



Efficacy of purchasing activities and strategic involvement: an international comparison

Efficacy of purchasing activities

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Abstract

Purpose – The purpose of this study is to examine the effects of purchasing activities and the purchasing function's involvement with corporate strategy on manufacturing competitiveness as it is affected by national differences. In particular, the authors are interested in the research question: do purchasing theories built on samples from mainly North American and Western European countries apply in other countries with different cultural contexts?

Design/methodology/approach – Based on the 511 samples collected from ten countries or two distinct cultural groups (Group 1: Asia; Group 2: Western Europe/USA), the authors tested a purchasing model that is well-grounded in the literature. Two statistical methods were applied. First, multiple-group structural equation modeling (SEM) analysis was performed to test the model. The authors then applied regression analysis to examine whether the two country groups differ in their choice and efficacy of purchasing activities and strategic involvement.

Findings – The results suggest that the intensity and efficacy of purchasing activities and strategic involvement vary between the two country groups, Asia and Western Europe/USA. The Western Europe/USA samples adequately fit the purchasing model, but the Asian samples do not. At the item level, the study finds a common set of purchasing activities contributing to manufacturing competitiveness regardless of national differences. The findings suggest that national differences matter in implementing purchasing activities.

Originality/value – This study represents a first attempt at using national culture to explain differences in purchasing activities and strategic involvement.

Keywords Global operations management, Purchasing, Supply chain, National difference, GMRG, National culture, Supply chain management

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1. Introduction

Over the last two decades, the role of the purchasing function has been well recognized as a central component of the operations strategy of a company (Das and Narasimhan, 2000; Krause *et al.*, 2001; Narasimhan and Das, 2001; Prahinski and Benton, 2004; Rozemeijer *et al.*, 2003; Talluri and Sarkis, 2002). What is missing from the literature, however, is a thorough understanding of effects that national influence may have on purchasing activities (PA) and how this affects manufacturing performance. Despite cautions from many studies, the extant operations management (OM) literature often assumes that theories developed based on USA or European data are universal and, though with no empirical support, applicable to other countries (Flynn and Saladin, 2006; Meyer, 2007; Pagell *et al.*, 2005; Kristal *et al.*, 2011; Niehoff *et al.*, 2011; Qing *et al.*, 2011). From the perspectives of both research and industry practice, ignorance of national differences can be misleading. For instance, Hofstede (2007) found that many applications of management theory have failed even with the most experienced international companies due to cultural misunderstanding. In support of this, using Chinese samples, Zhao *et al.* (2006) found that a manufacturing strategy theory developed using North American data may not be applicable to Chinese firms.

The effects of national differences on PA are noted but not properly studied or validated (Krause *et al.*, 2001; Quintens *et al.*, 2006; Riedel and Mueller, 2009; Kristal *et al.*, 2011). Often, purchasing studies have examined the issue of national differences using very limited data that were collected from a single country or two countries for comparison (Belyea, 2008; Pagell *et al.*, 2005). Moreover, national difference is often treated as a control variable, while its explanatory influence on PA is not well understood. Yet it is vital that managers responsible for global operations understand how resident managers, based in different countries, make different decisions affecting PA (Belyea, 2008; Riedel and Mueller, 2009). The overarching objectives of this study are, therefore, to validate previous findings showing cultural differences in PA and to further the understanding of how national differences influence the efficacy of PA on manufacturing performance.

The particular research question we intend to address is whether purchasing theories, though well grounded in the literature, are, in fact, universal and applicable to countries with distinct cultures. Specifically, we investigate the relationship between PA (including the implementation of PA and strategic involvement (SI) of purchasing functions) and manufacturing competitiveness (MC) performance across two culturally distinct country groups, Western Europe/USA and Asia. The following section reviews relevant literature pertaining to several frequently cited PA and strategic purchasing involvement and their importance to manufacturing performance. Research hypotheses are developed, followed by the presentation of research methodology, including samples and measurements. The statistical results and discussion in relation to national differences are presented. Finally, managerial implications and suggestions for future research are provided.

2. Literature review and theoretical development

Based on the purchasing literature (Carter *et al.*, 2000; Das and Narasimhan, 2000; Krause *et al.*, 2000; Narasimhan and Das, 2001; Ellram *et al.*, 2002; Petersen *et al.*, 2005) and suggestions from a group of experts (Whybark *et al.*, 2009), this section selects and reviews several PA that are frequently discussed and implemented in the industry.

This list of PA encompasses various practices related to procurement, supplier development and supplier involvement. For each PA, we review its impacts on various aspects of manufacturing performance, including cost, quality, delivery, and flexibility. We also review the effect of purchasing SI as suggested by previous studies (Lawson *et al.*, 2009; Narasimhan and Das, 2001; Tan, 2002).

2.1 Purchasing activities

(a) *Buyer sponsored supplier conferences.* Ellram and Edis (1996) described buyer sponsored supplier conferences as meetings with the firm's suppliers that cover such issues as expectations for the suppliers, as well as issues relating to the long-term supplier-buyer relationship. The involvement and importance of buyer and seller collaboration is evident in the literature. Several studies cited supplier conferences as a critical activity that enhances supplier and buyer collaboration and manufacturing performance (Carr and Pearson, 1999; Carter *et al.*, 2000; Chen *et al.*, 2004).

(b) *Formal strategic sourcing process.* Narasimhan and Das (2001) and Talluri and Narasimhan (2004) emphasized the importance of the strategic sourcing process that involves careful selection of suppliers, development of long-term relationships, and implementation of a continuous feedback system between buyer and supplier. The strategic sourcing process includes insourcing and outsourcing decisions, both of which contribute greatly to delivery performance (Carter *et al.*, 2000; Sislain and Satir, 2000).

