operationalized purchase importance in terms of financial importance, and asked the interviewees to indicate the category spend percentage compared to the total purchasing spend. We also validated these values by assessing the priority, criticality, and necessity of the purchase category (Olsen and Ellram, 1997; Lau et al., 1999; Lewin and Donthu, 2005). As the exact financial figures are highly confidential, we do not disclose this information.

First of all, we assessed supply risk and purchase importance in a detailed way by means of a qualitative analysis. Then, we transferred this information into a 1-5 Likert scale with the following scale options: 1: low, 2: low to moderate, 3: moderate, 4: moderate to high, 5: high. After measuring individual supply risk dimensions, we averaged the scores in each dimension to get a composite supply risk score, where values less than three indicate low supply risk and values higher than three indicate high supply risk. We also measured financial importance with the same 1-5 Likert scale. This quantitative measurement allowed us to position the purchase categories in the Kraljic (1983) matrix.

Supply base structure

We developed our supply base structure concept based on Choi and Krause (2006)'s "supply base complexity" concept. They define three dimensions of supply base (complexity):

- the number of suppliers in the supply base
- the degree of differentiation among the suppliers
- the level of inter-relationships among the suppliers (i.e. competition versus collaboration)

In addition to these three dimensions, we examined five more dimensions:

- the sourcing mode (i.e. single, dual, multiple sourcing)
- the type of suppliers
- the relationship duration
- the contract duration
- the level of information shared by suppliers

In order to measure the number of suppliers in the supply base, we used the following coding scheme: 1-3 suppliers: "very few", 4-10 suppliers: "few", 11-20 suppliers: "moderate", 21-50 suppliers: "moderate to many", more than 50 suppliers: "many". The type of suppliers was assessed in a qualitative way. Sourcing mode was indicated by the respondents as "single/sole, dual/parallel, or multiple sourcing". To measure the contract duration, as first discussed with the respondents how they would define short and long term contracts. Based on consensus, we arrived at the following coding: less than 6 months: "very short term", 6-12 months: "short term", 13-18 months: "short to moderate term", 19-24 months: "moderate term", 25-30 months: "moderate to long term", 31-35: "long term", 36 months or more: "very long term". Relationship duration was coded as short or long term based on qualitative inquiries with the respondents. Finally, the degree of differentiation, the level of collaboration and competition, and the level of information shared by suppliers was coded based on a 1-5 Likert type scale with the following scale options: 1: low, 2: low to moderate, 3: moderate, 4: moderate to high, 5: high.

Purchase category strategy and performance

In Chapter 2 we had found that the cost objective is the main objective in Cost Leadership strategies whereas both innovation and quality are equally important in Product Innovation strategies. Building on the items used in Chapter 2, we defined three items to measure cost objective, three items to measure innovation objective, and two items to measure quality objective, which the respondents indicated the level of emphasis and also the achieved category performance on each (see Appendix A). We also validated the answers from the questionnaire during the interviews. Based on this measurement we re-classified the CULTURES purchase category as being managed with a product innovation strategy. In case of doubt about the purchase category performance, we relied on the original classification done by the project sponsors as they are the least biased and have an overview about all the purchase categories.

5.5. RESULTS

Within-case descriptions and analyses provide the detailed background that helps to generate insights and assess the underlying mechanisms behind the observations (Barratt et al., 2011). Considering this, before directly comparing the supply base structures of purchase categories managed with product innovation and cost leadership strategies, we first developed the detailed case descriptions for the thirteen purchase categories we investigated. For reasons of brevity we present these descriptions in Appendix D. After summarizing each case, in this section we proceed with the cross-case analysis. Cross-case analysis is "the act of comparing and contrasting the patterns emerging from the within-case analyzes (Barratt et al., 2011). First of all, we examine product innovation and cost leadership strategies individually. After that, we compare the supply base structures for product innovation and cost leadership strategies.

5.5.1. Product Innovation Purchase Category Strategy

Supply market analysis

Table 5.3 and Figure 5.1 summarize the supply risk and financial importance of the seven purchase categories managed with a product innovation strategy. Based on Figure 5.1, two groups of purchase categories can be identified: i) purchase categories with low supply risk and high financial importance (leverage), and ii) purchase categories with high supply risk and low/moderate financial importance (bottleneck/strategic).

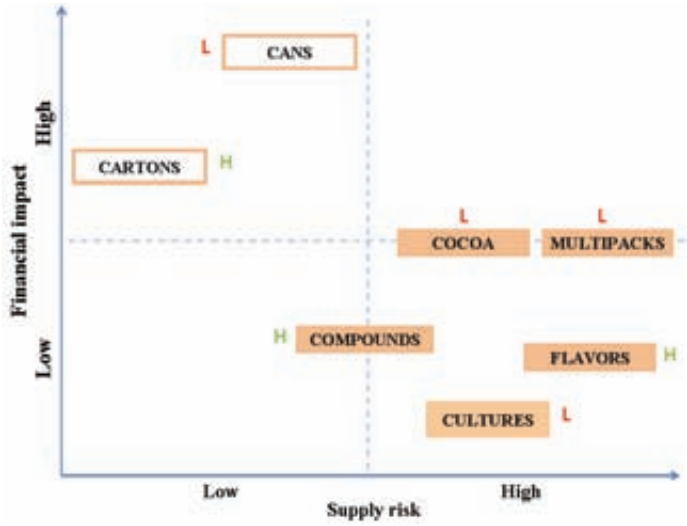
In the first group of purchase categories (CARTONS and CANS), product customization is very low, and entry barriers for new suppliers are low to moderate. Although the financial importance of both purchase categories in this group is high, supply risk is somewhat higher in CANS due to the moderate number of available suppliers, moderate supply continuity risk, and moderate supplier power. The difficulty of managing under high supply risk may partially explain the performance difference between the two purchase categories.

In the second group of purchase categories (FLAVORS, COMPOUNDS, MULTIPACKS, CULTURES, and COCOA) there are some differences across the individual supply risk dimensions although the overall supply risk is similar. In majority of the purchase categories, the supply market is quite concentrated, whereas in COMPOUNDS there are more

Table 5.3. Supply risk and financial importance of the purchase categories managed with a product innovation strategy

	Purchase categories						
	CARTONS	**FLAVORS**	**COMPOUNDS**	**CANS**	**MULTIPACKS**	**CULTURES**	**COCOA**
Supply risk types							
Availability of suppliers	Low	Few to moderate	Moderate	High	High	High	High
Entry barriers for new suppliers	Low to moderate	High, high entry barriers, also difficult to duplicate research	Moderate, but there are already many (big) players and some investment is needed.	Moderate, some investment is needed	High, market is dominated by system suppliers	Moderate to high, a market almost with no entrants, knowledge is lacking	High, high entry barriers, few global players
Supply continuity risk	Low, many suppliers available and focal firm is not really dependent	Low to moderate	Low to moderate	Moderate	Moderate to high, due to reliance on a few number of suppliers	Moderate	Moderate to high
Product customization	Low to moderate, not specific for focal firm	High, but IP is not protected, suppliers might sell the same product to competitors	Moderate to high, unique flavors, not easy to switch from one supplier to the other	Low, highly similar products across suppliers, highly interchangeable	Moderate to high, equipment and machinery dedicated to certain type of packaging	Moderate, each culture is unique, but not very specific for focal firm	Moderate
Supplier power	Low, focal firm can find other suppliers easily, and so can the suppliers	Moderate to high, focal firm a regional rather than a global player. It takes a long time to take business away from suppliers	Moderate, suppliers are not drastically increasing prices despite the highly monopolistic situation	Moderate, not the biggest customer of suppliers but still strategic	Moderate to high, quite dependent on system suppliers, slowly changing	Moderate to high, little power of focal firm to decrease price	Low to moderate, focal firm is a significant powder user
Avr. supply risk	1.4	4	3	2.8	4.2	3.6	3.6
Purchase imp.	6	3	3	8	5	2	5

Figure 5.1. Kraljic analysis of purchase categories managed with a product innovation strategy



Note: * "H" illustrates successful cases; "L" illustrates less successful cases

suppliers available. Supply continuity risk is somewhat higher in MULTIPACKS and COCOA. Product customization and entry barriers range between moderate to high. Supplier power is moderate to high in majority of cases, but in COCOA the case company has more power over their suppliers. It is notable that out of the five purchase categories in this group, three of them are classified as less successful cases. Overall supply risk is highest in MULTIPACKS and FLAVORS, followed by CULTURES, COCOA, and finally COMPOUNDS.

Supply base structure

Table 5.4 illustrates how the purchase categories managed with a product innovation strategy differ on various supply base dimensions. The ultimate aim in literal replication is to look for similar patterns in order to verify whether similar results occur for multiple cases (Yin, 1994). In line with this, we first examined whether there are similar patterns across four successful purchase categories and also across three less successful purchase categories. Our analyses suggest that although there are quite some similarities, there are also differences in some supply base structure dimensions within each configuration. When differences occur in literal replication, the researchers should not immediately discard these cases but instead try to

understand the underlying reason (Barratt et al., 2011). Considering this, as a next step we investigated whether the classification we identified in the previous sub-section is useful to investigate these differences. We found that supply base structures differ to some extent in leverage and bottleneck purchase categories. Additionally, we also identified some differences between successful and less successful cases (See Tables 5.5 and 5.6).

In purchase categories where there is low supply risk and high financial importance (leverage categories), the supply base structure is characterized by dual/multiple sourcing, long contract duration, no collaboration between suppliers but high levels of competition, and high levels of information shared by suppliers (except cost information). The successful case in this group differs from the less successful case by having many suppliers which are highly heterogeneous. This also allows the case company to not necessarily invest in a selected number of suppliers, but instead take the advantage of heavy competition which forces some suppliers to come up with innovations in order to differentiate themselves from the rest.

In purchase categories where there is high supply risk and low/moderate financial importance (bottleneck categories), the supply base structure is mostly characterized by few suppliers, short contract duration, homogenous suppliers, and no collaboration between suppliers. The increased supplier dependence results in short term contracts demanded by suppliers and lower volumes prevent multiple sourcing. Many respondents also state that the costs associated with managing multiple suppliers outweigh the benefits, thus dual sourcing is preferred. Different than successful cases, less successful cases in this group mostly depend on single sourcing, there is less information sharing of suppliers with the case companies, and the competition between the suppliers is somewhat lower. Although we could identify many similarities among the less successful categories in this group, we should note that MULTIPACKS stands out with some supply base characteristics that differ from the other purchase categories. For instance, it is the only purchase category where there is collaboration between the suppliers, and the competition between them is somewhat lower. The case company also aims to increase the heterogeneity in the supply base and invests in the local suppliers which they argue are more creative than the larger suppliers. We should be cautious in stating that these supply base structure differences explain the lower performance, because these changes have recently been implemented and thus can be argued to predict future performance better than current performance.

Table 5.4. Supply base structure in purchase categories managed with product innovation strategy

	Purchase categories						
	CARTONS	**FLAVORS**	**COMPOUNDS**	**CANS**	**MULTIPACKS**	**CULTURES**	**COCOA**
Number of (main) suppliers	Many (30 main suppliers, 200 in total)	Few (80% of purchases from 4 suppliers, 10 main suppliers, 46 in total)	Moderate (20 suppliers in total)	Few (4 major global suppliers, 10 in total)	Very few (50% from 2 main (system) suppliers 20 in total)	Very few (3 main suppliers, 5 in total)	Few (5 main suppliers)
Type of suppliers	"Supplier in every corner of the street, ranging from mom and dad stores to multinationals, but with quality differences" Suppliers also serve beverage and perfume industry where margins are much higher.	Very big, global suppliers with very high margins. Small suppliers are not preferred due to lack of R&D capabilities. Additionally, they do not either offer lower prices. No certain cost leader in the market, suppliers focus on quality and innovation.	Both global and local suppliers. For main products global suppliers are preferred.	Almost an oligopoly in many situations.	The majority is system suppliers which own the whole supply chain. System suppliers have less incentive to innovate. The aim is to develop smaller suppliers.	Few key players available globally. Suppliers supply multiple purchase categories of case company. They also supply beverages industry.	All suppliers are very large. The industry has consolidated tremendously over the past years.
Sourcing type (most used)	Dual/multiple sourcing: (But 65% of purchases are from one supplier)	Dual sourcing: "Working with one supplier would be limiting your access to innovation. In terms of development it is too costly to work with multiple suppliers. In development projects you mostly work with 2 suppliers".	Parallel sourcing: Innovation has a big part in this choice. However, single sourcing for many OPCOs.	Dual/multiple sourcing: "We avoid single sourcing at all costs"	Sole sourcing: "We aim to move from sole sourcing to dual sourcing, but we cannot change overnight. Multiple sourcing is not preferred as the cost of maintaining relationships very high in relation to benefits you get out"	Single sourcing: "Each supplier supplies different cultures, it is too costly and complicated to find a 100% match. One can try to match other cultures, but it is hard to change in the short term".	Dual sourcing: Multiple suppliers are preferred (cost-continuity). Share of suppliers changes per year. "Suppliers are on their toes, they have to innovate to protect growth of their business in the future."

