Antecedents to Supplier Integration in China: A Quantitative Study

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Abstract: The aim of this paper is to identify antecedents to supplier integration in China. A deductive approach was deployed by building on a qualitative pre-study and various strands of SCM literature. All in all, 14 hypotheses were derived and subsequently tested by drawing on an empirical sample collected from 88 manufacturing firms operating in China. The data was then analyzed using partial least squares (PLS) analysis. The results indicated that supplier integration was positively influenced by collaborative supplier capabilities, continuous supplier development, and supplier quality mindset. These in turn proved to be sequentially influenced by supplier top management support, buyer-side leadership effectiveness and internal support.

Keywords: supplier integration, China, collaborative relationship, purchasing and supply management

I. Introduction

Many industries today are characterized by a high degree of value added by suppliers in manufacturing [3, 4, 5], which strongly suggests the implementation of collaborative approaches [20, 21, 22, 23]. In many industries, key suppliers have taken on an increasing level of responsibility for developing and producing components rather than simply making predesigned parts [5, 24, 25]. As a consequence, the purchasing function in a company has become increasingly strategic and capable of generating competitive advantage through effective supplier management [26, 27, 28, 29].

Furthermore, earlier research has shown that factors such as cost, quality, and innovation are determined very early in the product development phase [7, 30]. A high degree of collaboration during the product development phase is needed in order to manage complexity which in turn affects quality, cost, innovativeness, and product variety [22, 31]. Furthermore, a common rule of thumb suggests that 80 percent of product costs are locked in during the first 20 percent of the product life cycle [32]. As a result, companies manufacturing complex products in particular (e.g. automotive, airplane, electronics) have deployed joint product development [5, 7, 33] and joint production planning activities with suppliers [34, 35, 36] as a means to increase the competitiveness of their own companies as well as that of the whole supply chain networks within which they exist.

As of today, researches on supplier integration have mostly been of descriptive nature in a Western context [49].

Hence, this research has failed to explain how to drive supplier integration, especially in Confucian countries like China where relationships play a pivotal role [50, 51]. Although most prior researches have been conducted through empirical data based on case studies or surveys, the topic still largely remains unexplored or is not supported by reliable empirical evidence [20]. In sum, research on supplier integration in the Chinese automotive industry is relatively scarce. Hence, this motivates the development of a novel framework that can capture idiosyncratic aspects of China, without overly relying on existing theories. Cai and Yang [52], Robb and Xie [53], Pyke et al. [11], Zhao et al. [54], Lockström et al. (2010) are some examples of studies that have focused on supply chain related topics in China in the past.

II. Conceptual Framework and Hypotheses

The research model in this paper is based on several existing theories relating to *supply chain integration* (SCI) of which *supplier integration* (SI) is defined as a subset belonging to the upstream part with respect to a focal firm.

In a qualitative study preceding this research, interviewees were asked to elaborate on factors that facilitate and drive supplier integration [9]. It turned out that the key drivers behind the extent to which SI can take place hinges on three key factors, namely 1) a set of supplier capabilities that enables interaction and collaboration between the buyer and the supplier, 2) continuous supplier development activities that build and make capabilities sustainable, and 3) quality mindset, which serves as a "organizational DNA" through which supplier integration is institutionalized. This is also in line with earlier research, which has stressed the importance of capabilities as a source of competitive advantage [68, 75]. Some of those capabilities are relation-dependent, i.e. their existence hinge upon the governance of two individual organizations working as dyads [70], which in the case of this research are represented by buyers and suppliers. The ability of suppliers to take on responsibility for product development activities has proven to be prerequisite from buyers in order to drive collaboration [76]. Having said that, it is proposed that supplier-specific capabilities influence the extent to which suppliers can become integrated with buyers. Consequently, we propose the following set of hypotheses:

H1a. The level of operational supplier integration is positively influenced by the level of collaborative supplier capabilities.

H1b. The level of financial supplier integration is positively influenced by the level of collaborative supplier capabilities.

H1c. The level of strategic supplier integration is positively influenced by the level of collaborative supplier capabilities.

Furthermore, another category that emerged from the pre-study was Continuous Supplier Development [9], where cross-functional teams consisting of buyers, logistics experts, quality engineers, and production managers were sent to the facilities of key suppliers to improve production processes and train staff and management. The importance of supplier development activities has been widely acknowledged in earlier literature [29, 77] as a means for transferring knowledge from the buyer to the supplier. However, the idiosyncratic feature of supplier development as was discovered during the pre-study is the necessity of continuity of such activities [9]. Among most of the investigated companies, supplier performance turned out to become volatile and drift away from pre-defined target levels as soon as the supplier development activities were stopped. There are various explanations to this, such as failure to establish a quality mindset, lack of clearly defined processes, lack of performance management systems, and high staff turnover rates [9]. Based on this finding, the following set of hypotheses was defined:

H2a. The level of operational supplier integration is positively influenced by the level of continuous supplier development.

H2b. The level of financial supplier integration is positively influenced by the level of continuous supplier development.

H2c. The level of strategic supplier integration is positively influenced by the level of continuous supplier development.

Next, the pre-study unanimously revealed that quality mindset of suppliers was a key driver of supplier integration (Lockström et al., 2010). Such a mindset were manifested in the perceived importance of quality, zero tolerance for defects, paying attention to details in operations, continuous improvement philosophy, and an acknowledged importance of the customer. According to Kenny [78] and Gabris et al. [79], mindset is represented as organizational values which collectively drive personal commitment, loyalty, teamwork and behavior. The importance of mindset as a driver of quality has been acknowledged in earlier studies [80, 81]. The lack of quality mindset has been frequently been pointed out as a common challenge to sourcing in China, and is often a reason why collaborative supplier

relationships cannot be sustained on a long term. With this in mind, the following set of hypotheses is defined:

H3a. The level of operational supplier integration is positively influenced by the level of supplier quality mindset.