(c) *Reverse auctions.* Reverse auctions allow buyers to make purchases by observing a series of bids from sellers (Essig and Arnold, 2001; Shrader *et al.*, 2004). Supply chain partners around the world can get connected using web-based electronic reverse auctions. Carter *et al.* (2000), Essig and Arnold (2001) and Rhea (2007) confirmed that e-procurement programs with e-reverse auctions could lower purchasing transaction costs, as well as increase opportunities for the purchasing function to produce value for the firm.

(d) *Supplier representatives in plant.* McIvor and McHugh (2000) identified supplier representatives in plants as assisting in two areas – purchasing and new product introduction. Suppliers could become members of cross-functional teams within the organization with their added benefit dependent on their level of participation and fellow team members' willingness to work with the supplier representative (Narasimhan and Das, 2001). Womack and Jones (2003) suggested that having supplier representatives housed in manufacturing facilities helps to quickly reduce response time associated with problems and mitigates negative effects. Specifically, with regard to new product development, utilizing supplier representatives reduces risks and resources, increases knowledge and its sharing, and reduces product-to-market time. Sara Lee Co. experienced a five-fold increase in process innovation with the use of in plant supplier representatives who provided quicker and more accurate feedback on quality and innovation (Atkinson, 2006).

(e) *Strategic alliances/partnerships.* A strategic alliance is a formal partnership between at least two firms that contributes to the strategic objectives of each firm (Pearson *et al.*, 1998). Strategic supplier alliances and partnerships can become competitive advantages through the development of long-term mutually beneficial relationships (Chen *et al.*, 2004; Kannan and Tan, 2002; Narasimhan and Das, 2001; Vonderembse and Tracey, 1999). In general, a long-term strategic relationship would allow for informal communication that can expand the involved companies' knowledge of competitive issues through greater discovery and disclosure of information.

(f) *Commercial procurement software (e-procurement)*. Electronic procurement, often thought of as web-based procurement, includes web-based enterprise resource planning (ERP), e-sourcing, e-tendering, e-reverse auctioning, and e-informing (Carter *et al.*, 2000; Kinner and Marci, 2005). Benefits of e-procurement include greater quantity and quality of information, thereby reducing uncertainty in PA, as well as faster processing in procurement activities (Essig and Arnold, 2001).

(g) *Cross-functional commodity teams*. According to Rozemeijer *et al.* (2003), cross-functional commodity teams manage supply and purchasing requirements of many business units within a firm by utilizing collaboration from various functional units. Developing purchasing synergy is the primary goal of cross-functional teams. Ellram *et al.* (2002) and Ellram and Edis (1996) confirmed the contribution that purchasing teams make toward the overall cost performance of a firm. Sarin and McDermott (2003) also showed that cross-functional teams allow for greater innovation and speed in decision-making.

(h) *Early supplier involvement in design/redesign of products*. Ellram *et al.* (2002) and Ellram and Edis (1996) considered early supplier involvement an effective communication mechanism during the beginning stages of product development and procurement operations. They suggested that early supplier involvement is important for new product development. Primo and Amundson (2002) also suggested there is a significant benefit to product quality from involving the vendor in new product development. Vendors who are intimately involved with companies in early design processes defining product requirements can significantly reduce cost and schedule performance issues by substantially reducing rework or total redesign of components involved with new designs. Kodak found many of these benefits in its early supplier involvement efforts with product design, as well as the benefits of reduced cycle time and quality problems (Ellram *et al.*, 2002).

(i) *Non-direct materials (MRO purchases) delegated to manufacturing/operations*. Maintenance, repair, and operations (MRO) purchases are trending toward being outsourced, resulting in a reduced supplier base and potential cost savings (Tan, 2002). In a survey distributed to 400 Fortune 500 purchasing groups, 42 percent responded that their companies had undergone significant changes in their MRO purchasing procedures, resulting in delegation of these procedures to the internal users of the goods/services (Carter *et al.*, 2000; Hendrick *et al.*, 1996).

(j) *Supply base rationalization (decrease/increase base)*. Determining the appropriate number of suppliers is the main foundation for supply base rationalization. The extant literature suggests that supply base rationalization enforces effective supplier selection, volume consolidation, and parts bundling, which in turn contribute to cost reduction and quality improvement, as is the case with Rover Motors (Das and Narasimhan, 2000; Narasimhan and Das, 2001).

(k) *Purchased items are classified as strategic or tactical and are purchased by separate teams*. Tactical activities are considered to be of lower importance than other PA. These activities include several processes such as ordering, quoting, and expediting (Carter *et al.*, 2000). Tactical purchases are likely to be outsourced and/or automated over the next ten years, with many tactical purchases pushed into large contracts, thereby reducing the number of employees involved in these purchases (Carter *et al.*, 2000). In contrast, strategic purchases represent items of greater importance, with the procurement process focusing on supplier selection, and selection and development of

cross-functional teams. Trent (2004) asserted that separation between strategic and tactical purchases improves procurement efficiency.

(l) *Formal supplier development program.* Prahinski and Benton (2004) defined formal supplier development programs as efforts by purchasing firms to measure and improve service and/or products received from supplying firms. Such programs can contribute to increased supplier and purchaser performance through enhanced communication and knowledge, which results in a significant positive improvement in buyer-supplier relationship (Petersen *et al.*, 2005). They also discovered that supplier development activities are positively and significantly related to all aspects of manufacturing performance.