Contract duration	Very long: 36 months, prices do not fluctuate much	Very long: 36 months (but it can be terminated by one party after 6 months)	Short: 12 months. Every year there are different crops.	Very long: 36 months	Short: 12 months. System suppliers are not willing to have longer contracts. This helps the conversion to non-system suppliers. The aim is to shift to 60 months contracts based on volume.	Short: 12 months "It would be better to have longer term contracts and focus on innovations".	Very short: 6 months. Due to high market volatility (both in terms of price and volume)
Supply base heterogeneity	Suppliers are very different in terms of size, organizational characteristics, technological capabilities, and geographical distance.	Suppliers are somewhat similar in terms of size, organizational characteristics, and geographical distance, but they differ to a high extent regarding their technological capabilities.	Suppliers are very similar in many aspects, except geographical distance. There are mostly global suppliers.	Suppliers are very similar in many aspects, except slight differences in terms of geographical distance.	Suppliers are very different in terms of size, organizational, technological capabilities, and geographical distance.	Suppliers are somewhat similar, but one of them is much smaller in size. Two larger suppliers have definitely better R&D capabilities.	Suppliers are very similar in many aspects, including technological characteristics
Supplier-supplier collaboration	Almost none. The only cooperation is in terms of European level tenders to serve the various locations of the case company.	None. Suppliers see their business as a "secret" and there is no information sharing. They also do not communicate with other purchase categories' suppliers.	None.	Almost none. There are only informal talks between suppliers, but no collaboration with each other.	Moderate. "It is not common in the industry, but we bring together two suppliers who are good at different parts of the business"	None. Everything is kept secret, but suppliers buy products from each other. "Size of the companies is big enough to do it on their own".	Almost none. They are just in the same cocoa federation. They collaborate with their own internal units, but not with each other.

Supplier-supplier competition	Very high. "They kill each other to the death, the margins are very low".	Very high. The case company also wants suppliers to fight; there is no need for them to allocate more volume to only one supplier.	Very high.	High. "Competition works better for innovation"	Moderate. "They really start innovating as soon as they feel competition"	Moderate to high. "The suppliers are in general happy with what they get. But that also means that they don't spend their energy on development".	High.
Information sharing	High level of technical and operational information sharing, but no cost information sharing at all.	No information sharing about cost and technology, and moderate information sharing about operations.	High level of technical and operational information sharing, but no cost information sharing.	High level of technical and operational information sharing, cost info is not shared at all. But due to in-house manufacturing cost information is available.	Moderate level of technical and operational information sharing, but very little cost information sharing.	Moderate level of technical and operational information sharing, but very little about costs.	High level of technical information sharing backed up by non-disclosure agreements, but no information sharing about costs and operations.

Table 5.5. Group 1 - Low supply risk, high financial importance (leverage)

	Successful	**Less Successful**
Similarities	Dual/multiple sourcing	Dual/multiple sourcing
	Long contract duration	Long contract duration
	No supplier-supplier collaboration	No supplier-supplier collaboration
	High supplier competition	High supplier competition
	High information sharing (except cost)	High information sharing (except cost)
Differences	Many suppliers	Few suppliers
	Heterogeneous suppliers	Homogenous suppliers

Table 5.6. Group 2 - High supply risk, low/moderate financial importance (bottleneck)

	Successful	**Less Successful**
Similarities	Few suppliers	Few suppliers
	Short contract duration	Short contract duration
	Homogenous suppliers	Homogenous suppliers
	No supplier-supplier collaboration	No supplier-supplier collaboration
Differences	Dual/parallel sourcing	Single sourcing
	High supplier competition	Moderate/high supplier competition
	High/moderate information sharing (except cost)	Moderate information sharing (except cost)

Conclusions

Combining the information from detailed within-case and cross-case analyzes, we arrive at two main conclusions about the supply base structure of purchase categories managed for product innovation strategy, and the performance implications.

First of all, we find that there are multiple supply base structures that are equally effective to successfully pursue a product innovation purchase category strategy. Our results show that in addition to purchase category strategy, supply market characteristics and purchase importance also have an important role in deciding the right supply base structure. If a product innovation strategy is implemented for leverage purchase categories, the approach to innovations is "Suppliers should bring us innovation in order to compete and differentiate themselves from the other suppliers". In these purchase categories, cost objectives are equally important and the preferred sourcing mode is dual or multiple sourcing. The long-term contracts also allow the buying firms to make suppliers fiercely compete on price. However, in bottleneck purchase categories managed for product innovation strategy, there is a higher level

of dependence on a homogenous group of suppliers. The approach to innovations in these purchase categories is "We should make suppliers interested in bringing us innovation". In majority of these purchase categories, the buying firms are dependent on a few, very big, global suppliers which are very secretive about their products. The aim is to have dual sourcing, but mostly they are dependent on single sourcing. Information sharing is also much lower compared to the leverage purchase categories. In order to decrease this dependency situation, the buying firms are trying to increase the competition between the suppliers which they believe also brings more innovation.

A second observation relates not to the differences, but to the similarities between the leverage and bottleneck purchase categories managed for product innovation. In both cases, the successful purchase categories are characterized by at least dual sourcing, high supplier competition, and no collaboration between suppliers at all. Another common point is the level of information sharing: in none of the cases suppliers share information about the costs.

5.5.2. Cost Leadership Purchase Category Strategy

Supply market analysis

Table 5.7 and Figure 5.2 summarize supply risk and financial importance of the six purchase categories managed with a cost leadership strategy, and suggest two groups: i) purchase categories with low supply risk and low financial importance (non-critical), and ii) purchase categories with moderate supply risk and high financial importance (leverage/strategic).

In the first group of purchase categories (PET, PHOSPHATES, ADJUNCTS, and INDPACK), overall there are low to moderate entry barriers for new suppliers, moderate supply continuity risk, low to moderate product customization, and low to moderate supplier power. All four purchase categories are found to have low purchase importance, with ADJUNCTS having the lowest value. INDPACK was considered as being less successful in achieving cost leadership objectives. We were not able to find any major differences between INDPACK and other purchase categories that have low purchase importance and low supply risk, except that "… there were too many suppliers, but not many who can actually meet the quality criteria (of the buying company)" in INDPACK. This might have resulted in increased costs in relation to product deficiencies and governance of suppliers for the exact quality criteria, which partially might explain the lower purchasing cost performance.

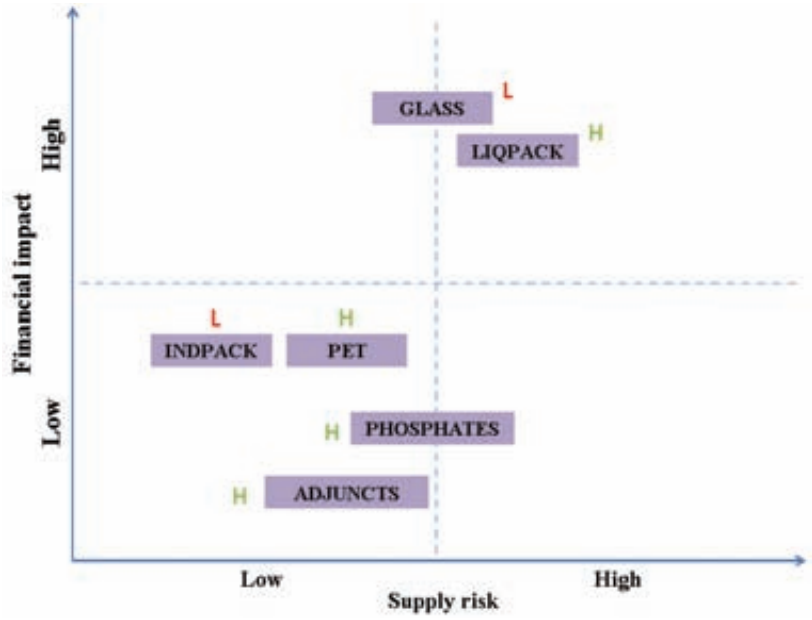
Table 5.7. Supply risk and financial importance of purchase categories managed with a cost leadership strategy

	LIQPACK	PET	PHOSPHATES	ADJUNCTS	INDPACK	GLASS
Supply risk types						
Availability of suppliers	Low	Moderate	Low	Moderate	Moderate	High
Entry barriers for new suppliers	Moderate to high, high set-up costs, very competitive in terms of cost	Low to moderate, few regional players but not much investment needed	Moderate to high, very difficult for new suppliers to enter	Moderate, not capital intensive market, but there are already many players.	Low to moderate	Moderate to high, margins are not very attractive for new entrants
Supply continuity risk	Low, suppliers are very big and not likely to fail or go bankrupt	Moderate, a necessary part of packaging	Moderate, depends on the year	Moderate to high, due to natural events	Moderate, too many suppliers but actually few can meet quality criteria	Low to moderate, seasonability in production. Can easily be switched to another supplier.
Product customization	Low to moderate, not specific for focal firm	Moderate, some products not easily produced by other suppliers	Low to moderate, not specific for focal firm	Low	Low to moderate, not specific for focal firm, but suppliers need to meet some strict quality requirements	High, all products are tailor made
Supplier power	Moderate to high, focal firm is interesting but suppliers are very big, difficult to negotiate	Low to moderate, focal firm is trying to bring more volume to regional suppliers to increase power	Low to moderate "Every supplier wants us as a customer"	Moderate, also depends on the year.	Low to moderate, suppliers are expecting an increase in shares and focal firm can use this to negotiate	Low to moderate, biggest customer in Europe, even more power over smaller suppliers
Avr. supply risk	3.2	2.6	3	2.6	2.4	3
Financial imp.	3.5	2.5	2	2	2.5	4

In the second group of purchase categories (LIQPACK and GLASS), supply risk is somewhat higher, due to the limited number of available suppliers and moderate to high supplier power in LIQPACK, and due to moderate to high entry barriers for new suppliers and high product customization in GLASS. Financial importance of LIQPACK and GLASS are both high. GLASS was considered as being less successful in achieving cost leadership objectives. Compared to LIQPACK, availability of suppliers is higher and supplier power is lower in GLASS; however, product customization is very high. We were not able to identify a clear link about how the supply risk and financial importance might have resulted in a lower performance in GLASS category.

Finally, the third observation relates to the supply base dimensions which differ between successful and less successful purchase categories. Our results suggest that in leverage purchase categories having fewer suppliers which are highly homogenous and in bottleneck purchase categories having single sourcing, less competition and less information sharing can negatively impact successfully pursuing cost objectives.

Figure 5.2. Kraljic analysis of purchase categories managed with a cost leadership strategy



Note: * "H" illustrates successful cases; "L" illustrates less successful cases

Table 5.8. Supply base structure in purchase categories managed with cost leadership strategy

	Purchase categories					
	LIQPACK	**PET**	**PHOSPHATES**	**ADJUNCTS**	**INDPACK**	**GLASS**
Number of (main) suppliers	Very few, 3 main suppliers	Few to moderate, 5 main suppliers (65% of purchases), 17 suppliers in total. The aim is to increase supplier number (security of supply, price competition)	Very few, 4 suppliers (95% of purchases), +2 smaller suppliers	Moderate, 5 global suppliers, 30 suppliers in total	Moderate, 12 suppliers in total	Moderate to many, 3 main suppliers (65% of purchases), 45 suppliers in total
Type of suppliers	Very big, global companies. The buying firm is interesting for them, but makes up only a rather small share of their total purchases.	A very diverse and fragmented local supply base. Big regional suppliers are preferred due to financial stability. The aim is to increase the share of regional suppliers that can supply multiple locations, but also have local backup.	Big, global suppliers. There are not many suppliers available. No single supplier that can supply all phosphate types/volume the buying firm needs.	Both global and local suppliers. The aim is to always have local suppliers next to global suppliers.	Many mergers in the past. No major supplier (equal shares). Not all suppliers match quality requirements. The aim is to increase the supply base.	Many mergers in the past. The aim is to have less from the top 3 suppliers, and develop small suppliers (higher purchasing power, opportunity to leverage)
Sourcing type (most used)	Dual sourcing. Asia: more standardized products, dual sourcing. Europe: differentiation: single sourcing (not favored)	Single/dual sourcing: In several OPCOs there is only one supplier.	Multiple sourcing: the four 4 suppliers can supply various types of phosphates. Depends also on the preference of sites and logistics	Parallel/multiple sourcing. The aim is to drive competition, get more market insights, secure supply	Multiple sourcing	Multiple sourcing: single sourcing is used only in case of very little volumes. ("I have the highest volume in Europe, why would I limit myself to single sourcing?)" The aim is to drive competition.

Contract duration	Short to moderate: 18 months (in Europe:12) Suppliers don't want long-term contracts, negotiation based pricing.	Moderate: 24 months. Long term contracts with regional preferred, with locals 12 months. "Financial situation of a supplier is more important than paying 5 cents, that's why the long term contract with regional."	Very short: 6 months (if the market is stable, it is 12 months)	Short: 12 months. Every year different crops.	Very long: 36 months (most of the time 36, but now 24+12 optional)	Mostly very long: 36 months. But contracts change depending on the location also (from 1 to 10 years). The prices are very attractive for 10 year contracts.
Supply base heterogeneity	Geographically and technologically the suppliers are somewhat similar, but in terms of size and organizational characteristics they are very different.	Suppliers are somewhat similar, but they differ in terms of geographical distance. Organizational characteristics differ to some extent: they operate in different industries	Geographically and in terms of size suppliers are somewhat similar, but in terms of organizational characteristics and technology they are very different. One supplier has better quality products.	Suppliers are quite similar in terms of technology, but quite different in terms of geographical distance, organizational characteristics, and organizational size. Large suppliers have more knowledge, and small suppliers are more flexible.	The suppliers are quite different from each other in terms of size, technology, and organizational characteristics. They are somewhat similar in terms of geographical distance.	Suppliers are very similar in many dimensions, except slight differences in terms of geographical distance.
Supplier-supplier collaboration	None.	Almost none. They only know about each other.	Almost none. Suppliers meet in fairs. But the information is available already. They are also not very much connected geographically.	Almost none. There is only some communication in joint meetings about legal issues and new materials.	Almost none.	Almost none. No collaboration between competitors, but sometimes they use each others' capacity.

