

A contingency view on the impact of supplier development on design and conformance quality performance

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Abstract

This study extends contingency theory's account of organisational size and culture by exploring the relationship between supplier development and internal quality performance. Drawing on supplier development research, the study aims to examine the moderating impact of organisational size and culture on the relationship between supplier development and design and conformance quality dimensions. Using survey data of 518 UK manufacturing organisations, we found that larger organisations with greater access to resources and a strong SCO culture tend to place the most weight on supplier development programmes which in turn yield higher internal quality performance. These findings contribute to 'Operations Management Practice Contingency Research (OM PCR)' and will raise awareness among operations managers of their future sourcing decisions.

Keywords: Supplier development, Contingency theory, organisational size, SCO culture, internal quality performance

1. INTRODUCTION

Supplier development is defined as “any effort of a buying firm with its supplier(s) to increase the performance and/or capabilities of the supplier and meet the buying firm’s short-and/or long-term supply needs” (Krause and Ellram 1997, 21). As a core dimension of Supplier Quality Management (SQM) practices, it has received substantial interest from both academics and practitioners for several reasons. Chief among these are the paramount importance of a supply chain (as opposed to a single firm) focus to achieve competitive advantage, cost considerations, improved supply flow and product quality, and the shift in purchasing decisions from domestic to global suppliers (Ungson and Wong, 2015). The perceived importance of supplier development is that of improving suppliers’ capabilities which in turn enhances the organisational performance (Matook, Lasch and Tamaschke 2009; Humphreys et al. 2011; Dou, Zhu and Sarkis 2014).

Although the majority of the extant literature (e.g., Humphreys, Li and Chan 2004; Krause, Handfield and Tyler 2007; Humphreys et al. 2011; Li et al. 2012; Lawson, Antony and Potter 2015) investigates the impact of supplier development programmes on suppliers performance, there is a shortage of studies of supplier quality management with a focus on the impact of supplier development programmes on buying organisation’s performance. For example, Carr and Pearson (1999) examine the impact of supplier evaluation on financial performance of buying organisations. They found that strategically selected and evaluated suppliers through a long term supplier relationship provide organisations with a better understanding of their suppliers’ performance and therefore, positively contribute to the organisation’s financial performance. Curkovic, Vickery and Droge’s (2000) study of quality-related programmes in automotive industry confirms the positive impact of supplier development on buying organisation’s internal quality performance, i.e., in terms of design quality and conformance quality.

Although these studies have made concerted efforts to (in)directly examine the impact of supplier development practices on buying organisation's performance, they are frequently devoid of critical analysis of the organisational context and impact of contingency factors (e.g. culture and organisational size) on the relationship between supplier development and internal quality performance of buying organisations. Sousa and Voss (2008) argue that the research around SQM should shift from justification of its value to identification of its contextual conditions. Given the dearth of supply chain research in this area, the supply chain management literature could be enriched by examining the manners in which different internal and external contextual factors influence the performance impact of supplier development activities on internal quality.

While different contextual factors impact on the implementation of quality management (e.g. number of suppliers, length of supplier development programmes, industry type), culture and organisational size have been often cited as the most common and crucial contextual factors to influence the performance impact of quality management programmes (see Reed and Walsh 2002; Wagner 2003; Krause, Handfield and Tyler 2007; Zu et al. 2011). In this regard and as it is proposed in this study, the literature could be enriched by examining the moderating effect of culture and organisational size on the relationship between supplier development and internal quality performance. Of these two contextual factors, organisational culture has received more attention in supply chain and quality management research in recent years (see McAfee, Glassman and Honeycutt 2002; Naor et al. 2008; Cadden, Marshall and Cao 2013; Gimenez-Espin, Jiménez-Jiménez and Martínez-Costa 2013). However, there has been a shortage of studies of supplier development and internal quality performance with a focus on supply chain culture. Referred to as Supply Chain Orientation (SCO) culture in the extant literature, SCO culture is used to signal a more holistic approach to the management of an

organisation's capabilities based on shared values, beliefs and patterns of behaviour both within and between organisations in a supply chain (McAfee, Glassman and Honeycutt 2002; Mello and Stank 2005). Under a SCO culture, the emphasis is placed on the congruence between internal corporate culture and external supply chain culture, if the supply chain is to be most effective and succeed. Given the importance of understanding the dynamics of culture both within and between organisations in a supply chain and a shortage of studies of SCO culture, the current study offers a response to such void in the past research by exploring the relationship between supplier development and internal quality performance under a SCO cultural environment.

In short, the current study contributes to the literature by proposing a conceptual framework to support the moderating effect of organisational size and SCO culture on the relationship between supplier development and internal quality performance. In contrast to previous research's focus on supplier development and organisational performance, the current study explores and analyses the performance impact of supplier development on internal quality (see Wen-li et al. 2003; Humphreys, Li and Chan 2004; Humphreys et al. 2011). While much existing research on performance impact of supplier development on organisational performance or internal quality has focused on the suppliers' internal quality management practices, the current study makes an attempt to study this relationship from the perspective of buying organisation (Curkovic, Vickery and Droge 2000). Succinctly, the aim of the current study is to contribute to the supply chain and quality management literature by examining the moderating effects of organisational size and SCO culture on the relationship between supplier development and internal quality performance.