2.2 Purchasing SI

SI, viewed as the integration of the purchasing function into corporate strategy, has been recognized for its strategic role (Johnson *et al.*, 1998; Lawson *et al.*, 2009; Narasimhan and Das, 2001; Tan, 2002). Many have even argued that purchasing contributes significantly to corporate performance, and thus, supply chain management and should be a key component for consideration when developing a company's overall strategy. In support of this idea, Pearson *et al.* (1998) discussed how overall firm performance is influenced by strategic supplier activities, especially in an international setting, pointing to additional reasoning in support of incorporating the purchasing function into corporate strategy. Lawson *et al.* (2009) and Tan (2002) found that companies are increasingly incorporating PA into corporate strategy, and he suggested that more research should be conducted on the specifics of integrating the purchasing function into corporate strategy.

Based on the above literature review, a theoretical model is proposed in Figure 1. We posit that those PA and the SI of purchasing have positive impacts on MC measures of cost, quality, delivery, and flexibility. The following hypotheses are thus developed:

H1. PA contribute to MC.

H2. Purchasing SI contributes to MC.

The research hypotheses are developed in order to test a purchasing model that, though well-grounded in the literature, has never been examined with a large international dataset. The impact of national differences on the role and the practice of PA require further investigation (Carr *et al.*, 2000; Kristal *et al.*, 2011; Monczka *et al.*, 2009). For instance, there is a greater awareness of the importance of resource utilization

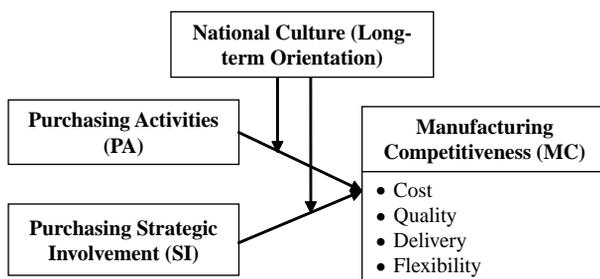


Figure 1.
Theoretical model

as influenced by the concept of lean manufacturing and just-in-time systems in Asia (Carr *et al.*, 2000). Many Asian manufacturers in China, Korea, and Taiwan use outsourcing to obtain the best components at the lowest possible price. They contract with vendors who's margins are thin owing to intense competition. These manufacturers depend on suppliers that can deliver cost effective, quality parts and in a timely manner. As such, the role of purchasing has become an important strategic function with an emphasis on more effective cost control and supply chain management (Qing *et al.*, 2011). The remainder of this section discusses the need for testing this model, taking into consideration national differences.

2.3 National culture differences

Global studies in various management fields have been performed analyzing cultural effects, such as supply chain effectiveness, project management, forecasting, and regulation compliance on supply performance. For instance, Wacker and Sprague (1998) considered the role of national cultural differences and the underlying approach in forecasting. Pagell *et al.* (2005) found that national cultural differences significantly influence international OM behaviors among similar manufacturing plants in the same industry located in different cultures. Flynn and Saladin (2006) examined whether or not the Baldrige criteria have relevance in countries with cultural differences. International projects raise additional issues and problems that have to be managed, such as legal/political issues, security, geography, economic status, infrastructure, and culture (Gray and Larson, 2006). Ruamsook *et al.* (2007) suggested that, to maintain and improve a firm's future competitive advantage under conditions of heightening global competition, firms must develop and enhance management knowledge in order to optimize the strategic values of differing regions and nations of supply. Their findings indicated the existence of country or regional differences pertaining to supplier performance in the supply chain.

Several researchers have used national culture to illustrate and explain differences between countries. Hofstede (1980) defined national culture as the collective mental programming of the people in a national context. Through an empirical study examining more than 10,000 managers in over 50 countries, he developed a quantitative classification scheme for measuring differences and similarities between national cultures. He then proposed that attitudes, beliefs, and behaviors could be categorized into five dimensions: individualism-collectivism, masculinity-femininity, power distance, uncertainty avoidance, and long-term orientation (LTO) (Confucianism). In light of these five dimensions, Hofstede *et al.* (2002) stated that people of a nation have "patterns of thinking, feeling, and acting that differentiate one country from another and continue to be transferred from generation to generation". Table I provides definitions for the five dimensions and the respective indices for different regions. There seem to be significant cultural differences between Asian, USA, and Western European countries, especially regarding LTO. Specifically, Asian countries receive an average score of 95, while both USA and Western Europe have average scores of 25.

According to Hofstede *et al.* (2002), LTO (Confucianism) refers to the extent to which one has a long- or short-term orientation. Values associated with LTO are thrift and perseverance; values associated with Short-term orientation are respect for tradition, fulfilling social obligations, and protecting one's "face". LTO was previously discussed as an influential factor in PA. For instance, the strategic sourcing process involves planning and organizing long-term purchasing agreements with suppliers, as suggested

Cultural dimension	Asia	Europe	USA	World average
Power distance: the extent to which the less powerful members of organizations and institutions (like the family) accept and expect that power is distributed unequally	60	40	38	52
Individualism: the relationship between the individual and the collective	20	56	90	40
Masculinity: the extent to which gender affects the division of labor	52	52	60	48
Uncertainty avoidance: the extent to which countries deem the pursuit of certainty important	60	70	42	61
Long-term orientation (Confucianism): the extent to which one has a long- or short-term orientation, especially toward respect for tradition, fulfilling social obligations, and protecting one's face	95	25	25	41

Source: www.geert-hofstede.com

Table I.
Hofstede's cultural dimension indices

by Cavinato *et al.* (2006). They argued that companies operating in cultures with higher future orientations would be more likely to utilize formal strategic sourcing processes. Moreover, Tucker (2008) asserted that strategic supplier partnerships allow for sharing of information that can be vital for the success of both organizations involved, especially when crossing international borders. The development and planning involved in these alliances and partnerships could be supported by a country's future orientation. Barnes (2008) suggested that supply base rationalization is supported by a future orientation, where organizations understand the ever-changing environment and make decisions to develop relationships and rationalize their supply base in an attempt to prepare for the future and secure success.