Supplier-supplier competition	Very high.	Very high	High.	Average to high. "There is competition, but it is not a price battle"	Average to high. They mostly compete; they do not know each other's products.	Very high
Information sharing	High level of technical and operational information sharing, but no cost information sharing at all	Moderate to high, cost information is known, there is no secrecy	High level of information sharing in all aspects. The information is actually available in the market. There is no secrecy.	Moderate information sharing of suppliers, but information is also available on the market	High level of technical and operational information sharing, and moderate information sharing about costs	High, cost and market information is available, there is no secrecy

Supply base structure

Table 5.8 illustrates how the purchase categories managed with a cost leadership strategy differ on various supply base dimensions. Similar to our findings about the purchase categories managed for a product innovation strategy, we did not identify a single supply base structure for either the successful or less successful purchase categories managed for cost leadership strategy. As a next step, we investigated the role of supply risk and financial importance on supply base structure. Building on our classification in the previous sub-section, we found that supply base structures differ to some extent in non-critical and leverage/strategic purchase categories. Additionally, we also identified some differences between successful and less successful cases in each group (See Tables 5.9 and 5.10).

In purchase categories where there is low supply risk and low financial importance (non-critical categories), the supply base structure is characterized by a moderate number of main suppliers which are highly heterogeneous, no collaboration between the suppliers at all, and high information sharing about not only operations and technological issues, but also about the costs. Many different sourcing modes are noted in this group such as single, dual, and multiple sourcing. In the less successful case, multiple sourcing is used, but as this mode is also noted in more successful cases it is not possible to state that it is one of the causes of the performance difference. What differ in the less successful case are the relatively longer contract duration and relatively lower level of supplier competition. As stated in the within-case analyzes, the lower performance in the INDPACK category is mostly attributed to the low availability of suppliers that are able to meet the quality requirements; however the longer contract duration and moderate level of supplier competition might also be the other factors explaining the performance difference.

In purchase categories where there is moderate supply risk and high financial importance (leverage/strategic categories), the supply base is quite homogenous with few differences among the suppliers which compete to a very high extent and do not collaborate at all. Apart from these similarities, the successful and the less successful case differ on many other dimensions. Compared to the less successful case, in the successful case there are fewer suppliers, and dual sourcing is the most heavily exercised sourcing mode. Additionally, contract duration is lower (the suppliers are not willing to have long-term contracts), and although there is some information sharing, suppliers do not disclose any detailed cost

information. Although this supply base structure seems more difficult to manage due to higher dependency on the suppliers, it might also allow the buying firm to engage in more strategic relationships with its small number of suppliers. Existing portfolio models such as Kraljic (1983) matrix also suggest a strategic partnership for such purchase categories.

Table 5.9. Group 1 - Low supply risk, low financial importance (non-critical)

	Successful	**Less Successful**
Similarities	Moderate number of suppliers	Moderate number of suppliers
	Heterogeneous supply base	Heterogeneous supply base
	No supplier-supplier collaboration	No supplier-supplier collaboration
	High information sharing	High information sharing
Differences	Single/dual/multiple sourcing	Multiple sourcing
	Short/moderate contract duration	Long contract duration
	High supplier competition	Moderate/high supplier competition

Table 5.10. Group 2 - Moderate supply risk, high financial importance (leverage/strategic)

	Successful	**Less Successful**
Similarities	Homogenous supply base	Homogenous supply base
	No supplier-supplier collaboration	No supplier-supplier collaboration
	High supplier competition	High supplier competition
Differences	Few suppliers	Moderate/many suppliers
	Dual/single sourcing	Multiple sourcing
	Short/moderate contract duration	Long contract duration
	High information sharing (except cost)	High information sharing

Conclusions

Combining the information from detailed within-case and cross-case analyzes, we arrive at three main conclusions about the supply base structure of purchase categories managed for cost leadership strategy, and the performance implications.

First of all, we find that there are multiple supply base structures that are equally effective to successfully pursue a cost leadership purchase category strategy, and that the supply market characteristics and purchase importance also have an important role in this. For instance,

while there is a more homogenous supply base in leverage/strategic purchase categories, in non-critical purchase categories suppliers differ to a greater extent in terms of size, organizational characteristics, technological capabilities, and geographical distance. We also observe that suppliers are less open to information sharing, especially not about costs, in the strategic purchase categories.

A second observation relates not to the differences, but to the considerable number of similarities between the two groups such as high level of competition, no collaboration between suppliers, and short to moderate contract duration. Interestingly, having long term contracts which is usually associated with cost leadership strategies in the literature, is only found in less successful cases in our data analysis. Additionally, all three types of sourcing modes are implemented in both groups.

Finally, a third observation worth mentioning is the high number of supply base dimensions which the successful and less successful cases differ in both non-critical and leverage/strategic purchase categories. Our results suggest that in non-critical purchase categories having long term contracts and less supplier competition, and in leverage/strategic purchase categories having many suppliers, multiple sourcing, long term contracts, and less supplier competition can negatively impact successfully pursuing emphasized objectives.

5.5.3. Cost Leadership versus Product Innovation Strategies: Comparing Supply Base Structures

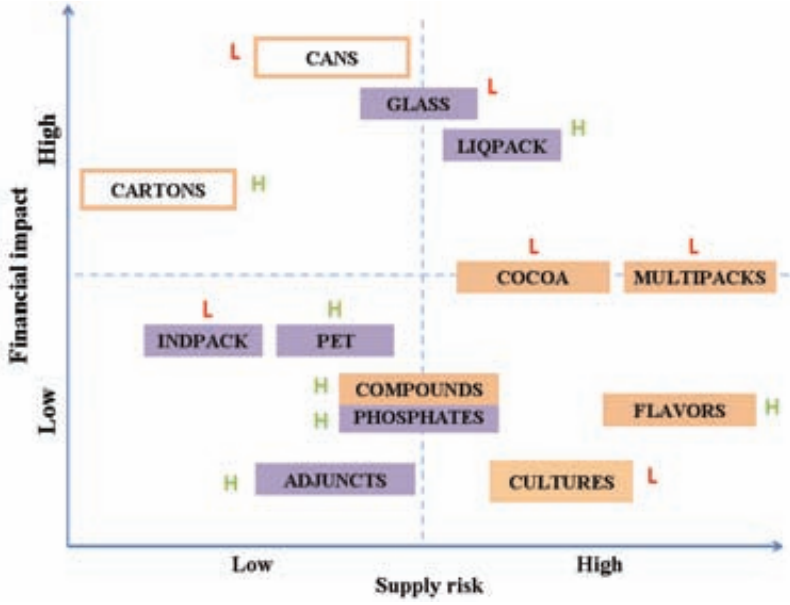
After discussing cost leadership and product innovation strategies individually, we are now able to compare the supply base structures of the two strategies. To support interpretation, in Figure 5.3 we also illustrate all purchase categories based on supply risk and financial importance. Below, we discuss the similarities and differences in each supply base structure dimension.

- **Number of suppliers:** We find that there is a moderate number of suppliers when implementing cost leadership strategies for both non-critical and leverage/strategic purchase categories. When implementing product innovation strategies, we find that there are only a few suppliers in bottleneck purchase categories and many suppliers in leverage purchase categories. Although at first glance it seems that purchase category strategies impact the number of suppliers, the impact of supply risk and

financial importance should not be neglected. Based on the literature, one would expect to find few suppliers for product innovation strategies and vice a versa for cost leadership strategies (Cousins et al., 2007; Koufteros et al., 2007). Although our results support this to some extent, leverage purchase categories managed with a product innovation strategy are an exception as there are many suppliers.

- **Sourcing mode:** When implementing product innovation strategies dual sourcing is the most heavily exercised sourcing mode, whereas in purchase categories managed with a cost leadership strategy all three kinds of sourcing modes are used (i.e. single, dual, and multiple). Single sourcing is observed in less successful purchase categories managed with a product innovation strategy. It was also mentioned in many of the interviews that multiple sourcing is not preferred for product innovation strategies, either, as the costs of managing the relationships outweigh the benefits. These findings suggest that although it is difficult to assess which type of sourcing mode is better to successfully manage a purchase category for cost leadership strategy, firms should probably avoid both single and multiple sourcing to successfully manage a purchase category for product innovation strategy.

Figure 5.3. Kraljic analysis



- **Supply base heterogeneity:** The literature suggests that a high level of supply base heterogeneity negatively impacts cost performance as it brings extra coordination costs and operational burden to manage very different suppliers, and that a high level of supply base homogeneity negatively impacts innovation performance as the suppliers having similar capabilities and operating in similar industries and environments might lack the diversity of knowledge required for innovation (Choi and Krause, 2006). In contrast to these arguments, we find that in purchase categories managed with a product innovation strategy supply base is quite homogenous in general – both in successful and less successful cases – except in the leverage purchase categories where a heterogeneous supply base is noted in the successful case and a homogenous supply base is noted in the less successful case. In purchase categories managed with a cost leadership strategy, the supply base is quite homogenous in leverage/strategic purchase categories, but heterogeneous in non-critical purchase categories. There is no difference in the homogeneity of the supply base between successful and less successful purchase categories managed with a cost leadership strategy. These findings suggest that although conceptually it was argued that heterogeneity is positively related to innovation performance and negatively related to cost performance, we did not find substantial support for these claims. Based on the remarks from the interviews, it was also clear that the impact of supply base heterogeneity on performance, especially on innovation performance, was not considered at all when implementing purchasing strategies.

- **Contract duration:** We find that when implementing product innovation strategies long term contracts are used for leverage purchase categories and short term contracts are used for bottleneck purchase categories. It is interesting to note that there is not a difference between successful and less successful cases. When implementing cost leadership strategies, short to moderate term contracts are used in both non-critical and leverage/strategic purchase categories and long term contracts are noted in less successful purchase categories. These results suggest that while implementing cost leadership strategies the choice between short and long term contracts also depends on the supply risk and financial importance, but has no impact on innovation performance. Interestingly, in contrast to the literature which suggests that long term contracts are better for cost leadership strategies (Peleg et al.,

2002), we find that short to moderate term contracts are better compared to long term contracts in both non-critical and leverage/strategic purchase categories managed with a cost leadership strategy.

- **Supplier-supplier collaboration:** Overall, there is no collaboration between the suppliers in purchase categories managed with either strategy. However, there is one exceptional case in a purchase category managed for product innovation, where the aim is to increase the collaboration between the suppliers of the same purchase category as they believe each supplier has unique contributions to innovations. Although it is suggested in the literature that not only competition but also collaboration between the suppliers can bring innovation (Sobrero and Roberts, 2002; Choi and Krause, 2006), we found very weak support for that. It could be the case that collaborations between the suppliers of the same purchase category are very rare whereas suppliers of different purchase category can be more easily involved in collaborations where they supply the different parts of a final product.

- **Supplier-supplier competition:** Not surprisingly, overall there is a high level of competition between the suppliers in purchase categories managed with either strategy. However, it is notable that in less successful purchase categories of both strategies there is somewhat lower competition. Therefore, it could be concluded that competition between the suppliers is beneficial for both cost and innovation performance.

- **Supplier information sharing:** When implementing cost leadership strategies, both in successful and less successful cases suppliers are open to information sharing in general; therefore, supplier information sharing does not seem to be a factor that impacts the success of cost leadership strategies. When implementing product innovation strategies, in successful purchase categories suppliers share information, but definitely not about costs. In less successful cases the level of information sharing decreases to some extent.

The above discussions provide detailed observations about the role of purchase category strategies and supply market conditions in each dimension of the supply base structure. Overall, we find that it is difficult to define an "ideal" supply base structure that

suits all purchase categories managed with a cost leadership or a product innovation strategy, and that the role of supply market and purchase category characteristics also need to be considered. Additionally, we find that the ideal supply base structures for cost leadership and product innovation strategies are not highly different from each other. Based on our findings, we formulate the following propositions to be investigated in future studies:

Proposition 1: The ideal supply base structure to successfully manage a purchase category depends both on purchase category strategy (i.e. cost leadership versus product innovation) and purchase category characteristics (i.e. supply risk and financial importance).

Proposition 2: The ideal supply base structures for purchase categories managed with a cost leadership or a product innovation strategy are not completely different from each other – while some supply base structure dimensions are different, many of them are similar.

Proposition 2.1: High competition and low collaboration between the suppliers, and high levels of supplier information sharing with the buyer are associated with higher purchasing performance in both cost leadership and product innovation purchase category strategies.

Proposition 2.2: Compared to single and multiple sourcing, dual sourcing is in general better for product innovation strategies, whereas all three types of sourcing modes can be effectively implemented in cost leadership strategies.

Proposition 2.3: Supply base heterogeneity does not impact purchasing performance in cost leadership strategies, but differs based on supply risk and financial importance, whereas the supply base is quite homogenous in product innovation strategies in general.

Proposition 2.4: Contract duration does not impact purchasing performance in product innovation strategies, whereas moderate term contracts compared to long term contracts are associated with higher purchasing performance in cost leadership strategies.

5.6. CONCLUSION

Firms purchase a variety of products and services which constitute a substantial amount of the total cost of goods sold, which can be as high as 80% in manufacturing firms (Dubois and Pedersen, 2002; Van Weele, 2010). Undoubtedly, the diversity of inputs purchased from suppliers requires different types of purchasing strategies as well as practices and structures customized per these different categories. Although the extant literature in the field of purchasing and supply management has acknowledged the variety in purchase categories, the impact of purchase category strategies on the supply base structure has been rarely examined in a comprehensive way.

The aim of this paper was to shed more light on the issue of whether a focus on cost leadership versus product innovation strategies impact the various supply base structure dimensions at the purchase category level. Furthermore, we were also interested in identifying which supply base structures are more effective to successfully implement each purchase category strategy. As the current state of knowledge on this topic is rather scarce, we adopted an exploratory approach and conducted multiple case studies of thirteen purchase categories in two firms operating in the food and beverages industry.