2. LITERATURE REVIEW AND RESEARCH HYPOTHESES

The theoretical foundation of the current study is built on the notion of contingency theory. This theory implies that there is no one best way of organising and that the appropriate form depends on the kind of environment under which an organisation operates (Fynes, Burca and Marshall 2004). Hence, the organisational performance depends on the extent to which the organisation can achieve alignment and fit between its internal characteristics and environmental requirements and conditions (Das, Handfield and Ghosh 2000). As such, it can be argued that there is no optimal supplier development programme for every organisation. Rather, supplier development programme is to be viewed as a context dependent factor which has to be fitted into its context – if effective management of supply chain and quality is to be achieved. In order to understand the circumstances under which supplier development processes can yield optimal internal quality performance, the next section presents a brief review of the literature on potential contextual factors that could influence the choice of supplier development. To better highlight the characteristics of the conceptual framework adopted for the current study, we gain insights from ‘OM practice contingency research’ conceptual model (see Sousa and Voss 2008) which entails three main components- i.e., contingency factors, OM practice and the associated performance outcomes. As such, these components provide the basis for the conceptual framework adopted for the current study as follows: organisational size and SCO culture are considered as contingency factors, supplier development corresponds to the selected OM practice, and design and conformance quality serve as the performance outcomes (see Figure 1).

Insert Figure 1 about here

In what follows, we provide a brief review of the literature pertinent to the key constructs of the conceptual framework and the presumed relationships among them.

Then, the correspondent hypotheses are developed to conceptualise the relationship between supplier development and internal quality performance (H1a-b), and the moderating effects of organisational size (H2a-b) and SCO culture (H3a-b) on the relationship between supplier development and internal quality performance.

2.1 Key variables of the research framework

Supplier development

The term ‘supplier development’ has been first applied by Leenders (1966) to explain the organisational activities to increase the number of reliable suppliers. It is defined as a programme to help organisations develop a network of competent suppliers which its ultimate goal is to enhance suppliers’ performance (see Krause, Handfield and Scannell 1998; Wagner 2010; Govindan, Kannan, and Haq 2010). To do so, organisations employ different practices and strategies to upgrade the ability of suppliers to respond to their buyers’ organisations requirements (Krause 1997; Lo, Yeung and Yeung 2007). For example, Sanchez-Rodriguez and Hemsworth (2005) classify these practices into three different categories of basic, moderate and advanced supplier development. They refer to supplier performance evaluation, standardisation of parts and supplier qualification as basic practices. Practices such as visiting the suppliers’ site to evaluate their capabilities and rewarding and collaborating with suppliers to improve materials are considered as moderate supplier development construct. Finally, training the suppliers’ personnel, involving suppliers into new product design process (Lawson, Antony and Potter 2015) and sharing information with supplier are viewed as advanced supplier development practices (Sanchez-Rodriguez and Hemsworth 2005).

Internal quality performance

This current study focuses on quality performance as a part of ‘SQM contingency research’ model (Sousa and Voss 2008). The primary reasons to focus on quality performance are as follows. First, enhancing quality performance (through supplier development) is considered as the ultimate purpose of SQM practices, (e.g. Shin, Collier and Wilson 2000; Lo, Yeung and Yeung 2007). Second, the quality of products is a function of the quality of raw materials and that the latter is subject to raw material suppliers (e.g. supplier quality management system, supplier quality requirements policies, buyer-supplier relationship) (Forker 1997). Therefore, effective supplier management and tailored supplier development initiatives can directly influence the raw material quality and consequently the quality of finished products. Third, previous research has provided evidence in support of a strong synergy between quality performance and quality practices such as supplier development (see Adam et al. 1997; Fynes and Voss 2001).

As a dimension of quality performance, internal quality performance (Parvadavardini, Vive and Devadasan 2015) refers to the percentage of items which have been produced without rework at the final inspection (Flynn, Schroeder and Sakakibara 1994). In most of previous research, internal quality performance is operationalised through two items: design quality and conformance quality (Fynes, Voss and Burca 2005).

Design quality is defined as the features and characteristics which are designed for the product to increase its usability (Fynes, Voss and Burca 2005; Zhu et al. 2009). Meirovich (2006) takes a market perspective to design quality and defines it as a fit between customer expectations and products design. In a similar vein, Widrick, Mergen and Grant (2002) argue that a deep understanding of customer requirements, translation of these requirements into a product and continuous improvement of the design process are the essential elements of design quality. Engineering design quality and industrial design

quality are the two main categories of design quality (Dixon and Duffy 1990). While engineering design focuses on technical specifications to generate products in detail (Fyne and De Burca 2005), industrial design lays stress on styling, appearance and aesthetics of a product (Yamamoto and Lambert 1994).

Conformance quality is delineated as “how well the actual product conforms to the design” (Fynes, Voss and Burca 2005, 343). Meirovich (2006) expounds conformance quality as a fit between characteristics of a product and its actual attributes. He further argues that conformance quality is an aspect of quality that focuses on internal procedures. Similar to design quality, different variables have been proposed to measure conformance quality. For example, Flynn, Schroeder and Sakakibara (1994) refer to defect rates, new product yield, scrap, and rework as conformance quality’s measures.