Overall, the extant literature has successfully demonstrated the effects national differences can have on various operations and supply chain decisions. Nonetheless, empirical support for the effect of national differences on PA is weak and is mostly from case studies or small-scale survey research, with only two country comparisons (Carr *et al.*, 2000). The issue of national differences and PA has not yet been properly examined. This study intends to use a large-scale dataset, with samples from multiple countries to further understanding of this issue. In particular, this study adds to the literature by considering the role of national differences across ten countries involving 511 manufacturing plants. Based on the LTO scores, we combined three Asian countries (China, Korea, and Taiwan) into one group, while Australia, the USA, and several Western European countries (Austria, Germany, Italy, Switzerland, and Sweden) were combined into another group. Table II summarizes the issues of the two groups of countries. There is a glaring difference in LTO scores between the two groups. The average LTO score for the first group is 93.33, which is significantly higher than that of the second group, 33.29. We posited that national differences, from the LTO standpoint, could potentially influence the choice and, thus, the efficacy of various PA and SI. Therefore, the following hypotheses are developed:

H3. There are significant national culture differences in the relationships among PA, SI, and MC.

H3a. National culture differences affect the emphasis placed on PA and SI.

H3b. National culture differences affect the contribution of PA and SI to MC.

Table II.
Long-term orientation
score and sample size

Group and country	LTO score	Sample size (<i>n</i>)
<i>Group no. 1: Asia</i>	<i>Avg. = 93.33</i>	<i>Total = 210</i>
China	118	57
Korea	75	103
Taiwan	87	50
<i>Group no. 2: W. Europe/USA</i>	<i>Avg. = 33.29</i>	<i>Total = 301</i>
Australia	31	30
Austria	31	16
Germany	31	58
Italy	34	51
Sweden	33	31
Switzerland	44	31
USA	29	84

Note: Total number of samples = 511

3. Research method

3.1 Data

The data was a subsample of Round IV of the Global Manufacturing Research Group (GMRG) survey effort. The GMRG is a multinational community of researchers studying the improvement of manufacturing practices worldwide (www.gmr.org), and consists of leading international academic researchers from over 20 countries who developed the GMRG database survey instrument for use around the world. This survey facilitates global comparison of the effectiveness of manufacturing practices (Whybark *et al.*, 2009). Since 1985, the GMRG has completed four rounds of the worldwide survey, from the most recent of which we obtained our data. The questionnaires were translated and back-translated for all countries by several academics. This study used the 511 samples collected from ten countries to perform necessary analyses for testing the proposed research hypotheses and the purchasing model (Figure 1). More details of the samples can be found in Table III.

Table III.
Sample demographics

	Overall (<i>n</i> = 511) (%)	Asia (<i>n</i> = 210) (%)	W. Europe/USA (<i>n</i> = 301) (%)
<i>Number of plant employees</i>			
< 50	15.8	9.3	17.3
50-100	23.2	25.7	22.4
101-500	40.9	40.4	42.1
> 500	20.1	24.6	18.2
	100.0	100.0	100.0
<i>Industry</i>			
Electric and electronic equipment (SIC 35 and 36)	24.5	59.6	16.5
Primary and fabricated metal (SIC 34 and 33)	27.7	10.3	28.5
Plastic (SIC 30)	12.4	8.3	15.9
Others (e.g. textile, food, chemicals, etc.)	35.4	21.8	39.1
	100.0	100.0	100.0

3.2 Measurement: constructs of interest

The items used in the analysis are presented in the Appendix. The PA scale addresses various activities in which purchasing personnel engage, including procurement, supplier involvement and development. For each PA, managers were asked to what extent the activity is implemented (on a scale of 1-7 with 1 being “not used” and 7 being “a great extent”). All the activities are selected from the following literature: Carter *et al.* (2000), Krause *et al.* (2000), Narasimhan and Das (2001), Ellram *et al.* (2002) and Petersen *et al.* (2005). Overall, a high score on this scale indicates the purchasing function is actively engaged in a large number of these purchasing practices, while a low score indicates a lower level of effectiveness or involvement. The scale for SI was adopted from Rozemeijer *et al.* (2003) and Lawson *et al.* (2009). It measures the levels at which the purchasing function participates in forming strategic plans and receiving support from top management. A low score suggests a low degree of SI from the purchasing function.

The scales for MC have respondents rate their competitiveness as compared to their major industry competitors (Kull and Wacker, 2010). We captured the four main dimensions of MC: cost, quality, flexibility, and delivery. The scale for continuous improvement was created and verified by previous GMRG studies (Pagell *et al.*, 2005; Yang *et al.*, 2010).

3.3 Psychometric properties

In this study, we used multiple items to present three latent constructs, PA, SI, and MC. Each latent construct was tested for internal consistency using Cronbach's α and construct reliability. Table IV shows that alpha coefficients were between 0.73 and 0.89, which are above the benchmark of 0.70 suggested by Nunnally (1978), and construct reliabilities were between 0.74 and 0.87, which are above 0.60. Overall, the results suggest high internal consistency of measurement indicators and, hence, reliability of each construct is ensured.