The contributions of this paper are three-fold. First of all, we develop the concept of supply base structure by introducing multiple dimensions and operationalizing them in a comprehensive way. While the few earlier studies that have examined this concept focused on the overall firm level, different than those studies we investigate this concept at the purchase category level. Second, we adopt a contingency perspective and examine supply base structure in relation to purchase category strategies and purchase category performance. We improve the internal validity of our findings by also examining supply market characteristics as the alternative mechanisms explaining supply base differences. Finally, summarizing our key findings we formulate some propositions to be tested in future studies, across different settings.

Although this paper presents a useful starting point for further research into the link between purchase category strategies and supply base structure, few criticisms may be raised. For instance, we only focused on two types of purchase category strategies: cost leadership and product innovation. As we have also argued in Chapter 2 of this thesis, there are certainly

more purchase category strategies such as "emphasize all" and "delivery reliability". As this is a first attempt, we preferred to focus on a limited set of purchasing strategies which enables detailed comparisons. Future studies can investigate supply base structure differences across more purchase category strategies.

A second issue may relate to our sampling approach. In order to choose our cases, we distinguished between cost leadership versus product innovation strategies, and successful versus less successful cases, resulting in a two-by-two matrix and thus four groups. From each group, we investigated multiple cases. It turns out that product innovation strategies were only observed in bottleneck and leverage purchase categories, and cost leadership strategies were only observed in non-critical and leverage/strategic purchase categories. In Chapter 2 we had found that product innovation strategies are implemented also in strategic purchase categories and cost leadership strategies are implemented also in leverage and bottleneck purchase categories. We were not able to investigate all of these differences in our study as it would require a substantial increase in the number of case studies. In order to capture all of this variety, future research can rely more on large N studies, or alternatively depending on the research question alternatively it focus on one type of purchasing strategy and investigate all four purchase category types (i.e. non-critical, leverage, bottleneck, strategic).

We had deemed it appropriate to conduct case studies due to the immature theory on this topic as well as due to our focus to understand "why" and "how" our investigated concepts relate to each other (or not). Obviously, our study does not provide statistical generalization, and future studies should consider collecting data across various purchase categories, in many organizations, and in different industries if the purpose is to improve generalizability. As this was a first attempt to investigate the link between purchase category strategies, supply base structure, and purchase category performance, we believe the main contribution of our study lies in its level of detail, generating rich data across many comparisons, and suggesting propositions that warrant further investigation.

APPENDIX A. CASE SELECTION CRITERIA

Purchase category strategy: Please indicate to what extent the following objectives have been pursued for the chosen purchase category by the management in the past 3 years?
Purchase category performance: Please indicate the current, achieved category performance in the following objectives:

- Reducing product/service unit prices ***(Cost leadership)***
- Reducing total costs (e.g. inspection, customer returns, labor, etc.) ***(Cost leadership)***
- Reducing asset utilization ***(Cost leadership)***
- Improving introduction rates of new products/services ***(Product innovation)***
- Improving the involvement of suppliers in designing new products/services o making changes in existing products ***(Product innovation)***
- Improving time-to-market with suppliers ***(Product innovation)***
- Improving durability and reliability of purchased products/services ***(Product innovation)***
- Improving conformance to specifications ***(Product innovation)***

APPENDIX B. QUESTIONNAIRE ITEMS AND INTERVIEW QUESTIONS

A. SUPPLY RISK:

Questionnaire:

1. What is the number of suppliers that are actively managed for this purchase category? ***(Supplier scarcity)***

2. Please indicate to what extent you agree or disagree with the following statements: (1: totally disagree, 7: totally agree)
   - It is difficult for new suppliers to enter the market successfully ***(Entry barriers)***
   - It is highly unlikely that we will experience an interruption in the supply of items in this purchase category *(Reverse item)* ***(Supply continuity risk)***
   - Products/services we buy in this category are custom built for us ***(Customization)***
   - We have bargaining power with the suppliers in this category *(Reverse item)* ***(Supplier power)***
   - Getting our business is important for the suppliers *(Reverse item)* ***(Supplier power)***

Interview:

1. What are the most critical aspects of the supply market for this purchase category, and why? ***(Supply risk)***

2. In which quadrant of Kraljic matrix is this purchase category located, and why? ***(Supply risk)***

B. PURCHASE IMPORTANCE:

Questionnaire:

1. What is the category spend as a percentage of total purchasing spend? ***(Financial impact)***

2. Compared to other purchases your firm makes, this purchase is: ***(Purchase criticality)***
   - (1) Unimportant – Important (5)
   - (1) Non-essential – Essential (5)
   - (1) Low priority – High priority (5)

Interview:

1. Describe this purchase category briefly. What kinds of products/services are being purchased? How important is this category for your company, and why?

C. SUPPLY BASE STRUCTURE:

Questionnaire:

1. What is the number of suppliers that are actively managed for this purchase category?

2. What is the average duration of contracts with the suppliers in this purchase category (in months)?

3. Which sourcing strategy is most heavily exercised for this purchase category?
   - Single sourcing (having one supplier by choice)
   - Sole sourcing (having one supplier due to monopoly)
   - Dual sourcing (having two suppliers)
   - Parallel sourcing (having two or more suppliers concurrently as single source suppliers for very similar products/services)
   - Multiple sourcing (having more than two suppliers)

4. Please indicate the level of similarity/dissimilarity of the suppliers for the chosen purchase category: (1: very similar, 5: highly different)
   - Geographical proximity (The level of similarity of suppliers in terms of their geographical distance to your company)
   - Organizational proximity (The level of similarity of suppliers in terms of their organizational context and culture)
   - Technological proximity (The level of similarity of the technical capabilities of suppliers)
   - Organizational size (The level of similarity of the size of suppliers)

5. To what extent do you agree or disagree with the following statements? (1: totally disagree, 7: totally agree)
   - The suppliers work together closely and exchange ideas and resources with each other
   - The suppliers work together on joint new product and process development projects
   - The suppliers contribute resources and expertise to accomplish shared objectives together
   - There are not direct lines of communication between the suppliers
   - There is minimum communication and in a very focused context between the suppliers
   - The suppliers mostly compete with each other
   - The average time-span of supplier relationships in this category is very long
   - We focus on long-term goals in relationships with suppliers in this category

6. To what extent do the supplier(s) in this purchase category share with your company... (1: to a very low extent, 7: to a very high extent)
   - Cost information
   - Technical information
   - Operational information

Interview:

1. Why do you do single/dual/multiple sourcing in this purchase category? Is the current policy optimal, or would you be in favor of increasing/ decreasing the number of suppliers in this category? Why?

2. Are there mostly long-term or short-term relationships with the suppliers in this category, and why?

3. How similar are the suppliers in this category (i.e. geographical distance, size, industries, and capabilities)? Is a homogenous or heterogeneous supply base preferred for this category? Is this a desired/conscious choice or an impact of the supply market?

4. Can you give some examples of supplier-supplier collaboration in this category?

5. Do your suppliers in this purchase category mostly collaborate or compete? Why/why not? Do they communicate? Would you be in favor of collaboration or competition between the suppliers in this category? Why? Do you think the current situation is ideal or would you be in favor of some changes?

APPENDIX C. INTERVIEW DETAILS

Interview	Category	Interviewee job title	Date	Interview type
INT1	N/A	Director Procurement	28.Nov.11	Initial
INT1	N/A	Procurement Director	28.Nov.11	Initial
INT1	N/A	Chief Procurement Officer (CPO)	28.Nov.11	Initial
INT2	N/A	Director Procurement	16.Jan.12	Project details
INT3	N/A	Director Procurement	07.Mar.12	Case selection
INT3	N/A	Category Manager Other Packaging	07.Mar.12	Case selection
INT4	Liqpack	Category Manager	13.Mar.12	Case detailed
INT5	Indpack	Buyer	14.Mar.12	Case detailed
INT6	Cartons	Category Manager	14.Mar.12	Case detailed
INT7	Cultures	Category Buyer	16.Mar.12	Case detailed
INT8	Cococa	Category Manager	22.Mar.12	Case detailed
INT9	Flavors	Category Manager	26.Mar.12	Case detailed
INT10	Phosphates	Category Manager	27.Mar.12	Case detailed
INT11	N/A	Global Purchasing Director	23.May.12	Initial/case selection
INT12	PET	Global Category Buyer Packaging Materials	27.Jun.12	Case detailed
INT13	Compounds	Lead Buyer Raw Materials	27.Jun.12	Case detailed
INT14	Glass	Global Category Leader Glass Packaging	04.Jul.2012	Case detailed
INT15	Multipacks	Global Category Leader Papers & Plastics	04.Jul.2012	Case detailed
INT16	Cans	Global Category Manager Metal Packaging	05.Jul.2012	Case detailed
INT17	Adjuncts	Global Category Director Raw Materials	05.Jul.2012	Case detailed
INT18	N/A	Director Procurement	19.Sep.2012	Results discussion
INT18	N/A	Category Manager Other Packaging	19.Sep.2012	Results discussion
INT19	N/A	Global Purchasing Director	July 2013	Results discussion

APPENDIX D: CASE DESCRIPTIONS

B.1. Product Innovation Strategy – Successful Cases

CARTONS

CARTONS is a packaging purchase category which includes corrugated carton that is mostly used for transportation, and folding carton and solid boards which are used for consumer packaging. The key objective in this category is lower costs and prices, but innovation objectives are also pursued to some extent. An example for innovations in corrugated cartons is producing cartons that have more strength and less material, and an example for innovation in folding cartons is different ways of bundling a product or new types of ink. The case company states that "We are not carton experts", and aims to shift generating innovations to the supply base.

There is a very big supply market for this purchase category including not only big global companies, but also many smaller, local suppliers. The prices do not fluctuate much, and contract durations with suppliers are very long. As a result of this, there is a very high level of competition among the suppliers and the margins are extremely low. The suppliers never collaborate with each other, except cooperation at European level tenders. The case company has a very favorable position: they are not dependent on any supplier and if there is a need they can change their suppliers immediately. However, the suppliers are also not too dependent on the case company as they also supply other industries such as the perfume industry where the margins are much higher.

Although innovations are sought in this purchase category, the category manager emphasizes that they have to be careful about the costs. Because unlike the perfume industry for instance, they only have a limited amount they can spend on the packaging. He further states that "We do not want to come up with innovations ourselves, we want to force suppliers to come up with innovations. Of course there are joint works with R&D, but the drive and work needs to come from suppliers". Although the objective is to reduce the supply base, the richness of the supply base is also seen as an advantage in terms of innovations, but it is not an objective explicitly pursued.

The case company enjoys the benefits of high levels of competition between the suppliers, not just based on price, but also based on innovation. In their very big supply base, there are

always some suppliers which want to differentiate themselves from the rest, and thus they innovate.

FLAVORS

The category FLAVORS consists of items that are used to give the products a certain unique taste, and therefore has a strategic importance although the total spend is not very high. 80% of the purchases for this purchase category come from four preferred suppliers, and there are six more suppliers with whom the case company does business regularly. In total there are 46 suppliers (some flavor types cost very little, but they are necessary for some products). Dual sourcing is used in most cases, and the aim is to decrease the number of suppliers substantially. Contract duration is indefinite, but the parties hold the right to terminate the contract after six months.

There is not a cost leader in the supply market, and being innovative is everything for the suppliers. Low cost country suppliers also do not offer cost advantages. However, the suppliers compete to a high extent, and they try to match each others' flavors. The suppliers are very secretive about their products and it is impossible to learn details about the cost components. Although the purchasing function of the case company investigates the smaller suppliers, R&D department is not willing to work with these suppliers as they argue that big flavor companies outperform the smaller ones in innovation and development. The entry barriers for new suppliers are extremely high as it is very difficult to duplicate research and technical capabilities. The case company is considered as a big regional customer by the supplier firms, but not as a big global customer. The supplier firms are not willing to be strategic partners based on long-term contracts, because their margins are very high.

The purchase category manager states that in case of new product development projects, they prefer to talk with two suppliers and make them compete, because bundling more volumes to a supplier has no effect on the prices, and it limits innovations. Engaging in partnerships with a selected number of suppliers is not preferred by the case company. The purchase category manager states that "… with these partnerships, your flavor library will be more transparent, but will not bring you any money. (Also)... you are limiting yourself and not benefiting from other suppliers. You can't tap into their innovation knowledge any more. It does not really make sense." Innovations mostly come from the suppliers and it is not in the form of joint innovations with the case company. Only in very rare cases where the suppliers

also have something to learn, they are willing to work in joint projects. Ownership of the IP rights is always an issue in such cases because the suppliers want to sell the same products to other customers, including the competitors.

COMPOUNDS

The COMPOUNDS category is a mixture of several juices, flavors, and stabilizers leading to an all-in-one product containing taste, acidity, sweetness, and color. The purchase category is considered to have moderate importance in general, but some of these purchases are highly crucial for some products of the case company. This is a purchase category where introducing new products is considered more important than the cost objectives.

The supply market consists of both local and global suppliers, and overall the case company has around 20 suppliers. Recently, they started doing business with four more small suppliers. However, the majority of the business is done with a few global suppliers. Although for some operating companies there is single sourcing, the aim of the category manager is to engage more in more parallel sourcing with the aim of developing alternatives. As each flavor is unique, it is not very easy to switch suppliers and product customization is high. Usually, contracts with suppliers are short term because most of the products purchased are dependent on the crops of each year. As there are mostly long-term relationships with suppliers, the short contract duration is not considered a problem. Supply continuity risk is quite low and a scarcity would only impact the prices to a moderate extent.