Contingency factors

Organisational size has been frequently cited as one of the most important contingency factors in both general organisation studies and operations management research (e.g. Shah and Ward 2003; Jayaram, Ahire and Dreyfus 2010). It is usually operationalised by the number of employees (e.g. Sila 2007) and natural log of sales revenues (Krause and Ellram 1997). There are two broad classes of empirical studies of the relationship between size and quality management implementation. The first group of studies (e.g. Benson, Saraph and Schroeder 1991; Shah and Ward 2003) provides evidence in support of the positive impact of size on TQM effectiveness by arguing that since larger organisations have access to more and appropriate resources, they are more successful in their attempt to achieve better quality and performance outcomes through TQM. In contrast, the second group of studies (e.g. McAdam and McKeown 1999; Sila 2007; Jayaram, Ahire and Dreyfus 2010) state that smaller organisations have a higher ability to adapt to quality

management requirements – owing to the fact that they can benefit more from a less complicated structure and processes.

Culture has traditionally been treated as a contingency factor and often analysed at an organisational level. Under this conceptualisation, culture has been frequently discussed as a key moderator variable in organisational research. Given the increasingly connected and global sphere of business and the shift from domestic to a global sourcing, more recent studies of culture in quality and supply chain management have focused on inter-organisational culture. Such focus is attributed to the fact that competition has been shifted from organisation level to supply chain level. Cadden et al. (2015) define organisational culture as the personality of an organisation. In the context of supply chain, this definition implies that SCO culture can be regarded as the personality of a supply chain. SCO culture considers supply chain as a unit in order to create value for the whole supply chain (Hult et al. 2008). As such, strong SCO culture has the potential to differentiate an organisation amongst competitors.

Mentzer et al. (2001) suggest the following five dimensions of SCO culture: trust, commitment, cooperative norms, organisational compatibility, and top manager support. Supply chain members may not be able to run their material, information and financials flows with other members effectively, if there is not an acceptable level of cultural consistency (e.g., trust) among them (Narayanan, Narasimhan and Schoenherr 2015; Capaldo and Giannoccaro 2015). Commitment is also crucial in SCO culture (Min, Mentzer and Ladd 2007), owing to the fact that it allows supply chain's members to establish a long-term relationship with each other (Krause, Handfield and Tyler 2007). Other scholars (e.g. Mello and Stank 2005) talk about cooperative norms (i.e. a shared value) as an integral element of a SCO culture. Cooperative norms among members of the supply chain network are deemed essential for organisations to effectively synthesise

and combine their efforts to achieve mutual and individual goals. In addition, it can be argued that the existence of shared cooperative norms could result in creating organisational compatibility or enabling organisations to operate complementarily (see Mello and Stank 2005). Finally, there is a general consensus on the role of top manager support as an integral part of an undeniable part of any organisation's SCO culture. Taken together, this brief review of literature highlights certain specific factors that could facilitate transition to a SCO culture.

2.2 Research hypotheses

Prior research pertinent to supplier development practices (e.g. Modi and Mabert 2007) considers quality performance improvement as one of the most important goals of supplier development. While most of this work (e.g., Lawson, Antony and Potter 2015) has focused on the positive impact of supplier development activities on supplier performance, there are very few studies that examine this relationship from a buying organisation's perspective (e.g. Forker 1997; Vonderembse and Tracey 1999; Li et al. 2012). For example, Li et al. (2012) argue that supplier development plans with a focus on close collaborative ties with suppliers can significantly enhance quality performance and consequently strengthen the competitive advantage of the buying organisation. They further suggest that collaborative supplier development plans such as training suppliers, investing in supplier operations, evaluating supplier performance and providing advice on supplier organisational procedures can motivate suppliers to participate in the buying organisation's product design and manufacturing processes (Wagner 2010). As a result, it can be argued that such collaborative supplier development plans can positively impact on the design quality and conformance quality of the buying organisation. In a similar vein, Shin, Collier and Wilson (2000) suggest that supplier development encourages close

cooperation between manufacturers and their suppliers in product design, which can effectively lead to reduce defect rate, scrap, and rework. They further argue that advanced supplier development through early supplier involvement in product development is key to the quality of finished product and that the latter can significantly improve the quality performance of the buying organisation. Taken together, these supplier development activities could lead to high quality raw materials delivered by suppliers and that the latter can ensure a higher degree of design and manufacturing quality of the buying organisation. Therefore, it can be suggested that:

Hypothesis 1. *Supplier development is positively associated with (a) design quality, and (b) conformance quality.*

As larger organisations typically have greater resources than smaller organisations, the flexibility of resource allocation to supplier development activities (e.g. supplier evaluation and supplier training) is higher in larger organisations (see Ounnar et al. 2007; Koufteros, Cheng and Lai 2007). Larger organisations have greater ability to invest in core resources such as human and financial resources which are deemed essential for any supplier development programme (e.g. Wagner 2003; Percy and Giunipero 2008). Koufteros, Cheng and Lai (2007) refer to lower importance and lower priority of suppliers for smaller organisations which in turn could limit or even undermine supplier development programmes of smaller organisations. Reed and Walsh (2002) empirically demonstrate that there is a significant relationship between organisational size and supplier development. They posit that large organisations have a greater opportunity to increase the technological ability of their suppliers and consequently implement suppliers' development programmes more effectively. Given that, it can therefore be concluded that as quality performance of suppliers enhances due to implementation of supplier development practices in one hand, and quality performance of a buying

organisation depends on the quality performance of its suppliers (Forker 1997) on the other hand, organisational size may strengthen the relationship between supplier development and organisational internal quality performance.