Next, convergent validity and discriminant validity were assessed. O'Leary-Kelly and Vokurka (1998) suggested that the use of CFA to assess convergent and discriminant validity is more powerful and requires fewer assumptions than the traditional multi-trait multi-method (MTMM) matrix method. In the CFA model, each item was linked to its corresponding construct and the covariances among those constructs were freely estimated. The resulting model fit indices are $\chi^2(237) = 529.916$, IFI = 0.944, NFI = 0.904, CFI = 0.944, RMSEA = 0.049, which were better than the threshold values recommended by Hu and Bentler (1998). Moreover, all of the factor loadings are greater than 0.60 and the t -values are significantly greater than 2.0. In summary, the convergence of items on the factors they are intended to measure with significant positive loadings and a good overall model fit demonstrate the convergent validity and unidimensionality of these scales (Hair *et al.*, 1998).

Discriminant validity is tested by comparing the correlation coefficients between latent constructs with the variance-extracted percentages for each construct (Fornell and Larcker, 1981). The results indicate the variance-extracted percentages for constructs were higher than the correlation coefficients between latent constructs. The variance inflation factors (VIF) of all latent constructs were below the recommended value of ten, implying the lack of multicollinearity, thus discriminate validity is supported.

Factor/items (Cronbach's α)	Factor loading
<i>1. Purchasing activity (PA): $\alpha = 0.893$; CR = 0.821</i>	
PA1. Buyer sponsored supplier conferences	0.642
PA2. Formal strategic sourcing process	0.667
PA3. Reverse auctions	0.685
PA4. Supplier representatives in plant ^a	NA
PA5. Strategic alliances/partnerships ^a	NA
PA6. Commercial procurement software	0.706
PA7. Cross-functional commodity teams	0.715
PA8. Early supplier involvement in design	0.646
PA9. Non-direct materials	0.696
PA10. Supply base rationalization	0.674
PA11. Purchased items classified as strategic or tactical	0.643
PA12. Formal supplier development program	0.746
<i>2. Strategic involvement (SI)</i>	
SI1. Input to overall long-term strategic plan	0.829
SI2. Top management support	0.781
<i>3. Manufacturing competitiveness (MC)</i>	
Cost performance: $\alpha = 0.827$; CR = 0.863	
MC1. Manufacturing costs	0.872
MC2. Product costs	0.899
MC3. Raw material costs	0.748
Quality performance: $\alpha = 0.868$; CR = 0.865	
MC4. Product features	0.870
MC5. Product performance	0.901
MC6. Product quality	0.808
Delivery performance: $\alpha = 0.751$; CR = 0.738	
MC7. Order fulfillment speed	0.825
MC8. Delivery speed	0.669
MC9. Delivery flexibility	0.663
Flexibility performance: $\alpha = 0.768$; CR = 0.761	
MC10. Flexibility to change output volume	0.832
MC11. Flexibility to change product mix	0.790

Table IV.
Factor loading and
construct reliability
analysis

Notes: ^aItems are deleted due to the low factor loadings or high cross-loadings; $n = 511$; fit indices for the overall CFA model (encompassing all factors): $\chi^2 = 529.916$; $df = 237$; $\chi^2/df = 2.236$; IFI = 0.944; NNFI = 0.904; CFI = 0.944; RMSEA = 0.049

4. Statistical analysis

For the purposes of this study, two statistical methods were applied. First, multiple-group structural equation modeling (SEM) analysis was performed to test the postulated research hypotheses and the model in Figure 1. Next, we applied regression analysis to examine whether the two country groups differ in their choice and efficacy of PA and SI.

4.1 SEM analysis

A series of multi-group SEM analyses were performed, using LISREL 8.70, to examine whether different groups (Group 1: Asia; Group 2: Western Europe/USA) have different path coefficients of the structural model (Byrne, 1994). We also performed another analysis treating Asia, USA and Western Europe as three separate groups.

Table V summarizes the SEM results; including model fit indices, standardized path coefficients, and significance levels. The results for both SEM analyses, two groups (Asia vs Western Europe/USA) and three groups (Asia vs Western Europe vs USA), are similar. Our discussion is based on the findings from the two group analysis as presented in Table V(a).

First, for the All-sample group, the fit indices were all found to be within an acceptable range (CFI = 96, NFI = 0.94, RMSEA = 0.050), suggesting a good fit between the model-implied covariance matrix and the data. All causal paths are statistically significant at the 0.05 level, supporting *H1* and *H2*. In other words, both PA and SI improve all four aspects of MC where the impacts on delivery ($\lambda = 4.30^*$; $\lambda = 4.47^*$) and flexibility ($\lambda = 4.09^*$; $\lambda = 4.43^*$) are higher than on cost ($\lambda = 1.77^*$; $\lambda = 2.04^*$) and quality ($\lambda = 2.04^*$; $\lambda = 2.24^*$).