Similar to the FLAVORS purchase category, the suppliers in COMPOUNDS are also very secretive about their products and the cost information is not known. Although the market is somewhat tight, the suppliers do not behave in an opportunistic way due to balanced buyer-supplier power. Additionally, there is quite a high level of competition between the suppliers. Some small suppliers collaborate with big suppliers in order to do business with the case company.

Innovations in this purchase category are achieved in two ways: either the suppliers come up with new products or the case company approaches the suppliers with their new product ideas. The purchase category manager admits that the first approach is seen more as "… suppliers try to push more. Because every product they can sell is a new business for them." Innovations come from big, global suppliers and smaller suppliers have less access to the case

company in terms of bringing innovation. The case company does not invest in the developments of suppliers, because IP rights are always problematic as the suppliers do not want to develop a new product only for a single customer.

B.2. Product Innovation Strategy – Less Successful Cases

CANS

CANS is the biggest packaging purchase category of the case company and constitutes almost 50% of the total packaging spend. This purchase category also entails products such as crown corks, aluminum bottles, and draft kegs. The products are quite customized, which also helps economies of scale. Innovations are quite important, but there is a very high emphasis on achieving the lowest total cost of ownership. Some examples of innovation are lighter materials and new types of ink.

There are four global suppliers for this purchase category, and six more smaller suppliers which are linked to the four global ones through technical licenses or joint ventures. The suppliers are quite similar in many dimensions, and there are not a lot of new entries to the market. Sometimes, this oligopoly situation can make the suppliers less competitive both in terms of cost and innovations, and lack behind. In that case, the case company makes some "wake-up calls" and rearranges the shares of the suppliers. It seems that one reason for the less satisfactory performance outcomes in this purchase category could relate to having a very small and homogeneous supply base.

Single sourcing is avoided at all costs, but having more than three suppliers on a single line is not considered feasible, either. Contract duration with the suppliers is very long, but contracts are also open to renegotiations. The buying firm-supplier power is quite balanced – the case company is not their biggest account, but still considered as strategic for all the suppliers. However, there is still the impact of price volatility, which might change the power balance.

The case company organizes supplier innovation day events where the key suppliers are asked to present their newest products. This competition increases the suppliers' motivation as it also gives the image to "We will go to your competitor if we do not like your idea". The suppliers do not collaborate on joint innovation projects. As the supply market is quite tight,

at the corporate level the suppliers are aware that they have to be innovative in order to be different. There is one relatively smaller and more entrepreneurial supplier, but it is not more superior in terms of innovations. The case company does not invest in the suppliers, because usually there are problems related to IP rights; suppliers do not want to develop a product only for a single customer. Innovation ideas usually come from suppliers, but the purchase category manager thinks that a better approach is where they tell the suppliers what they think is innovation. This, he argues, is more efficient for the suppliers and actually also would be preferred by them. Clearly, there is a need for more open communication between the case company and the suppliers of this purchase category, and the initiative probably has to come from the case company.

MULTIPACKS

MULTIPACKS is a paper-based packaging used in premium segment products and has a big impact on customer communication. Although cost objectives are important, innovations and value creation are considered as the most important objectives, which is a different situation than other packaging categories such as CANS or GLASS. There is a high level of product customization due to the value-adding role of the purchase category.

The supply market is highly dominated by two key system suppliers. System suppliers own the whole supply chain; they grow their own trees, make the conversion, and also supply their own machines. More than 60% of the purchases of the case company come from system suppliers. Only for one of these suppliers is the case company a preferred customer. These suppliers also "set the rules of the game", create high entry barriers for new suppliers as they also control the raw materials, and sometimes even sue the smaller suppliers. These conditions led the system suppliers to lack behind in innovations as basically they did not have any motivation to be more innovative. The system suppliers were also very protective about their IP rights even though in some cases there were joint innovations with the case company.

Now, the case company is trying to change this dependency situation by giving more business to smaller, local suppliers, and also trying to make these suppliers' products run on system suppliers' machines. By investing more in local suppliers, the aim is to make them compete at the global supplier level. These investments are in the form of increased business (not other financial investment, such as in joint R&D). The case company finds that local suppliers are even more creative than the system suppliers, and have more modern equipment.

The purchase category manager states that increased competition clearly helps to have a more favorable position with the system suppliers, and also increases innovation at system suppliers. The case company also examines new materials used in other industries (i.e. thicker recycled materials that has long durability even in the refrigerator), with the purpose of increasing their flexibility further and increasing competition. However, they admit that it is not their plan to take away all the volume from system suppliers and this change process will obviously take some time.

Currently, contract duration is very short due to two reasons. First of all, system suppliers are not willing to have long-term contracts. Second, it is also beneficial for the case company as it allows the transition to non-system suppliers and checking if the new suppliers meet their specifications. The future plans include reversing this and moving into five-year contracts based on volume, which they argue will also boost long-term relationships, especially with the new suppliers. The plan regarding the sourcing mode is to move from single to dual sourcing, but not to increase the supply base to a very high extent and do multiple sourcing, as they believe that the cost of maintaining the relationships do not match the benefits.

One notably different approach in this purchase category is the supplier-supplier collaboration. The purchase category manager states that "What we are now doing is not something common in the industry. We now bring two suppliers together, where we say 'For us you are not in competition, you are actually not comparable to each other. You are very good in this part of the business, the other one is very good in that part… So, why don't you start collaborating?' We expect some value coming from that." Supplier-supplier collaboration is encouraged, but the case company is not willing to manage this itself due to increased coordination costs.

It seems that the less satisfactory innovation performance outcomes in this purchase category highly relate to being dependent on system suppliers which are not very competitive at all and have little incentive to innovate. It is interesting to note that in order to improve performance the company is trying to foster both competition by introducing local suppliers and also collaboration between suppliers with different capabilities.

COCOA

COCOA is a characterizing ingredient for many products of the case company, and it includes products such as cocoa powders, chocolate, and compounds. It is mostly grown in developing parts of the world, and in some years there can be serious supply continuity risks due to production or political instabilities. For this purchase category, the major purchasing objectives are supply continuity and innovation.

The supply market has consolidated tremendously over the past years and consists of a very few global suppliers. There are five main suppliers in this purchase category. The case company has been doing business with these suppliers for a very long time, and although they are not the major customer of their suppliers, they are still interesting for the suppliers.

In order to cope with the supply continuity risk, the company engages in dual supply and even plans to do multiple sourcing at more locations. However, products are not fully exchangeable, which increases the supply risk. The market is extremely volatile as it is dependent on natural events and crops each year. Therefore, the case company prefers to have short term contracts with suppliers, which is also the norm in this industry. The purchase category manager states that this also "… causes the suppliers to be on their toes regarding innovations", as they change the shares of the suppliers every year. But at the same time, it could also give the suppliers an insecure feeling and thus prevent investing substantially in new products to be developed for the case company.

Some examples for innovation in this purchase category relate to using products with fewer flavors, dispersability, solubility, and behavior in low pH environments. Innovations come from both the own R&D of the case company and the suppliers. However, it is not really a joint development. Suppliers come up with a new product and give privilege to the case company to use it the first time in the market. Occasionally the suppliers make special blends for the case company. The purchase category manager states that sometimes they also have ideas which they want to explore with suppliers. Suppliers share high level of technical information backed up by non-disclosure agreements, but there is no information sharing about the costs. Although innovations are important for this purchase category, the purchase category manager states that "We should not forget we are not a cocoa company; we cannot put all our resources into getting more market knowledge".

The majority of the innovations are incremental. Innovations mostly come from long term suppliers with proven capabilities, and there are not many examples of innovation coming from new suppliers. Suppliers do not collaborate at all for joint projects. Currently, there are no formal innovation performance measurement systems, as it is difficult to assess per category, because it is the final product that is innovative or not in the market.

CULTURES

CULTURES is an ingredients category which consists of 100 different cultures. Similar to FLAVORS, this purchase category is also characterized by low purchasing spend but high criticality as cultures are the defying factor in how the final products look like and taste. Therefore, getting more innovative products from the suppliers is quite important. Some examples for innovations are cultures which help reduce salt in cheese, or fat and sugar in desserts. Although cost reduction is an important objective as well, the case company does not have a lot of power towards the suppliers to push the prices down.

The case company has three main suppliers and overall there are five suppliers in the market. Each culture is considered unique and only produced by a single supplier. However, this single sourcing situation does not pose serious threats in terms of supply continuity as the cultures can be produced upfront and stored. The contract duration is quite short at the moment, and the case company is considering having longer term contracts as they believe price negotiations are very time consuming and brings little in return. The case company has been doing business with the current suppliers for more than ten years, and is a preferred customer for the two big suppliers. Entry barriers are very high and there have not been many entrants in the past years. Alternative supplier search is at moderate levels because switching costs to benefit from an alternative lower cost supplier is much higher.

The suppliers are not just producing cultures, but are also active in other related areas. The two larger suppliers have definitely better R&D capabilities. But this is considered as a non-ideal situation for the case company as it makes them more dependent on the larger suppliers. The category buyer believes that there needs to be two to three smaller suppliers in order to keep the competition going, which helps to achieve both lower costs and more developments. The suppliers compete, but not to a very high extent because in general they are happy with what they get. They do not collaborate with each other, either, as everything is kept as a secret.

Currently, the case company informs the suppliers regarding what kind of innovations they want and ask the suppliers whether they can do it or not. In other words, innovation ideas mostly come from the case company, but the development is done by the suppliers. However, the category buyer believes that suppliers need to be involved more. He states that "If you keep the suppliers in the dark regarding where you want to go in the long term, then it is very difficult to come up with innovative ideas… Having a long term strategy with suppliers is important, maybe we should also ask the suppliers 'how does the future cheese market look?' ". The case company neither invests in the suppliers for innovation, nor pays a premium. However, the category buyer believes that development costs are somehow hidden in the price. Only in few new product developments the case company has agreements on exclusivity, and usually suppliers own the IP Rights.

B.3. Cost Leadership Strategy – Successful Cases

LIQPACK

LIQPACK is a paper-based packaging purchase category where there is not much differentiation in the products' functionality, appearance, and convenience. Therefore, the main focus is on cost reduction. There is not much product innovation, but the case company aims to achieve process efficiency, for instance by having new machines with higher capacities. Spend-wise, it is one of the biggest purchase categories of the case company.

The supply market is dominated by two key global players, and there are hardly any new entrants due to high costs – the market is already very competitive in terms of cost. Therefore, although the case company is one of the major players in their market, their share among the customers of the suppliers is not very big. Dual sourcing is the most heavily exercised sourcing mode, but at some locations due to smaller volumes there is single sourcing. One of the reasons of dual sourcing is to increase the competition between the suppliers and get more price reductions. As the case company has been doing business with these two suppliers for more than 15 years, the tough price discussions are not damaging the buyer-supplier relationships. Suppliers are not willing to have long-term contracts, and especially in Europe the contract duration is around 12 months. This is also due to the high volatility of the underlying markets.

The suppliers do not share any cost information at all with the case company, but they do share some technical and operational information. As the industry has matured and a certain price level has been achieved, slowly innovation is also entering the agendas. In Asian operations, the case company is engaged in co-development with suppliers regarding filling lines, and in Europe there is not co-development, but they try to be the first buyer of suppliers' innovations.

PET

PET is a packaging purchase category that includes pre-forms to produce plastic bottles. It is especially used for large contents. Currently, the major focus of purchasing is on reducing costs, because for the market where plastic is used cost price of the bottles is very important. The purchase category spend is only about 2-3% of the total purchasing spend, but it is still important because if there are problems with the supply that means the products cannot be packed.

The entry barriers for new suppliers are not very high, but as the margins are quite low and there is a high dominance of a few key regional players, there are not many new suppliers. The case company has five main suppliers which supply around 70% of the total spend. Overall, the total supply base for this purchase category is somewhat fragmented: there are regional players which are preferred due to their financial stability, but also some local suppliers which are more flexible. At many locations, there is single sourcing. One of the purchasing objectives is to increase the total number and share of regional suppliers, but also have more local back-up in order to secure the supply and increase the price competition. This, they believe, will also bring more bargaining power to them. However, some products of the case company cannot be easily produced by another supplier, and finding new suppliers takes sometimes half a year.

The contract duration is about 24 months with the regional suppliers, and 12 months with the local suppliers. The suppliers compete to a high extent and they do not collaborate. The suppliers are open to sharing information with the case company on various issues including the costs, because this information is already available in the market (there is no secrecy). Although the main focus in this purchase category is on costs, in the future they want to explore innovations further. The category buyer states that innovations usually come from either the biggest suppliers or design agencies. He further adds that even though innovations

are not explicitly discussed on the table with the suppliers, in one way or the other the development costs of suppliers are reflected on the final price.

PHOSPHATES

The PHOSPHATES purchase category includes ten main types of phosphates that are used in pre-dried products such as coffee whiter. It is a very traditional industry where cost is the main driver. The purchase category buyer states that there have not been any developments at all since 15 years. The main purchasing objective is to achieve lower total costs of ownership (i.e. not just price, but also logistics costs). The purchasing spend is not very high, but a possible scarcity can impact some of the products, therefore making the delivery objective more important than the cost objective sometimes. However, the purchase category buyer states that the case company has more purchase categories that are more profitable.

The margins of the suppliers are quite low in this industry, and the entry barriers for new suppliers are quite high. Compared to a few years ago, the case company now has more preferred suppliers which enable them to be more flexible to the changing volumes and prices. There are four main global suppliers which supply 95% of the total volume. Although there are only four main suppliers, they differentiate to some extent. For instance, one of them has better quality products, and also tries to find ways of using existing products in new end products. The suppliers compete to a high extent and they do not collaborate.