Hypothesis 2. *The impact of supplier development on (a) design quality and (b) conformance quality is positively associated with large organisations.*

As noted in the previous section, supplier development aims to enhance suppliers' capabilities to work as an integral part of a supply chain to fulfil a focal organisation's needs as well as achieving suppliers' individual objectives (Lo, Yeung and Yeung 2007). This may not be thoroughly accessible, if organisations do not have a SCO culture to work as a whole in their supply chain (Hult et al. 2008). Organisations with a SCO culture "acts in a manner that manages flows from supplier to customer, takes a systems approach to viewing the supply chain as a whole rather than its constituent parts, and seeks synchronisation and convergence of intra- and inter-firm operational and strategic capabilities" (Mello and Stank 2005, 547). To enhance supplier performance, it is expected that organisations with strong SCO culture to perform supplier development activities such as training suppliers' personnel (Forker and Hershauer 2000), investing in suppliers' operations (Krause 1997), visiting supplier site (Wen-Li et al. 2003), and evaluating and providing them with timely feedback (Forker and Hershauer 2000). Krause, Scannell and Calantone (2000) argue that training suppliers' personnel could enhances buying organisation's conformance quality through reducing the defect rates, scrap and rework. Thus, an organisation SCO culture is willing to perform supplier development activities not least because supplier performance positively contributes to its own performance (Sanchez-Rodriquez and Hemsworth 2005). Li et al. (2012) characterise SCO culture based on top management support, trust in supplier, and commitment to a long-term relationship to influence the attitude of a buyer towards its

suppliers and its involvement in supplier development. Kim et al. (2010) and Narayanan, Narasimhan and Schoenherr (2015) focus on imperative role of trust and commitment in making the cooperation between a buying organisation and its supplier(s) work. Trustworthy relationship between an organisation and its suppliers may lead the organisation to demonstrate a high level of willingness to share its information, rewards and risks with its suppliers. On the other hand, organisations with low commitment to a SCO culture may fail to effectively implement supplier development programmes and manage quality (Krause, Handfield and Tyler 2007). Thus, SCO culture has the potential to make an organisation combine its efforts with its suppliers (Mello and Stank 2005) and strengthen the performance impact of supplier development programmes on its internal quality practices. In short, the following hypothesis can be offered:

Hypothesis 3. *The impact of supplier development on (a) design quality and (b) conformance quality is positively associated with high SCO culture.*

3. METHODOLOGY

3.1 Measures

To collect large amount of empirical data for further statistical inferences about the underlying regularities of the proposed research framework, a survey method was adopted. A structured type of questionnaire selected in this study contained closed questions, which is one of the most commonly used in the field of operations management. In line with Neelankavil's (2007) questionnaire design process, the initial draft of the questionnaire was carefully designed with regards to length, arrangement, structure, wording, layout and flow. To conduct the final step of the design process, the questionnaire was re-evaluated to produce valid and reliable data. To do so, the initial

draft was modified by two expert groups of academia who were specialists in the area of operations and supply chain management, and business experts, who had extensive experience and expertise relating to quality and supply chain activities in the UK manufacturing sector. As a result, the necessary changes were made to the layout and contents of the questionnaire.

The final version of the questionnaire was composed of the following three sections: supplier development, SCO culture, and design quality and conformance quality. On average, each variable had some seven measures. All questions were designed in the form of positive statements in which the respondents were required to weigh the degree of their agreement with the statements based on a 7-point Likert scale. To ensure content validity of the questionnaire, all measures were adopted from prior work and adjusted were necessary. Having secured the face validity and the content validity of the survey instrument (i.e. re-evaluation process of the questionnaire survey by the academics and business experts), the reliability of the survey instrument was conducted through a pilot test. To obtain a reasonable response rate, the questionnaire was sent to a randomly selected sample of 200 UK manufacturing firms, yielding a response rate of 16%. As a result of initial statistical analysis, the questionnaire was found reliable and valid enough to be employed for conducting the survey. It is worth nothing that the designed questionnaire (see Appendix A) is applicable to future research to evaluate supplier development plans, internal quality performance and the degree of SCO culture within a manufacturing supply chain, all from a buying organisation's perspective.