The results also suggest the moderating effects of national culture on the causal model since two groups display different path coefficients of the structure model (Byrne, 1994). As shown in Table V(a), three causal paths are moderated by the variable of culture (i.e. PA → cost, PA → quality; SI → cost). According to the estimated path coefficients, the impact of PA on cost and quality for the Asia group is significantly different from that of the Western Europe/USA group ($\Delta\chi^2 = 42.52^{**}$ (cost); $\Delta\chi^2 = 21.62^*$ (quality)). Meanwhile, the effect of SI on Cost is also significantly different between the two groups ($\Delta\chi^2 = 50.56^*$). The results suggest that the strategy of improving cost and quality performance by performing PA works effectively for the Western Europe and USA group but not so for the Asia group. On the other hand,

(a) Multi-group SEM: two groups						
Path coefficients (standardized)						
Structural path	All sample	Group no. 1: Asia (n = 210)	Group no. 2: W. Europe/ USA (n = 301)	$\Delta\chi^2(df = 1)$		
PA → cost	1.77*	1.04	1.56**	42.52**		
PA → quality	2.04*	1.62	1.72**	21.62*		
PA → delivery	4.30*	3.49**	3.54**	0.36		
PA → flexibility	4.09*	3.36**	3.42**	0.53		
SI → cost	2.04*	1.64**	1.09*	50.56**		
SI → quality	2.24*	1.84*	1.72*	4.71		
SI → delivery	4.47*	3.69**	3.65**	-0.24		
SI → flexibility	4.43*	3.67**	3.62**	0.33		
(b) Multi-group SEM: three groups						
Path coefficients (standardized)						
Structural path	All sample	Group no. 1: Asia (n = 210)	Group no. 2: W. Europe (n = 217)	Group no. 3: USA (n = 84)	$\Delta\chi^2(df = 2)$	
PA → cost	1.77*	1.70	2.18*	2.19*	37.66**	
PA → quality	2.04*	1.38	2.41*	2.64*	23.51*	
PA → delivery	4.30*	5.06*	5.13*	5.09*	0.26	
PA → flexibility	4.09*	4.88*	4.96*	4.91*	0.83	
SI → cost	2.04*	2.23**	1.51*	1.50*	44.02**	
SI → quality	2.24*	2.52*	2.49*	2.24*	4.71	
SI → delivery	4.47*	5.08*	5.01*	5.10*	-0.06	
SI → flexibility	4.43*	5.09*	5.01*	5.09*	0.9	

Notes: Significant at: * $p < 0.05$ and ** $p < 0.01$; $\chi^2 = 528.58$; RMSEA = 0.050; NFI = 0.94; CFI = 0.96; RMR = 0.050; GFI = 0.92

Table V. SEM results

the Asian samples appear to benefit more from purchasing SI than the Western Europe/USA samples regarding cost performance ($\lambda = 1.64^*$ vs $\lambda = 1.09^*$).

For the second SEM analysis (Asia vs Western Europe vs USA), similar results are found (Table V(b)). Namely, the impact of PA on cost and quality for Group no. 1 are significantly different from Groups nos 2 and 3. In the meantime, the path coefficients for the USA group and the Western Europe group are not significantly different. While more studies must be performed to generalize the findings, our results raise a valid proposition that PA and SI adopted by different culture groups have potentially different impacts on MC, especially with regards to cost performance. Our findings in Table V suggest that LTO is a more plausible indicator than geographical location to define country groups and predict the effects of PA and SI.

In summary, the SEM results suggest that the relationships among PA, SI, and MC are not always consistent between the two country groups. Therefore, *H3* is supported. PA and SI in the Asia group do not seem to contribute to MC in the same manner as is seen in the Western Europe/USA group. In order to gain a deeper understanding of the emphasis and efficacy of particular PA, we decided to perform further analyses at the individual PA level.

4.2 Regression analysis: contribution of PA and SI

Table VI displays the descriptive statistics for PA, SI, and competitive goal performance. In general, with a few exceptions, countries in Asia receive higher ratings for their efforts in implementing PA and purchasing SI. Meanwhile, no statistically significant difference between Asia and Western Europe/USA is found regarding the four aspects of competitiveness.

Four regression analyses were performed next to examine the effects of individual PA and SI on four competitiveness goals. The results of the regression analyses reveal that many PA contribute to firm performance, but not all activities in both groups

Item	Group no. 1 (Asia) (<i>n</i> = 210)	Group no. 2 (W. Europe/USA) (<i>n</i> = 301)	Group mean difference
Purchasing strategic involvement	4.80	4.63	*
Buyer sponsored supplier conferences	4.08	4.04	—
Formal strategic sourcing process	4.70	3.59	**
Reverse auctions	3.34	3.97	**
Commercial procurement software	3.83	2.39	**
Cross-functional commodity teams	3.99	2.76	**
Early supplier involvement in design	4.47	4.67	**
Non-direct materials	4.16	3.04	**
Supply base rationalization	4.53	3.60	**
Items classified as strategic or tactical	3.89	3.95	—
Formal supplier development program	4.25	2.78	**
Cost	4.66	4.31	—
Quality	5.46	5.51	—
Delivery	5.07	5.21	—
Flexibility	5.11	4.96	—

Table VI.
Mean score: purchasing activities, strategic involvement and competitiveness

Note: Significant at: **p* < 0.05 and ***p* < 0.01

similarly or significantly contribute to all four competitiveness goals (Table VII). More importantly, the contribution of individual PA and SI varies between Asia and Western Europe/USA. While SI influences cost performance in the Asian group, this factor appears to be more influential in Group no. 2 on quality, delivery and flexibility performance. For the Asia group, only five out of ten PA contribute to competitiveness. In contrast, for the Western Europe/USA group, eight out of ten activities have significant effects on MC. Only four particular activities (reverse auction, cross-functional team, supply base rationalization, and formal supplier development) are beneficial to both groups. Each country group has a different bundle of PA that it could implement to enhance performance. Overall, the results in Tables VI and VII indicate that the emphasis and efficacy of PA and SI between these two groups are substantially different, thus supporting *H3a* and *H3b* at the item level.