Due to the supply continuity risk, the case company is trying to find more local, smaller suppliers. There is not a single supplier that can supply all different phosphate types and volumes that the buying company needs, and multiple sourcing is used at many locations. The contract duration is very short, and only in stable market conditions 12 months contracts are possible. However, due to long term relationships with the case company this does not create any problems. Trust levels between the case company and the suppliers are also quite high. The case company is a preferred customer for all suppliers (i.e. the purchasing spend is more than 5%). The components of the phosphate and individual cost dimensions are widely known in the market; therefore, the suppliers are not hesitant to share information.

ADJUNCTS

ADJUNCTS is a purchase category which includes purchase items such as corn, sorghum or glucose that are used in some products as an alternative to the main ingredient. The

purchasing spend is quite low, but in some products adjuncts are highly important as they give the characteristic taste. The key focus in purchasing is on costs. Innovations in this purchase category relate more to optimizing the supply chain, increasing the yields, and process efficiencies. Supply continuity is another critical issue as the natural events and weather conditions highly impact the availability and demand/supply balance in this purchase category. Due to this volatility in volumes, the contract duration is in general about 12 months.

Adjuncts is not a very capital intensive industry and the entry barriers for new suppliers are not very high; however, it is not a very attractive market as there is already quite some competition between the existing suppliers. The supply base consists of five global suppliers, and in total there are about 30 suppliers. In addition to the global suppliers, the sourcing policy is to have two or three local suppliers for a group of purchases. Therefore, they mostly do either dual or multiple sourcing. This allows the case company to drive competition, and also enables them to get more insights about different markets. Big suppliers are mostly used for the bulk of the production and smaller suppliers help to mitigate peak demand.

The purchase category manager indicates that they also actively try to have a good balance between the suppliers, and for instance not give too much share to a specific supplier, especially to the smaller ones in order to not substantially impact the suppliers' business (in case something goes wrong). The buyer-supplier power is balanced and the case company is a preferred customer of their main suppliers. Suppliers in this purchase category compete to a moderate extent, but there is not a very severe competition based on price. Suppliers do not collaborate with each other; they only communicate to a low extent about legal issues and new materials. To a moderate extent, suppliers are not hesitant to share information about costs, operations, and technical issues.

B.4. Cost Leadership Strategy – Less Successful Cases

GLASS

GLASS is one of the major packaging purchase categories of the case company where the purchasing spend is quite high. It is considered as a traditional and mature category "… where most people know a lot about it already. There are two key purchasing objectives: cost and security of supply. The category manager states that "… in terms of innovations, there is not

much out there. All the techniques are known and what is left is only combining the existing technologies. Most of the innovations do not happen on the glass, but on labels that are used to decorate the bottles".

The supply market has consolidated during the past years, and the margins are not very attractive which limits the new entrants to some extent. In total, there are approximately 45 suppliers in this purchase category, and almost 70% of the purchases are from three big, global suppliers. The aim is to decrease the total share of the major suppliers and develop the local suppliers more. To some extent, small suppliers offer cost advantages over the larger ones. The objective is always to have three or more supplier per purchase, but if the volumes do not allow many suppliers then they do single sourcing. Contract duration is in general around three years, and sometimes can even increase to ten years and offer very attractive prices.

The purchases are highly customized for the case company. Supply disruption risk is not very high and the only issue is the seasonality in demand, which might sometimes create problems due to the flat production pattern of the suppliers. However, neither the high customization nor the volume volatility poses a serious threat; the category manager states that it is quite easy to switch to another supplier. The case company is a major glass customer in Europe, and therefore their bargaining power is quite high. For all of their suppliers, they have the preferred customer status.

As the supply market is a very traditional one, a lot of information is already available on the market. Additionally, the case company has an open book cost structure with one glass factory; therefore, they know the costs exactly. Suppliers do not collaborate with each other and they compete to a high extent. The case company tries to develop the smaller suppliers by giving them more business, but there is no financial investment in terms of shared development costs, for instance. The category manager states that the suppliers also do not want to engage in innovation which they can only use with the case company.

INDPACK

The INDPACK purchase category includes products such as big bags, paper bags, and pallets. The spend percentage is not very high, purchased items are commodity products and not really customized for the case company, and the purchased category is not considered a high

priority. There is a strong cost emphasis for all purchased products in this purchase category, and for some of them quality is also very important. However, some of the suppliers have difficulties matching the quality requirements of the case company. The majority of the case company's suppliers focus on building and chemical industry where the sole focus is on cost, and there are only a few specialized in food and beverages industry where there are stricter quality requirements.

There are many suppliers in the market, but the case company has 12 suppliers in total. There is not one or a group of major suppliers due to the volumes being shared equally between them. There are not a lot of suppliers that can handle the majority of the volumes and the diversity of the products. Accordingly, the key purchasing objectives are to increase the supply base further, and standardize the specifications. The main sourcing mode is multiple sourcing and contract duration is around 36 months. Supplier relationships are long-term mostly, and for three suppliers the category buyer considers the position of the case company as the preferred customer. The suppliers compete to a moderate extent, and they do not know much about each others' products. The suppliers are quite open to information sharing about technical issues and operations, but they only give some suggestions to the case company regarding how to improve the specifications in order to reduce the costs.

Chapter 6

CONCLUSIONS

6.1. INTRODUCTION

The objective of this dissertation was to examine how firms can effectively manage their various purchase categories in order to have a high purchasing performance. Building on the strategy-structure-performance paradigm of contingency theory (Chandler, 1962; Ginsberg and Venkatraman, 1985), we specifically focused on the link between purchase category strategies, purchasing and supply base structures, and purchase category performance. Table 6.1 summarizes the findings as well as the key contributions of each chapter.

In *Chapter 2*, we first developed a purchasing strategy taxonomy at the purchase category level. We defined strategy based on the strategic intent (Hamel and Prahalad, 1989), and investigated the patterns of emphasis on five competitive priorities: cost, quality, delivery, innovation, and sustainability. Although it was discussed in the literature that competitive priorities can be used to define purchasing strategies (Krause et al., 2001), this notion was never tested at the purchase category level. Analyzing data collected from 318 manufacturing firms in ten countries through the use of cluster analysis, we identified five purchase category strategies: *Emphasize All, Cost Management, Product Innovation, Delivery Reliability*, and *Emphasize Nothing*. We found that firms pursue multiple competitive priorities simultaneously in some purchase category strategies but focus on one or a few key competitive priorities in others. Therefore, our purchase category strategy taxonomy provides support for both the trade-off

(Hayes and Wheelwright, 1984; Skinner, 1985) and combinative capabilities arguments (Kristal et al., 2010; Rosenzweig and Easton, 2010). We subsequently investigated how this purchase category strategy taxonomy relates to the Kraljic matrix, a purchasing portfolio model utilized frequently in practice. We found that some strategies are more likely to be implemented in certain quadrants of the matrix but that within each quadrant, it is possible to implement various purchase category strategies in an effective way. This finding empirically validates our argument that existing portfolio models alone do not provide sufficient guidance for defining appropriate strategies.

In *Chapter 3*, we investigated the link between purchase category strategies and purchasing structure. We focused on two purchase category strategies identified in *Chapter 2*: Cost Leadership and Product Innovation, and examined three dimensions of purchasing structure: centralization, formalization, and cross-functionality. Although purchasing structure has been investigated to some extent in previous studies (e.g. David et al., 2002; Johnson, Klassen, Leenders, & Fearon, 2002; Rozemeijer, van Weele, & Weggeman, 2003; Foerstl, Hartmann, Wynstra and Moser, 2013), a holistic approach investigating the multiple dimensions of purchasing structure along the lines of (mis)fit was missing. Additionally, the focus has been mostly on the overall purchasing structure and the notion that purchasing structure can vary across different purchase categories has been somewhat neglected. As a response to these gaps, we investigated to what extent the (mis)fit between purchasing strategy and purchasing structure impacts purchasing performance. Analyzing data collected from 469 firms in ten countries, we demonstrated that the strategy-structure misfit negatively impacts purchasing performance in executing both cost leadership and product innovation strategies. We also illustrated the mechanism for how the strategy-structure misfit works. We found that purchasing proficiency fully mediates the effect of cost misfit and partially mediates the effect of innovation misfit. These findings suggest that the strategy-structure misfit has a negative impact on the quality of how purchasing processes are executed, which in turn decreases cost and innovation performance. We further speculated that the partial mediation suggests that innovation misfit not only impacts internal processes, but its effect might extend beyond the firm boundaries and also negatively impact supplier behavior.

Table 6.1. Summary of this dissertation's findings

Chapters	Main findings	Scientific contribution
Chapter 2	Based on the competitive priorities emphasized *(i.e. cost, quality, delivery, innovation, sustainability)*, five purchase category strategies can be identified: *Cost Leadership, Product Innovation, Delivery Reliability, Emphasize All, and Emphasize Nothing.*	Building on the notion that the competitive priorities used to define operations strategies can also be used to define purchasing strategies (Krause et al., 2001), we present an empirical test at the purchase category level.
	Firms pursue multiple competitive priorities simultaneously in some purchase category strategies but focus on one or a few key competitive priorities in others.	We illustrate that both the trade-off (Hayes and Wheelwright, 1984; Skinner, 1985) and combinative capabilities arguments (Kristal et al., 2010; Rosenzweig and Easton, 2010) are necessary to define the full portfolio of purchasing strategies.
	Many purchase category strategies can be implemented equally effectively in the same Kraljic quadrant, but some purchase category strategies are more likely to be implemented in certain quadrants.	We empirically illustrate that existing purchasing portfolio models do not fully cover the variety in purchase category strategies, and that they should be complemented with an extra layer based on competitive priorities.
Chapter 3	When managing a purchase category with a cost leadership strategy, the higher the deviation from the ideal purchasing structure (cost misfit), the lower the purchasing cost performance. When managing a purchase category with a product innovation strategy, the higher the deviation from the ideal purchasing structure (innovation misfit), the lower the purchasing innovation performance.	By adopting the "fit perspective", we empirically illustrate that the notion that "organizational design characteristics should enable a chosen strategy" (Porter, 1985; Miller, 1987) is valid also at the purchase category level.
	Purchasing proficiency fully mediates the relationship between cost misfit and cost performance, and partially mediates the relationship between innovation misfit and innovation performance. We speculate that the partial mediation suggests that innovation misfit not only impacts internal processes, but its effect might extend beyond the focal firm boundaries and negatively impact supplier innovative behavior.	We do not only empirically validate that a strategy-structure misfit is detrimental for purchasing performance, but we also illustrate how this mechanism works.

Chapter 4	By reviewing 465 survey articles published in six key operations management journals during the period of 2006-2011, we find that pooling of data from apparently heterogeneous groups is common practice in the operations and supply management field, but awareness and consequently maximization and testing of equivalence remains limited.	We increase the awareness in the operations and supply management field about measurement equivalence and illustrate that it is a serious threat to validity in many studies having collected data from apparently heterogeneous groups.
	We develop a comprehensive set of guidelines showing ways to identify possible sources of heterogeneity, maximize measurement equivalence during study design, test for equivalence post data collection, and deal with partial or non-equivalence.	Our framework is the first in the operations and supply management field which provides guidelines for all stages of data collection and analysis.
Chapter 5	Building on theory and our data, we identify five dimensions of supply base structure: the number of suppliers and the sourcing mode, heterogeneity of suppliers, interaction between suppliers (i.e. collaboration vs. competition), relationship and contract duration, and supplier information sharing.	We develop the concept of "supply base structure" by examining its multiple dimensions, and investigating it at the purchase category level.
	The ideal supply base structure to successfully manage a purchase category is affected both by the purchase category strategy (i.e. cost leadership versus product innovation) and purchase category characteristics (i.e. supply risk and financial importance). Our findings suggest that the impact of purchase category characteristics is higher.	We develop propositions to be tested in future studies.
	The ideal supply base structures for purchase categories managed with a cost leadership or a product innovation strategy are not completely different from each other – while some supply base structure dimensions are different, many of them are similar.	We develop propositions to be tested in future studies.

In *Chapter 4*, we investigate the topic of measurement equivalence, an issue that is of crucial importance in survey research when data is collected from apparently heterogeneous groups, such as different countries or different respondent types (Rungtusanatham et al., 2008). In *Chapter 2* and *Chapter 3*, we use data from the International Purchasing Survey (IPS) project which consists of data collected from ten countries. In both chapters we test for measurement equivalence by means of generalizability theory, which is a test appropriate for small sub-samples. In *Chapter 4*, we investigate measurement equivalence in detail, and present a methodological paper where we first perform a literature review about the current state of controlling and testing for measurement equivalence in the operations and supply management field. We find that although in many studies there are various sources of heterogeneity (e.g. different countries, different data collection methods, different respondent types) hardly any study takes into account the threat of measurement inequivalence on the validity of their findings. After that, we develop a comprehensive set of guidelines showing ways to identify possible sources of heterogeneity, maximize measurement equivalence during design, test for equivalence post data collection, and deal with partial or non-equivalence.

In *Chapter 5*, we investigate the link between purchase category strategies and supply base structure, an external structure which is also argued to be affected by strategy. Again, we focus on cost leadership and product innovation strategies. There has been very little research about supply base structure, and an empirical analysis at the purchase category level and in relation to purchasing strategies and purchasing performance was missing. Therefore, we adopted an exploratory approach and used the multiple case-study method. Having investigated 13 successful and less successful purchase categories managed with a cost leadership or a product innovation strategy, we used this rich data to develop propositions relating supply base structure to purchase category strategies and performance. We found that the ideal supply base structure to successfully manage a purchase category depends on both purchase category strategy (i.e. cost leadership versus product innovation) and purchase category characteristics (i.e. supply risk and financial importance). We also illustrated that the ideal supply base structures are not completely different from each other – while some supply base structure dimensions are different, many of them are similar across successful and less successful purchase categories. These results make use conclude that the links between purchase category strategies, supply market characteristics, and supply base structure are stronger than the link between supply base structure and purchase category performance.