3.2 Sampling Technique

Having chosen a web-based survey to collect data, an invitation to participate in the survey and the link to the online questionnaire (designed in Qualtrics) were emailed to

participants. Senior executives with purchasing/supplier and quality management responsibilities across the four chosen manufacturing industries, were invited to take part in the survey. In order to increase the response rate, the web-based inquiry was followed up by two reminder emails. Of the initial 2800 questionnaires distributed to the manufacturing organisations (listed on www.freeindex.co.uk), a total of 518 completed responses were collected across the four manufacturing industries in the UK, yielding an overall response rate of 18.5%. The response rate was found acceptable as it correlates favourably with other empirical studies on supplier development which ranged from 16% to 25% (e.g., Watts and Hahn 1993; Krause, Handfield and Tyler 2007; Wagner 2010).

In order to ensure whether the data gathered from the early respondents can be combined to those collected after the reminder emails (late respondents), Chi-square test was undertaken to measure nonresponse bias. The results demonstrated no significant difference ($p > 0.05$) between the early and late responses. Given the existence of no response bias in the data, the two sets of the data were combined to form a single set of data for further analysis.

3.3 Profile of the respondents

This research employed a single report data collection method from each organisation, which has been largely used in operations and supply chain management research (e.g., Wong, Boon-itt and Wong 2011). To minimise the potential bias related to the single report dataset, this research endeavoured to collect data from key informants in the participating organisations (e.g., director, quality manager and purchasing manager, nearly 90 percent). Table 1 presents a descriptive overview of the respondents.

Insert Table 1 about here

As Table 1 shows, the majority of the respondents were directors and only 11 percent of the participants had different roles (e.g., sales manager, and quality and logistics managers). Although the data on both independent and dependent variables were obtained from a single key informant respondent from the participating organisations, our database showed that the common method bias was not an issue due to the scale's internal consistency and the appropriateness of the self-report method (see Conway and Lance 2010). Thus, it can be safely argued that the collected data were reliable and valid for further analysis.

In respect of organisational size, nearly 74 percent of the participating organisations (n= 382) were small and medium size enterprise (SMEs). As expected, the highest and lowest proportion of the respondents were from plastics and precision mechanics respectively – largely owing to the manufacturing density across these two industries in the UK.

3.4 Data Analysis

In addition to face validity and content validity, factor analysis was employed to ensure construct validity. To this end, Principal Component Analysis (PCA) was utilised in the current study. Using SPSS v.20, a cut-off point of 0.4 was set for removal of the items. As a result, 5 items were screened out. The five deleted items had either a factor loading of less than 0.4, or a cross-loading with another component. Cronbach's alpha (1951) was performed to ensure scale reliability. All constructs obtained an alpha score of greater than 0.7. As a result of the foregoing analyses, the research constructs were found reliable and valid enough to be used for further analysis and interpretation.

Prior to regression analysis, correlation analysis was utilised to investigate any covariance between research variables. Pearson Product-Moment Correlation Coefficient

(PPMCC) was employed to identify and determine the degree of association of factors. As demonstrated in Table 2, while the correlation coefficients were all positive, the degree of the correlations varied in a range of low (PPMCC= 0) to medium (PPMCC= 0.652) correlations. To test for the presence of any autocorrelation, Breusch–Godfrey test (Breusch 1978; Godfrey 1978) was employed. Under the null hypothesis of no autocorrelation, this test illustrated no danger of auto-correlation in the dataset.

Insert Table 2 about here

Liner regression was utilised to estimate design quality and conformance quality from supplier development. As Table 2 indicates, supplier development significantly influenced design quality ($\beta = .598$, t value= 16.942, $p < 0.001$, $R^2: 0.457$), meaning that H1a is supported. In respect of H1b, the findings indicated that the more effective the supplier development programmes of a buying organisation, the higher the level of internal quality conformance. Hence, the results confirm H1b and lend support to the reinforcing link between supplier development and conformance quality ($\beta = .318$, t value= 7.625, $p < 0.001$).

In order to examine the contingency effects of organisational size (H2) and SCO culture (H3) a hierarchical moderated regression analysis was utilised. This method has been widely used in prior work to explore the moderating impact of contextual factors (e.g. Naor et al. 2008; Zhang, Linderman and Schroeder 2012). As illustrated in Table 3, Model 3 investigates the contingency effect of organisational size on the link between supplier development and design quality. The corresponding results reveal that as the organisational size increases, the contribution of supplier development to design quality enhances. Therefore, H21 is supported. Similarly, the results lend support ($p < 0.001$) to H2b (see MODEL 6 in Table 3), which postulates the moderating effect of organisational size on the strength of the link between supplier development and conformance quality.

The findings of H2a-b indicate that large organisations are able to derive more value from supplier development activities.

Insert Table 3 about here

In order to investigate the moderating impact of SCO culture on the relationship between supplier development and internal quality performance, the same hierarchical moderated regression method was employed. The results in MODEL 3 of Table 4 (i.e. H3a) indicate a significant relationship between the moderator, i.e., SCO culture and the outcome, i.e., design quality ($\beta = .178$, t value= 4.873, $R^2 = 0.576$, $p < 0.001$). The conjunction of this moderator with supplier development and conformance quality presented significant results (see MODEL 6). As can be seen from Table 4, adding the interaction effect results in a higher R squared ($R^2 = 0.487$) compared to MODELS 4 and 5. Hence, both H3a and H3b are supported.