5. Discussion

5.1 Culture and efficacy of PA and SI

Since most purchasing and supply chain management theories were developed based on western culture and data, it is important to verify whether those theories are universal (Pagell *et al.*, 2005; Hofstede, 2007). Our statistical findings suggest that there are differences between the two country groups regarding their emphasis and efficacy of PA and SI. The SEM results reveal that the proposed purchasing model, which is well grounded from the purchasing literature, does not receive the same support from the Asian samples despite being verified by the Western Europe/USA data. Three out of eight causal paths were found to be significantly different between the two country

Items	Group no. 1 (<i>n</i> = 210)				Group no. 2 (<i>n</i> = 301)			
	Cost	Quality	Delivery	Flex.	Cost	Quality	Delivery	Flex.
PA1. Buyer sponsored supplier conferences						(+)**		
PA2. Formal strategic sourcing process			(+)**	(+)**				
PA3. Reverse auctions	(+)**				(+)**			
PA4. Commercial procurement software								
PA5. Cross-functional commodity teams	(+)**					(+)**		
PA6. Early supplier involvement in design						(+)**		
PA7. Non-direct materials								(+)**
PA8. Supply base rationalization	(+)*				(+)*			
PA9. Purchased items classified as strategic or tactical						(+)*		
PA10. Formal supplier development program			(+)**				(+)**	
Purchasing strategic involvement	(+)**				(+)**	(+)**	(+)**	(+)**

Note: Significant at * $p < 0.05$ and ** $p < 0.01$

Table VII. Individual purchasing activities, strategic involvement, and competitiveness

groups (Table V). Several OM studies previously cautioned about the application of theories developed in North American and European countries to other parts of the world (Pagell *et al.*, 2005; Zhao *et al.*, 2006). This study validates and reinforces that message.

Another interesting observation from the SEM results is that the strength of path coefficients associated with PA appears to be consistently weaker in Group no. 1 (Table V(a) and (b)). On the other hand, the influences of SI are consistently stronger in Group no. 1. This finding implies that PA and SI in Asian countries do not have the profound contribution to MC as is seen in Group no. 2. In other words, Asian firms, with a relatively high LTO, perceive themselves as being more intensively engaged in PA, but they are not as effective as their Western Europe/USA counterparts regarding the implementation (Tables VI and VII). Ruamsook *et al.* (2007) also observed that European countries and the USA have better supply chain management than some of their counterparts in Asia. Clearly, the question appealing to managers is why differences occur, and there may be several possible explanations for differential effectiveness of PA between the two country groups. For instance, it is likely that the plants in the USA and Western Europe have more advanced IT or more expertise to perform some of those PA (Carr *et al.*, 2000).

It is also possible to attribute the differential effectiveness to the use of Hofstede's culture scale. According to another renowned national culture research project, the Global Leadership and Organizational Behavior Effectiveness (GLOBE) study, cultural dimensions should be assessed from two perspectives, "as is" and "should be" (House *et al.*, 2002). The first perspective indicates where managers believe their country currently is and the latter represent where they believe their country ideally should be. Therefore, it is likely that Hofstede's LTO score captures the "should be" aspect but not the "as is". Based on the GLOBE project, the countries in Group no. 1 (Asia) generally have higher "should be" scores than those in Group no. 2 (Western Europe/USA), a finding consistent with the information from Hofstede's LTO scores. Meanwhile, Group no. 1 has lower "as is" scores than Group no. 2. Specifically, the average "as is" score for Group no. 1 is 3.89, as opposed to 4.15 for Group no. 2. That means, in practice, that the countries in Group no. 2 are actually managing their purchasing function more in tune with the long-term perspective (as is), while Group no. 1 may desire to be more that way (should be) but fail to. In other words, the mere fact that an Asian firm claims to engage in PA does not mean that those PA will be well implemented or deliver competitive advantage. It is beyond the scope of this study to investigate and compare Hofstede's and GLOBE's culture scales, but our findings definitely suggest an interesting future research topic.

5.2 Culture and engagement of PA and SI

In addition to different path coefficients found from the SEM models, our results reveal that sample plants from Asia perceive that their engagement in PA and SI was more intensive and more aligned with competitive strategy (Table VI). As discussed earlier in the literature review (Cavinato *et al.*, 2006; Tucker, 2008), at least three PA have particular long-term implications on manufacturing operations and are likely to be emphasized by countries with high LTO scores. Those three particular activities and the associated LTO scores for both groups are "formal strategic sourcing process" (4.70 vs 3.59), "supply base rationalization" (4.53 vs 3.60), and "formal supplier development program" (4.25 vs 2.78). We decided to examine how much of the difference between the two groups of countries can be accounted for by the cultural dimension LTO. To do so,

we used hierarchical regression with industry and employment entered as controls in the first step and LTO scores entered in the second step. Hierarchical regression was chosen since it provides a clear picture of additional explanatory power created by adding elements of culture to a base model.

Table VIII summarizes the results of hierarchical regression for the three selected PA: “formal strategic sourcing process”, “supply base rationalization”, and “formal supplier development program”. For all analyses, we consistently obtain increased adjusted R^2 values after adding the cultural dimension LTO to the control model consisting of only plant size and industry. For “formal supplier development”, the adjusted R^2 is 0.046 with size and industry included in the model, and the addition of LTO score increasing the figure to 0.201, or an increase of 0.155. For the other two activities, the adjusted R^2 increases from 0.029 and 0.023 to 0.095 and 0.087, respectively. It appears that LTO offers significant explanatory power to the choice and engagement of PA. Again, these three particular PA are examined since there is support in the literature for their connection to LTO. Future research should review and verify the effects of culture on other activities.