In conclusion, in this thesis we investigate how the purchasing structure and supply base structure should be organized to effectively manage purchase category strategies. Our studies illustrate the importance of defining purchase category strategies by considering the competitive priorities, and having a structure that matches the strategy. Our findings are not only scientifically relevant, but they also suggest guidelines for purchasing professionals regarding successful purchase category management. In the next sections, we conclude by stating the theoretical contributions, managerial contributions, and limitations and suggestions for future research.

6.2. THEORETICAL CONTRIBUTIONS

In addition to discussing how the findings in each chapter of this dissertation inform existing scientific knowledge (Table 6.1), it is also important to summarize the key theoretical contributions. This dissertation makes a number of contributions to the purchasing and supply management literature, strategy literature, and innovation literature. Furthermore, it contributes to survey research by suggesting a comprehensive guideline to improve validity and reliability. Below, we elaborate on the theoretical contributions.

6.2.1. Purchasing and Supply Management Literature

This dissertation makes four main contributions to the purchasing and supply management literature. First of all, its specific focus on purchase category level as the unit of analysis enables extending previous studies about purchasing strategies and purchasing structure which were mostly at the functional or department level (e.g. González-Benito, J., 2010; Johnson and Leenders, 2001; Rozemeijer et al., 2003). Despite the practical relevance of purchase category management, there has been surprisingly very little research, if any, investigating purchasing strategy formation and implementation at the purchase category level. Although firms might have overall purchasing strategies, and overall supply base and purchasing structures, the variety in the types of purchased products and services necessitates differentiation in these strategies and structures. This dissertation responds to the recent studies in the purchasing and supply management literature which suggest adopting a micro as opposed to macro level analysis building on the argument that the variation across purchase categories has a huge

impact on the purchasing strategies, structure, and practices (e.g. Karjalainen 2011; Luzzini et al., 2012; Terpend et al., 2011; Trautmann et al., 2009).

Second, this dissertation contributes to bridging the gap between purchasing and supply management and other related fields. Building on previous studies that suggest a strong link between operations and purchasing (Baier et al. 2008; González-Benito 2010; Watts et al. 1992), we develop a purchasing strategy taxonomy based on competitive priorities from operations. We extend previous studies examining the alignment between purchasing and operations strategies (e.g. Baier et al. 2008; González-Benito 2007; Pagell and Krause, 2002) by testing the applicability of this phenomenon at the purchase category level. Our results suggest that purchase category strategies need to be defined considering not only the supply risk and purchase importance discussed in existing purchasing portfolio models (e.g. Kraljic, 1983; Olsen and Ellram, 1997), but also the competitive priorities.

Third, another theoretical contribution of this dissertation to the purchasing and supply management literature is examining purchasing strategy and purchasing structure not separately, but in relation to each other. As mentioned earlier, both topics have been discussed to a high extent in previous studies (albeit mostly at the overall purchasing function level), but to the best of our knowledge this dissertation makes the first attempt to examine the link between purchasing strategy and purchasing structure.

Finally, we develop and provide a detailed operationalization of the concept of supply base structure building on the supply base complexity construct discussed by Choi and Krause (2006) in their conceptual paper. We suggest additional dimensions and provide the first empirical investigation of the supply base structure concept.

6.2.2. Strategy Literature

Although the main contribution of this thesis is to the purchasing and supply management literature, there are also some implications for related research fields. First of all, we adopt one of the most examined frameworks in strategy literature, strategy-structure-performance paradigm, and examine it in the context of purchasing, and more specifically at the purchase category level. This responds to the calls for research that investigates strategy not only at the

overall firm level, but also specifically within the functions. Our findings support that view that strategy-structure-performance paradigm is also meaningful in the purchasing function context and suggest that this paradigm is not only useful at macro but also at micro levels. Second, we illustrate an example for the 'extended' strategy-structure-performance paradigm by also examining the role of processes. In Chapter 3, we find support for the mediating role of purchasing processes between purchasing strategy-structure fit and purchasing performance, which provides support for the extended strategy-structure-processes-performance paradigm (Rodrigues et al., 2004; Zheng et al., 2010).

6.2.3. Innovation Literature

This dissertation has some implications for the innovation literature as well. The number of firms which approach external knowledge domains and collaborate with external parties rather than relying solely on their own R&D capabilities has increased tremendously especially in the past two decades (Primo and Amundson, 2002; Sobrero and Roberts, 2001). Among these external resources, suppliers are cited as the major actors which can substantially increase the innovation performance of buying firms by helping to reduce costs, shorten time-to-market, and improve overall design effort (Carson, 2007; Clark, 1989; Handfield et al., 1999). Therefore, it is in the best interest of firms to understand how their purchasing function can enable getting more innovations from suppliers. Previous studies investigating supplier innovation has mostly focused on the timing and extent of supplier involvement as well as managing the relationships with them (e.g. Wynstra et al., 2003); but a focus on the design of the purchasing function and supply base had not been investigated before. This dissertation illustrates that product innovation is one of the key purchase category strategies, and suggests ideal supply base and purchasing function structures to pursue such strategies.

6.2.4. Survey Research

Surveys are increasingly used by researchers to collect empirical data, not only in purchasing and supply management, but also other related fields. Surveys allow collecting data from a large number of observations, but special attention needs to be paid to survey design and data collection in order to generate valid and reliable results. A major part of the data used in this dissertation comes from the International Purchasing Survey (IPS) Project, where information from companies operating in various industries in ten countries in Europe and North America

was collected by means of an online questionnaire. Therefore, it was deemed important to discuss some of the measures taken in the IPS project to increase reliability and validity. In Chapter 4, we develop a comprehensive set of guidelines showing ways to identify possible sources of heterogeneity, maximize measurement equivalence during study design, test for equivalence post data collection, and deal with partial or non-equivalence. This comprehensive framework contributes to survey research by increasing the awareness in the operations and supply management field about measurement equivalence and illustrating that it is a serious threat to validity in many studies having collected data from apparently heterogeneous groups. Our framework is the first to provide guidelines for all stages of data collection and analysis.

6.3. MANAGERIAL CONTRIBUTIONS

The findings of this dissertation provide useful guidelines for managerial decision-making in the area of purchase category management. Purchase category management is a very common practice among firms, and its importance and adoption are expected to increase even more in the near future (Trent, 2004; Monczka & Peterson, 2008). We should caution that the results presented in this dissertation are not only relevant for firms which have purchase category management in place, but also for those which would like to manage their purchase categories in a more strategic way.

Purchase category managers might use the purchase category strategy taxonomy developed in this dissertation in combination with their existing classifications. Our results help purchase category managers realize that classifying purchase categories purely based on supply market conditions and purchase importance is not sufficient. We show that multiple purchase category strategies can be effectively implemented under similar supply market conditions, but that some strategies are more likely to be implemented under certain conditions. A related future line of investigation can be to assess what determines the effectiveness of different purchasing strategies under similar conditions, and whether the purchasing practices adopted differ between these strategies.

The significant impact of the congruence between purchasing strategy and purchasing structure on purchasing performance in implementing both cost leadership and product innovation category strategies highlights the necessity of giving priority to organizational

design issues. Although firms might have an overall purchasing structure, decision makers should not underestimate the importance of adapting the purchasing structure to the different purchase category strategies. The additional insights gained by the mediation analysis help managers understand the impact organizational design problems can have on the execution of internal processes. A misfit between purchasing strategy and purchasing structure negatively impacts the quality of internal processes in implementing both cost leadership and product innovation strategies, which in turn decrease purchasing performance. However, we urge purchase category managers to be even more cautious about innovation misfit as our results suggest that the detrimental effects of it do not only impact internal processes, but possibly extend beyond the boundaries of the firm and impact supplier behavior as well.

Another contribution to practice is highlighting the interplay between purchase category strategies, supply base structure, and supply market and purchase category characteristics. At the moment purchase category managers seem to consider supply base as a direct function of the supply market characteristics, and do not aim to adjust its structure to their purchase category strategy (i.e. cost leadership versus product innovation). Our results demonstrate that although supply base structure cannot be examined in isolation, still purchasing managers can adjust some of the structure dimensions to support their purchasing strategy.

Consequently, this dissertation provides strategic directions for firms regarding how to design their purchasing and supply base structures to successfully implement purchase category strategies.

6.4. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This dissertation is not without limitations. We tried to minimize methodological limitations by adopting multiple research strategies (i.e. survey and case study) and taking the necessary precautions to increase validity and reliability. However, there are still some areas which can be improved in future studies.

First of all, the cross-sectional nature of the data prevents us from making strong assumptions about causality. Future studies could employ longitudinal settings, which also help uncover the dynamic relationships between purchasing strategies and purchasing structure. Second, as a result of having a very large survey project we had to rely on single

informants. Although our analyses indicate that there is not an obvious threat of common method bias, future studies would benefit from incorporating multiple informants and data sources to triangulate data. One option could be to approach multiple respondents from the purchasing function, but a better option could be to also approach for instance R&D managers, in relation to evaluating innovation performance. Third, we relied on perceptual measures to evaluate purchase category performance. It is often argued in the literature that using objective data is a better choice when assessing performance, especially when relying on single informants (Ketokivi & Schroeder, 2004). However, our unit of analysis at the purchase category level prevents us to define purchasing performance measures that are consistent and available across firms and across purchase categories, especially in relation to innovation performance. Finally, we focused on a single industry and a limited number of purchase categories to examine the link between purchasing strategies and supply base structure. Due to the scarcity of previous knowledge and our aim to develop the concept of supply base structure further, the multiple case study strategy was the most suitable option. To generate further insights and test the propositions suggested in this dissertation, future studies could rely on large scale surveys conducted across firms operating in different industries.

In addition to methodological limitations, there are some scope limitations as well which need to be examined in future studies. One possible extension to examining purchase category strategies is to investigate to what extent organizational level purchasing strategies impact purchase category level strategies. Additionally, the issue of effectively managing different purchase category strategies under similar supply market and purchase category characteristics warrants further investigation. A possible extension is investigating the differences between purchasing practices adopted in each purchasing strategy.

Another area for future research is investigating the link between strategy and structure in other purchasing strategies identified in Chapter 2: Emphasize All, Emphasize Nothing, and Delivery Reliability. We heavily relied on previous studies from the innovation literature to develop hypotheses about the most suitable purchasing structure for cost leadership versus product innovation strategies. To the best of our knowledge, there are no studies which suggest ideal supply base structures for Emphasize all or Delivery Reliability strategies, for instance. Therefore, a useful extension would be to adopt more descriptive approaches,

possibly by means of the case study method. This could also allow for examining more dimensions of purchasing structure.

A final area of improvement in generating knowledge about the link between purchasing strategy and supply base structure could be to examine more cases. In order to choose our cases, we distinguished between cost leadership versus product innovation strategies, and successful versus less successful cases, resulting in a two-by-two matrix and thus four groups. From each group, we investigated multiple cases. It turns out that product innovation strategies were only observed in bottleneck and leverage purchase categories, and cost leadership strategies were only observed in non-critical and leverage/strategic purchase categories. In Chapter 2 we had found that product innovation strategies are implemented also in strategic purchase categories and cost leadership strategies are implemented also in leverage and bottleneck purchase categories. We were not able to investigate all of these differences in our study as it would require a substantial increase in the number of case studies. In order to capture all of this variety, future research can rely more on large N studies, or alternatively, depending on the research question it can focus on one type of purchasing strategy and investigate all four purchase category types (i.e. non-critical, leverage, bottleneck, strategic).

Notwithstanding these limitations, we hope that this dissertation will inspire further research into purchasing strategies, processes, and structures at the purchase category level, and help bridge the gap between practice and theory in this area.

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SUMMARY

Over the past decade in particular, purchasing and supply management has transformed from a purely tactical and operational function into a strategic one which can substantially contribute to the competitiveness of organizations. In line with practitioners' growing interest in purchasing's impact on performance, researchers have also examined various assumed correlates with performance, such as purchasing strategies, supply base management, and purchasing organization design. However, in the majority of these studies the focus has been on purchasing strategies and practices at the function/department level. What has not yet been covered to the same extent in the literature is purchasing and supply management at the purchased item/purchase category level. It is crucial for firms to successfully manage the large variety of products and services they purchase by formulating and implementing different purchasing strategies for different purchase categories, but scientific knowledge about this topic is still limited.

This dissertation contributes both to theory and practice by examining purchasing strategy formation and implementation at the purchase category level. Building on the strategy-structure-performance paradigm of contingency theory three main questions are investigated*: i) What are the different purchase category strategies?, ii) What are the links between purchase category strategies, purchasing structure, and purchasing performance?*, and *iii) What are the links between purchase category strategies, supply base structure, and purchasing performance?*

In *Chapter 2*, I first develop a taxonomy of purchasing strategies based on the competitive priorities emphasized for a purchase category. Various purchasing portfolio models have been discussed in the literature, but these typically focus on a limited set of contingencies (such as purchase importance and supply risk) to identify purchasing strategies. Examples from practice suggest that strategic intent is a more direct differentiator of purchasing strategies, but there is a scarcity of research on this topic. In this chapter, strategic intent is defined on the basis of competitive priorities in operations (i.e. cost, quality, delivery, innovation, sustainability), which have conceptually been argued to be highly valid in purchasing, yet without substantial empirical evidence. Analyzing a large scale survey data set (from the International Purchasing Survey (IPS) project, www.ipsurvey.org) collected in ten countries, I

identify five purchase category strategies: Emphasize All, Cost Management, Product Innovation, Delivery Reliability, and Emphasize Nothing. I subsequently investigate the link between this purchase category strategy taxonomy and the Kraljic matrix, a frequently utilized purchasing portfolio model in practice. The results show that some strategies are more likely to be implemented in certain quadrants of the matrix, but that within each quadrant it is possible to implement various purchase category strategies in an effective way. Thus, the findings of this chapter suggest that practitioners should not just focus on purchase category characteristics to define purchase category strategies, but also consider competitive priorities as a complementary layer.