Insert Table 4 about here

4. DISCUSSION

To scrutinise the relationship between the key research constructs, three hypotheses (H1a-b-H3a-b) were developed. Overall, the findings lend support to the proposed hypotheses and theories underpinning the moderating impact of organisational size and SCO culture on the relationship between supplier development and internal quality performance. In respect of H1, the findings of the current study are consistent with Lo, Sculli and Yeung (2006) who have provided empirical evidence in support of the impact of supplier development on organisational quality performance. In particular, Curkovic, Vickery and Droge (2000) argue that supplier development significantly contributes to design quality and conformance quality in the automotive industry. The findings of the current study provide empirical grounds for previous theory-driven arguments and expand the previous research findings on the performance impact of supplier

development and quality performance (see Curkovic, Vickery, and Droge 2000). As addressed by H2, the results illustrate that the synergy between supplier development and internal quality performance is considerably higher in larger organisations than SMEs. One explanation is that large organisations have access to more resources for supplier development activities such as supplier education, evaluation as well as investment in supplier facilities. This finding is consistent with Koufteros, Cheng and Lai's (2007) study of supplier integration in product development in that the authors refer to the high flexibility of large organisations (as opposed to SMEs) in spending resources on supplier development activities. Finally, with respect to SCO culture, the results support the research hypothesis that supplier development-internal quality performance relationship would be more robust under a high level of SCO culture (H3a-b). The findings indicate that buying organisations with high level of SCO culture are more willing to apply supplier development activities. One explanation is that SCO organisations are motivated to perform supplier development programmes, largely owing to the fact that enhanced supplier performance could have positive ramifications for the performance of buying organisation. In this respect, the results of the current study lend support to previous research findings (e.g. Mello and Stank 2005; Li et al. 2012) in a sense that cooperation among the members of the supply chain network (e.g. buyer cooperation in supplier development) would be stronger if there is a high level of SCO culture.

5. CONTRIBUTIONS AND FUTURE RESEARCH

This study builds upon prior research on the moderating impact of contingency factors on the relationship between supplier development and internal quality performance. Based on the findings, the remainder of this article is devoted to a discussion of the implications of the findings.

From a theoretical perspective, the current study endeavours to respond to and shed light on the inherent ambiguities associated with the relationship between supplier development and internal quality performance. Unlike the extant studies of supplier development and quality performance which are either conceptual or actual case studies, the current study adopts a survey method to provide empirical ground in support of the performance impact of supplier development programmes on quality (see Curkovic, Vickery and Droge 2000; Lawson, Antony and Potter 2015). Indeed, in contrast to previous scholars' focus on internal quality performance as a single construct (e.g. Lo, Yeung and Yeung 2007; Wong, Boon-itt and Wong 2011), the current study operationalised internal quality performance as a multidimensional construct and theorised it as design quality and conformance quality.

The findings of this study also contributes insights into the application of contingency theory in supplier development context by postulating the contingent nature of supplier development upon a myriad of internal and external factors. In this respect, it is argued that supplier development is not a universal concept which could always bring many benefits to organisations. Rather, the impact of supplier development on internal quality performance hinges on the circumstances, context and environment under which an organisation operates. Thus, this study advances SQM research by developing a comprehensive conceptual framework in which all relevant and previously explored variables of supplier development, internal quality performance and the contingency factors of organisational size and SCO culture were brought together and conceptualised in a single model. The developed framework enables supply chain and quality management scholars to explain the manner in which the potential benefits of supplier development to internal quality performance outcomes can be realised and strengthened. As such, the proposed conceptual framework contributes to operations management

practice contingency research (OM PCR) proposed by Sousa and Voss (2008) by extending the use of contingency perspective to operationalise supplier development activities. Hence, further extensions to the current study could draw on other theoretical perspectives to the study of supplier development and its performance effects in a broader range of contexts.

The current study has also important implications for production, supply chain and quality managers who intend to assist suppliers to further develop performance and capabilities (e.g. improving internal quality performance) that will be of value to the buying organisation. In this respect, the findings draw the attention of managers to the significant role of supplier development and suggest that effective implementation of supplier development activities is contingent upon a thorough understanding of situational/contextual factors that moderate the performance impact of supplier development schemes. In a similar vein, managers should be aware of the notion of SCO culture which is vital in designing effective supplier development programmes. A SCO culture is not restricted to a specific business unit/department of buying organisation; rather, it pervades the entire organisation (Li et al. 2012). Hence, in order to design, execute and achieve the expected deliverables of supplier development programmes (e.g. improving internal quality performance) and improve the competitiveness of each organisation and the supply chain as a whole, the onus is on the management to cultivate a SCO culture based on a set of shared values and behavioural patterns (trust, commitment, cooperation), both within and between organisations in a supply chain (McAfee, Glassman and Honeycutt 2002; Mentzer et al. 2001). So failure to comprehend the contingency nature of supplier development programmes could lead to wrong choice of contextual factors, irrelevant and insufficient contextual information and suboptimal decision to yield superior internal quality performance. Further, the absence of a

contextual evaluation of supplier development interventions will not only prevent managers to achieve the desired outcomes of supplier development programmes, but also put the buying organisation at the risk of losing customers (due to low internal quality performance and associated internal/external failure costs) and competitive position in the market (Li et al. 2012). Furthermore, in order to reap the potential benefits of effective supplier development programmes, there is a need on the part of buying organisations to invest time and efforts in creating long-term collaborative relationships. As Michael Dell, founder and CEO of Dell Computer, has put it succinctly, “Collaboration is the new imperative” (Mariotti 1999, p. 75), meaning that buyer-supplier collaborative relationship (as opposed to transactional and arm-length approach) is more conducive to total cost reduction and improved timeliness and internal quality performance (see also Leuschner, Rogers and Harvet 2013). Hence, supplier development initiatives adopted by buying organisations create far more opportunity for collaborative relationship and consequently increase the likelihood of improved quality performance, continuous improvement and reduced supply disruptions (Li et al. 2012).