In summary, our findings from both SEM (Table V) and regression analysis (Tables VII and VIII) offer strong support for our research proposition that national culture could affect PA. National differences or national culture are often treated as control variables in OM literature (Pagell *et al.*, 2005). We are working under the belief that while controlling for culture is better than ignoring it, doing so may still conceal important differences across cultures. Results based on using culture as a control variable may give a false sense of the universality of a theory and/or result. Our findings indicate the significant explanatory power of national culture, validating the need for using national culture to study national differences regarding purchasing and supply chain management decisions.

6. Conclusions

Having an understanding of the international cultures involved in PA is vital to successful operations, but many purchasing managers do not have the necessary understanding of national differences (Belyea, 2008; Riedel and Mueller, 2009). In the past, OM literature often treated national culture as a control variable (Pagell *et al.*, 2005), ignoring the possibility of using culture as a variable to explain and predict differences

Step	Formal strategic sourcing		Selected purchasing activities		Formal supplier development	
	Model variables	<i>t</i> -value (sig.) adjusted R^2	Model variables	<i>t</i> -value (sig.) adjusted R^2	Model variables	<i>t</i> -value (sig.) adjusted R^2
1	Size	3.638 (0.000)	Size	3.415 (0.001)	Size	4.738 (0.000)
	Industry	-0.168 (0.064)	Industry	-1.323 (0.186)	Industry	-1.857 (0.064)
		Adj. $R^2 = 0.029$		Adj. $R^2 = 0.023$		Adj. $R^2 = 0.046$
2	Size	2.376 (0.018)	Size	2.163 (0.031)	Size	2.965 (0.003)
	Industry	-0.712 (0.477)	Industry	-0.180 (0.858)	Industry	-0.111(0.911)
	LTO	6.150 (0.000)	LTO	6.078 (0.000)	LTO	9.785 (0.000)
	Adj. $R^2 = 0.095$		Adj. $R^2 = 0.087$		Adj. $R^2 = 0.201$	

Note: Independent variables: size, industry, LTO

Table VIII.
Hierarchical regression:
LTO and purchasing
activities

in PA across nations. Responding to the call for better understanding of national differences, this study aims at addressing the research question:

RQ1. Do purchasing theories built on samples from mainly Western companies apply in other cultural contexts?

Based on the data collected from ten countries or two distinct cultural groups, we tested a purchasing model that is well-grounded in the literature. Our results suggest that the intensity and efficacy of PA and SI vary between the two country groups, Asia and Western Europe/USA. The Western Europe/USA samples adequately fit the purchasing model in Figure 1, but the Asian samples do not. At the item level, we find a common set of PA contributing to MC regardless of national differences. Yet we also find substantial evidence of culturally specific selections of activities. MC is achieved by implementing different bundles of PA adopted by manufacturing plants from different cultures. In short, the findings suggest that national differences matter in implementing PA. Previously built purchasing theories and models may not be universal and more studies must be done to examine their applicability. While globalization becomes more widespread, the differences between national cultures must be part of research and theory development regarding supply chains.

This study represents a first attempt at using national culture to explain differences in PA and SI. To successfully manage an international supply chain, it takes more than knowing that PA are implemented differently in different countries. While our results clearly suggest the influence of a particular cultural dimension, LTO, companies must realize what makes purchasing management different in various countries. Specifically, future studies should continue to investigate what dimensions of national culture influence operations decisions and to what extent as well as how that influence occurs. In particular, OM research needs to move beyond macro-level theory that focuses on whether culture matters to the more micro-level question focusing on how culture matters (Pagell *et al.*, 2005). Such an understanding will better prepare multi-national companies to more effectively manage the global supply chain.

This study adopted Hofstede's culture scale to examine the effects of national culture on PA and decisions. We were able to connect LTO scores with the emphasis firms in different countries place on their PA and SI. Nonetheless, Hofstede's culture score failed to predict the efficacy of PA and SI. Future OM research should examine and compare alternative culture scales (e.g. the GLOBE study) regarding their pros and cons for assessing various aspects of purchasing and supply chain decisions. A reliable scale that could accurately capture various cultural dimensions would be beneficial to multinational firms. Other cultural dimensions such as uncertainty avoidance and assertiveness should also be investigated for their relevance to PA between countries. Finally, we examined a list of PA that were carefully selected based on the literature and suggestions from renowned scholars who are familiar with the industry practice. It is still possible that some important PA may have been overlooked.

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Appendix

- (1) *Manufacturing competitiveness*. For each of the items listed below, how does your plant's performance compare with your major competitors? (1 – far worse, 7 – far better):
 - Cost: direct manufacturing costs, total product costs, raw material costs.
 - Quality: product features, product performance, perceived overall product quality.
 - Delivery: order fulfillment speed, delivery as promised, delivery flexibility.
 - Flexibility: flexibility to change output volume, flexibility to change product mix, manufacturing throughput time.
- (2) *Purchasing strategic involvement*. (1 – not at all, 7 – a great degree):
 - To what degree does your procurement organization influence (have direct input to) the overall long-term strategic plan?
 - To what degree does top management support the strategic importance of purchasing by providing adequate financial resources?
- (3) *Purchasing activity*. To what extent are the following activities implemented to contribute to the organization's competitive goals? (1 – not at all, 7 – a great extent).

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