Having identified five key purchase category strategies in Chapter 2, in *Chapter 3* I focus on the two most distinctive types of purchase category strategies - cost management and product innovation - and study the implementation of these strategies. More specifically, I investigate how the deviation from an ideal purchasing structure impacts purchasing performance when implementing cost management and product innovation strategies. Hypotheses are developed combining organization, innovation, and purchasing literatures. It is predicted that a purchasing structure characterized by high centralization, high formalization, and low cross-functionality is better for implementing cost management strategies whereas a purchasing structure characterized by low centralization, low formalization, and high cross-functionality is better for implementing product innovation strategies. The results obtained using the IPS data set demonstrate that the strategy-structure misfit negatively impacts purchasing performance in both strategies. Furthermore, the results show that purchasing proficiency (the level of quality in executing purchasing processes) is a mediator on this relationship. The findings aid managerial decision making by illustrating the detrimental impact of purchasing strategy-structure misfit on purchasing processes and purchasing performance.

Due to using a large scale, international survey data set in two key chapters of this dissertation, it is deemed important to also discuss measurement equivalence which can impact the validity of the findings in such data collection efforts where multiple respondent groups are present. In *Chapter 4* of this dissertation, first the current state of measurement equivalence in operations and supply management (OSM) literature is analyzed. A detailed review of 465 survey papers in six leading OSM journals between the period of 2006-2011 indicates that the awareness and use of measurement equivalence tests is very limited, yet

there is a substantial amount of studies that collect and use data from apparently heterogeneous groups of respondents which hence carry a threat of measurement inequivalence. After this review, building on the experiences gained and the best practices implemented in designing and implementing the above mentioned survey project, a detailed framework based on novel approaches is developed. The chapter concludes by suggesting OSM scholars to use this framework in order to increase the validity of the findings in their survey projects where data is collected from transparently different groups.

In Chapter 5, I investigate the link between purchase category strategies and supply base structure. Five supply base structure dimensions are examined: The number of suppliers, differentiation of suppliers, interaction between suppliers, relationship and contract duration, and level of supplier information sharing. Additionally, the role of purchase category characteristics (i.e. supply risk and financial impact) as an alternative mechanism explaining the supply base structure is also discussed. By means of the multiple case study method, I investigate 13 direct purchase categories in two international firms operating in the food and beverages industry, and develop several hypotheses to be tested in future studies. The findings of this chapter suggest that although purchasing strategy and purchase category characteristics impact the supply base structure, the ideal supply base structures for implementing a cost leadership or a product innovation strategy are not completely different from each other – several supply base dimensions overlap. Detailed discussions of several supply base structure dimensions in this chapter provide rich insights for practitioners regarding supply base design.

Consequently, the findings of this dissertation contribute to the scientific and managerial knowledge about developing purchase category strategies and successfully implementing them by designing the purchasing structure as well as the supply base structure in line with these strategies. With the purchasing and supply management function having a more strategic role in many organizations today, the findings of this dissertation are deemed to be both timely and useful for both practitioners and researchers.

SAMENVATTING

Inkoop en leveranciersmanagement heeft, met name in het afgelopen decennium, een transformatie doorgemaakt van een puur tactische en operationele functie naar een strategische functie die substantieel kan bijdragen aan de concurrentiepositie van organisaties. De impact die inkoopmanagement kan hebben op de prestaties van de organisatie heeft de aandacht van inkoop professionals getrokken. In wetenschappelijk onderzoek is veel aandacht uitgegaan naar verschillende mogelijke determinanten van prestaties zoals inkoopstrategieën, leveranciersmanagement, en de organisatie van inkoop. Maar, in de meeste van deze studies was het niveau van analyse de inkoopfunctie of de inkoopafdeling. Veel minder aandacht is uitgegaan naar inkoop en leveranciers management op het niveau van de artikelgroep / inkoopcategorie. Het formuleren en uitvoeren van verschillende inkoopstrategieën voor de grote verscheidenheid aan producten en diensten die organisaties kopen is heel belangrijk voor hen, maar de wetenschappelijke kennis over dit onderwerp is nog beperkt.

Dit proefschrift draagt bij aan de theorie en de praktijk van inkoopmanagement door de vorming en implementatie van inkoopstrategie op artikelgroep niveau te onderzoeken. Voortbouwend op het paradigma "strategie-structuur-prestaties" van de contingentietheorie, worden drie hoofdvragen onderzocht: i) Wat zijn verschillende artikelgroep strategieën?, ii) Wat zijn de verbanden tussen artikelgroep strategieën, inkoopstructuur, en inkoopprestaties?, en iii) Wat zijn de verbanden tussen artikelgroep strategieën, structuur van de supply base en inkoopprestaties?

In hoofdstuk 2, ontwikkel ik eerst een taxonomie van inkoopstrategieën op basis van de (competitive priorities) die door een inkopende organisatie voor een artikelgroep worden benadrukt. In de literatuur worden diverse inkoop portfoliomodellen besproken, maar deze concentreren zich op een beperkt aantal contingenties, zoals financieel belang en toeleveringsrisico geassocieerd met de in te kopen artikelgroep. Voorbeelden uit de praktijk laten zien dat strategische intentie een meer directe differentiator van inkoopstrategieën is, maar onderzoek naar dit onderwerp is schaars. In dit hoofdstuk wordt strategische intentie gedefinieerd op basis van (competitive priorities) (uit operations management) (dwz kosten, kwaliteit, levering, innovatie, duurzaamheid), waarvan conceptueels aangevoerd dat deze

evenzeer geldig zijn voor inkoop, maar zonder substantieel empirisch bewijs. Op basis van de analyse van een grootschalige survey data set (van het International Purchasing Survey (IPS) project, www.ipsurvey.org), met data uit tien landen, identificeer ik vijf artikelgroep strategieën: Benadruk Alles, Kostenmanagement, Productinnovatie, Leverbetrouwbaarheid, en Benadruk Niets. Vervolgens onderzoek ik het verband tussen deze taxonomie en de Kraljic-matrix, een veel gebruikt inkoopportfolio model in de praktijk. De resultaten tonen aan dat sommige strategieën vaker worden uitgevoerd in bepaalde kwadranten van de matrix, maar dat het in elk kwadrant mogelijk is om verschillende artikelgroep strategieën op een effectieve manier uit te voeren. Dus, om artikelgroep strategieën te definiëren, moeten inkoopprofessionals zich niet alleen richten op artikelgroep kenmerken (zoals belang en risico), maar ook op de competitive priorities als een aanvullende laag.

Na het identificeren van vijf belangrijke artikelgroep strategieën, richt ik me in hoofdstuk 3 op de twee meest onderscheidende strategieën - kostenmanagement en product innovatie. Ik richt me op de uitvoering van deze strategieën, en exploreer hoe de afwijking van een ideale inkoopstructuur de inkoopprestaties van een artikelgroep beïnvloedt. De hypothesen zijn ontwikkeld op basis van een combinatie van de organisatie, innovatie, en inkoop literaturen. De verwachting is dat een inkoopstructuur gekenmerkt door hoge centralisatie, hoge formalisering en lage cross-functionaliteit beter is voor de uitvoering van een kostenmanagement strategie, terwijl een inkoopstructuur gekenmerkt door lage centralisatie, lage formalisering en hoge cross-functionaliteit beter is voor de uitvoering van een productinnovatie strategie. De resultaten verkregen na analyse van de IPS data tonen aan dat de misfit tussen strategie en structuur een significant negatief effect heeft op inkoopprestaties bij beide typen strategieën. Bovendien laten de resultaten zien dat inkoop bekwaamheid (de kwaliteit van de uitvoering van inkoopprocessen) een mediërende variabele is in de relatie tussen misfit en prestatie. Deze bevindingen ondersteunen de besluitvorming door managers doordat ze de nadelige gevolgen van een misfit tussen inkoopstrategie en inkoopstructuur op inkoopprocessen en inkoopprestaties laten zien.

Omdat in twee belangrijke hoofdstukken van dit proefschrift een grootschalige, internationale survey dataset wordt gebruikt, wordt ook een hoofdstuk aan "measurement equivalence" (meetvariantie) gewijd. In deze vorm van dataverzameling waar er duidelijk meerdere onderling verschillende groepen respondenten zijn, kan meetvariantie tussen

groepen invloed hebben op de geldigheid van de bevindingen. In hoofdstuk 4 van dit proefschrift, wordt eerst de huidige stand van zaken betreffende measurement equivalence in de operations - en inkoopmanagement (OSM) literatuur geanalyseerd. Een gedetailleerd overzicht van 465 survey papers in zes toonaangevende OSM tijdschriften uit de periode 2006-2011 geeft aan dat de bekendheid met en het gebruik van toetsen voor measurement equivalence zeer beperkt is. Toch is er een aanzienlijke hoeveelheid studies gepubliceerd die gegevens verzamelen en gebruiken van ogenschijnlijk heterogene groepen respondenten. De geldigheid van deze studies kan dus bedreigd worden door meetvariantie. Na deze beoordeling van de literatuur, en voortbouwend op de ervaringen en de best practices zoals geïmplementeerd in het ontwerpen en uitvoeren van het bovengenoemde onderzoeksproject, wordt op basis van nieuwe inzichten uit de meettheorie een gedetailleerd raamwerk voor het omgaan met meetvariantie ontwikkeld. Het hoofdstuk sluit af met de aanbeveling dat onderzeoekers uit het OSM veld dit raamwerk gebruiken om de geldigheid van de bevindingen in survey projecten waarbij data wordt verzameld uit duidelijk heterogene groepen te vergroten.

In hoofdstuk 5 onderzoek ik het verband tussen artikelgroep strategieën en de structuur van de supply base. Vijf dimensies van de supply base structuur worden onderzocht: het aantal leveranciers, de mate van differentiatie tussen leveranciers, interactie tussen leveranciers, relatieduur en contractduur, en de mate van informatie-uitwisseling met leveranciers. Bovendien wordt de rol van artikelgroep kenmerken (toeleveringsrisico en financieel belang) als een alternatieve verklaring van de supply base structuur ook besproken. Met behulp van een meervoudige case study onderzoek ik 13 artikelgroepen die tot de directe inkoop behoren van twee internationale bedrijven die actief zijn in de voedingsmiddelen industrie. Verscheidene hypothesen worden ontwikkeld om in toekomstige studies te toetsen. De bevindingen van dit hoofdstuk suggereren dat hoewel de inkoopstrategie en artikelgroep kenmerken de supply base structuur beïnvloeden, de ideale supply base structuren voor de uitvoering van een kostenmanagement of een productinnovatie strategie niet geheel verschillend zijn van elkaar - meerdere supply base dimensies zijn gelijk in beide strategieën. Gedetailleerde besprekingen van diverse supply base structuur dimensies bieden rijke inzichten voor inkoop professionals voor het ontwerpen van de supply base.

Samenvattend dragen de bevindingen van dit proefschrift bij aan de wetenschappelijke en bestuurlijke kennis over i) het ontwikkelen van artikelgroep strategieën, en ii) het succesvol implementeren van deze strategieën door het ontwerpen van de structuur van de inkooporganistaie en van de supply base in lijn met deze strategieën. In het licht van de meer strategische rol die de inkoop en leveranciersmanagement functie heeft gekregen in veel organisaties, worden de bevindingen van dit proefschrift zowel tijdig en nuttig geacht te zijn voor zowel inkoopprofessionals als inkooponderzoekers.

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Melek Akın Ateş was born on 5 August 1985 in Izmir/Turkey. She holds double Bachelor's degrees in Business Administration and International Trade and Finance from Izmir University of Economics, Turkey, where she graduated as the valedictorian in 2007. She was awarded the Huygens Scholarship from the Dutch Ministry of Education, Culture and Science which allowed her to start the Supply Chain Management master at Rotterdam School of Management, Erasmus University. After graduating (cum-laude), in October 2008 she joined the Department of Management of Technology and Innovation of the same university to pursue a PhD.

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PURCHASING AND SUPPLY MANAGEMENT AT THE PURCHASE CATEGORY LEVEL STRATEGY, STRUCTURE, AND PERFORMANCE

Over the past two decades, purchasing has evolved from a clerical function focused on buying goods and services at a minimum price into a strategic function focused on value creation and achieving competitive advantage. This dissertation examines how firms can effectively manage their various purchase categories in order to have a high purchasing performance. Building on the strategy-structure-performance paradigm of contingency theory, I specifically focus on the link between purchase category strategies, purchasing and supply base structures, and purchase category performance.

Analyzing data from an international purchasing survey project, I identify five purchase category strategies based on the competitive priorities emphasized: Emphasize All, Cost Management, Product Innovation, Delivery Reliability, and Emphasize Nothing. The findings demonstrate that some strategies are more likely to be implemented under certain conditions, but that it is possible to implement multiple purchase category strategies in an effective way under the same conditions. After identifying these strategies, using the same data set I examine the link between purchase category strategies and purchasing structure. The results suggest that the strategy-structure misfit has a negative impact on the quality of how purchasing processes are executed, which in turn decreases cost and innovation performance. Finally, I investigate the link between purchase category strategies and supply base structure, an external structure affected by strategy. Using the multiple case study method, I develop propositions to be tested in future studies. Consequently, this dissertation extends knowledge on purchasing and supply management by generating theoretical and managerial insights regarding how to successfully manage purchase categories.

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