The findings of the research can be generalised to and applied in manufacturing organisations in other industries/contexts. Indeed, this research attempted to deal with one of the long establishing real-world concerns of buying organisations with respect to their sourcing decisions, i.e., how to ensure that a supplier supplies the inputs that fulfil the quality expectations of a buying organisation (Friedl and Wagner 2012). The results clearly encourage managers to (further) invest in their supplier development activities and adopt a strong culture of supply chain oriented to deal with the forgoing logistics issue. Future studies can investigate the impact of other contingency factors on the investigated association. To what extent can the scope of operations – local, national and international – affect internal quality performance improvement in a buying organisation with basic,

moderate and advanced supplier development processes (see Sánchez-Rodríguez and Hemsworth 2005)? Are all outperformers among those organisations whose human resources invested in supplier development programmes exceed others? How can employing an integrated Information System (IS) solution facilitate supplier development to yield higher and more sustainable outcomes? What type of business environment - highly regulated as in UK or less regulated as in most emerging economies- is in favour of supplier development programmes? Does the degree of economic stability play any role in encouraging organisations to invest in/pursue supplier development programmes? Such questions may be raised in this regard, which can be addressed in light of new research.

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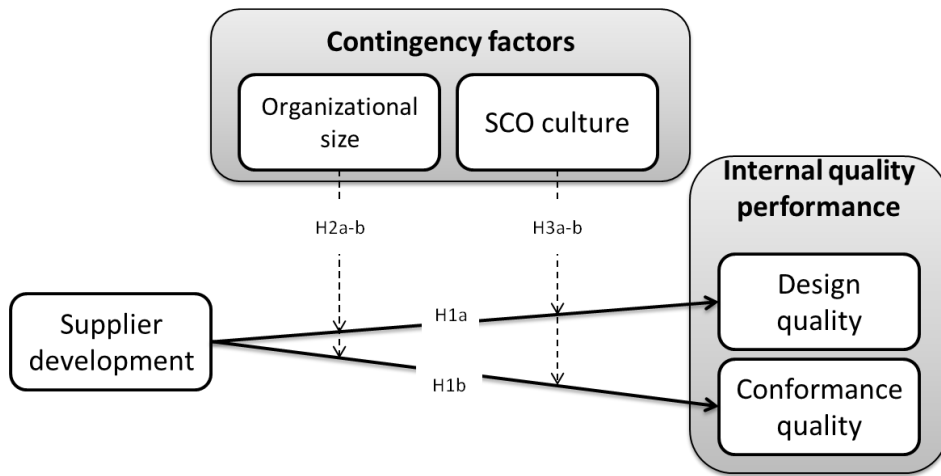


Figure 1. Research hypotheses

Table 1. Demographic characteristics of the respondents

Role		
	Frequency	Percent
Director	128	24.7
Quality manager	149	28.8
Purchasing manager	184	35.5
Other	57	11.0
Organisational size		
	Frequency	Percent
Less than 250 employees	382	73.7
More than 250 employees	136	26.3
Industry type		
	Frequency	Percent
Electronic	135	26.1
Chemical	126	24.3
Plastic	143	27.6
Precision mechanics	114	22.0
Total	518	100

Table 2. Pearson correlation coefficients

Variable names	Supplier development	Design quality	Conformance quality	SCO culture	Organisational size
Supplier development	1				
Design quality	0.598***	1			
Conformance quality	0.318***	0.000	1		
SCO culture	0.652**	0.528**	0.570**	1	
Organisational size	0.411**	0.451**	0.370**	0.523**	1

P* <0.1; P**<0.01, P***<0.001

Table 3. The results of H2a-b

Dependent variable: design quality						
	MODEL 1		MODEL 2		MODEL 3	
Independent variables	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>
<i>Supplier development</i>	.598	16.942***	.363	11.169***	.399	4.407***
<i>Organisational size</i>			.515	15.836***	.517	15.681***
<i>Supplier development</i> × <i>Organisational size</i>					.139	3.426***
<i>R squared</i>	.457		.568		.568	
Dependent variable: conformance quality						
	MODEL 4		MODEL 5		MODEL 6	
Independent variables	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>
<i>Supplier development</i>	.318	7.625***	.183	4.065***	.611	5.100***
<i>Organisational size</i>			.298	6.609***	.615	5.666***
<i>Supplier development</i> × <i>Organisational size</i>					.190	7.100***
<i>R squared</i>	.201		.172		.246	

P* <0.1; P**<0.01, P***<0.001

Table 4. The results of H3a-b

Dependent variable: design quality						
	MODEL 1		MODEL 2		MODEL 3	
Independent variables	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>
<i>Supplier development</i>	.598	16.942***	.215	5.546***	.222	5.865***
<i>SCO culture</i>			.588	15.205***	.693	15.911***
<i>Supplier development</i> × <i>SCO culture</i>					.178	4.873***
<i>R squared</i>	.457		.557		.576	
Dependent variable: conformance quality						
	MODEL 4		MODEL 5		MODEL 6	
Independent variables	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>	<i>Beta</i>	<i>t value</i>
<i>Supplier development</i>	.318	7.625***	.205	4.870***	.212	5.084***
<i>SCO culture</i>			.804	19.052***	.714	14.898***
<i>Supplier development</i> × <i>SCO culture</i>					.151	3.756***
<i>R squared</i>	.201		.473		.487	

P* <0.1; P**<0.01, P***<0.001

Appendix A: Survey items and sources

Section 1: Supplier Development	
<p>This part asks you some questions about the activities which are used by your organisation to enhance the abilities of your suppliers. Adopted from: Wen-li et al. (2003); Lo and Yeung (2006); Wagner and Krause (2009); Carr and Kaynak (2007); Wagner and Krause (2009) Range: Totally disagree- Totally agree (7-point Likert scale)</p>	
SD1	We evaluate suppliers' price, quality and delivery performance regularly through a supplier rating system.
SD2	We provide our suppliers with training/education.
SD3	We provide our suppliers with equipment or tools for process improvement
SD4	We provide our suppliers with capital for new investments at their facilities.
SD5	We give manufacturing related advice to our suppliers (e.g. processes, machining process, machine set up).
SD6	We give quality related advice to our suppliers (e.g. use of inspection equipment, quality assurance procedures).
SD7	We collaborate with our suppliers in improvement and development activities for new raw materials and parts.
Section 2: Internal quality performance	
<p><u>Design quality</u> In this section, we would like to know about your internal quality performance. We ask you to give your evaluation of what your feel has come out of your organisation's quality performance. Adopted from: Swink (2000); Fynes, Voss and Burca (2005); Petersen, Handfield and Ragatz (2005) Range: Totally disagree- Totally agree (7-point Likert scale)</p>	
DQ1	Our designed products meet technical performance.
DQ2	Our designed products meet the customers criteria for material.
DQ3	Our designed products meet the customer criteria for cost.
DQ4	Our designed products meet the criteria for ease of production and or assembly.
DQ5	Our designed products are easy for our supplier to execute.
DQ6	Unique features are provided for our special customer requirements.
DQ7	Our average number of engineering change orders in first year after product introduction due to production problems is low.
<p><u>Conformance quality</u> This part asks you some questions to measure the quality of your manufactured products. Adopted from: Fynes and Voss (2002); Kaynak (2003); Fynes et al. (2005) Range: Totally disagree- Totally agree (7-point Likert scale)</p>	
CQ1	The cost of scrap is a low present of our product cost.
CQ2	The cost of rework is a low present of our product cost.
CQ3	We deliver the products to our customers in a short time.
CQ4	We have low defect rate for our products at final inspection.
CQ5	We have internal yield for our new products introduction.
Section 3: Contextual factors	
<p><u>Supply Chain Oriented Culture</u> In this section, we would like to ask you some questions about the level of SCO culture in your organisation. Adopted from: Mentzer et al. (2001); Mello and Stank (2005) Range: Totally disagree- Totally agree (7-point Likert scale)</p>	
SCO1	Our firm trusts its internal and external supply chain partners.
SCO2	Our firm is committed to long-term supply chain relationships.
SCO3	Our firm establishes cooperative norms in relationships.
SCO4	Our firm seeks out other firms that are compatible in goals and objectives.
SCO5	Our top management support SCM activities.
<p><u>Organisation size</u> Extracted from: Sila (2007); Jayaram, Ahire and Dreyfus (2010)</p>	
OS1	What is the total number of employees in your company? <250 employees <input type="checkbox"/> > 250 employees <input type="checkbox"/>

Background	
<i>Industry type</i>	
IT1	What is the industry that your organization is working in? Electronics <input type="checkbox"/> Chemical <input type="checkbox"/> Plastic <input type="checkbox"/> precision mechanics <input type="checkbox"/>
<i>Supplier Quality Management duration</i>	
Adopted from: Powell (1995); Ahire and Golhar (1996); Jayaram, Ahire, and Dreyfus (2010)	
SQMD1	How long have you trained your suppliers' personnel? <input type="checkbox"/> Less than 1 year <input type="checkbox"/> between 1 and 3 years <input type="checkbox"/> more than 3 years
SQMD2	How long have you worked with your current major suppliers? <input type="checkbox"/> Less than 1 year <input type="checkbox"/> between 1 and 3 years <input type="checkbox"/> more than 3 years
SQMD3	How long have you made contract with your major suppliers? <input type="checkbox"/> Less than 1 year <input type="checkbox"/> between 1 and 3 years <input type="checkbox"/> more than 3 years

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