H3b. The level of financial supplier integration is positively influenced by the level of supplier quality mindset.

H3c. The level of strategic supplier integration is positively influenced by the level of supplier quality mindset.

Another driver that emerged from the pre-study was top management support. The importance of this factor has also been frequently stressed in literature from the past. For example, Dale and Cooper [82], Deming [81], and Kanji et al. [80] have shown that leadership is essential for setting the vision/mission, organizational culture and strategy. Obviously, top management of the supplier's organization is responsible for effective leadership to materialize. Among the respondents of the pre-study, top management support was stated as needed for building and nurturing buyer-supplier relationships; it was found that without it, it is difficult to build and nurture the same kind of thinking throughout the organization [9]. The pre-study revealed that top management of the suppliers also can help creating congruence of strategic goals and with customers in terms of strategic alignment, capacity allocation and organizational interfaces [9, 83]. Put simply, it is proposed that the top management of suppliers is ultimately responsible for the integration with their customers, by having capabilities, organizational development and organizational culture as key levers. As a result, the following set of hypotheses is proposed:

H4a. The level of collaborative supplier capabilities is positively influenced by the level of supplier top management support.

H4b. The level of continuous supplier development is positively influenced by the level of supplier top management support.

H4c. The level of supplier quality mindset is positively influenced by the level of supplier top management support.

Another aspect that emerged out of the pre-study was the role of leadership [9]. Most leadership research has primarily focused on "influencing a group of people to achieve a common goal" within one's own organization [84] by virtue of formal power and authority [85]. The relevant aspect in the pre-study proved to be the organizational leadership behaviors towards the supplier organizations. This is in line with the discussion by Kanja et al. [80], who states that leadership is "the simultaneous performance of leaders in the roles of establishing and sharing the values,

developing and communicating the vision, mission, selecting and implementing a strategy, and managing other operational key issues." It seemed that leaders in the buyer organizations who had managed to facilitate a high degree of supplier integration had taken a systematic approach. They not only focused their efforts on single functions, but also targeted the senior management among their own suppliers and actively worked at a very personal level to convince these managers to adopt their own values, beliefs, etc [9]. They also convinced them to make strategic adaptations and to invest in new machinery/equipment, etc., in line with the strategic orientation of their own companies. This is also confirmed by earlier research such as which stresses the need for socialization processes [86], and alignment [87] to drive supplier integration. Although Modi and Mabert [77] claims that "An organization's top management is aware of its current and future business needs", this is not always the case in China, where many suppliers often take a rather myopic view of their companies instead of a holistic supply chain perspective [9]. The novelty in this context is the characteristics of *inter-organizational leadership*, meaning leadership exerted across firm boundaries, and not only within one's own organization which is the traditional case. Having said that, the following hypothesis is proposed:

H5. The level of supplier top management support is positively influenced by the level of buyer leadership effectiveness.

The data revealed that the challenges concerning supplier integration in the Chinese automotive industry are not only related to the suppliers themselves, but also to internal constraints of the buyers [9]. Such challenges were manifested by a lack of cross-cultural management skills of expatriate managers, and skepticism of the headquarters towards domestic suppliers. As one of the interviewees said: "Managing headquarter expectations is many times more difficult than managing Chinese suppliers" [9]. An interesting and prevalent internal challenge was identified as unrealistic headquarter expectations. This resulted in frustration by the headquarters over the perceived under-achievement of local supply managers. Large buying organizations also seemed to have a harder time adapting to local conditions, leading to overdependence on the headquarters [9]. Obviously, without internal support, it becomes very difficult for the local purchasing organization in China to create the necessary adaptation of strategies, processes and organizations to effectively integrate suppliers. These findings have been acknowledged in earlier studies [88], where internal managerial support was identified as a key driver. Considering the discussion above, the following final hypothesis is defined:

H6. The level of buyer leadership effectiveness is positively influenced by the level of internal support.

The conceptual framework formed by the collection of hypotheses is shown in 错误！未找到引用源。.

Figure 1. Conceptual framework and hypotheses
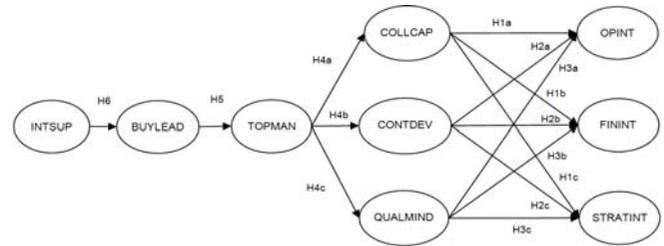
III. Data Collection

In order to validate the model indicated in 错误！未找到引用源。, quantitative empirical data was collected through an online survey. The sample domain for the study comprised purchasing managers, general managers, quality assurance managers and supplier quality engineers at business unit level of large-sized companies operating in China. The pre-study showed that these groups are typically directly involved in managing strategic supplier relationships in China. 564 questionnaires were successfully sent out and 88 usable questionnaires were finally obtained, implying an effective response rate of 15.6 percent, which is slightly lower compared to those of mail surveys but poses no problem as sometimes have been pointed out in literature [91, 92]. This is also in line with trends in empirical research studies [93, 94], even more so in China were domestic companies are usually very secretive about disclosing any kind of business-related information. The sample represented a wide range of industries, corresponding to SIC codes 07, 17, 28, 34, 35, 36, 37, 47, 48 and 55. For this study, only manufacturing industries were included, deliberately focusing on those where joint product development activities take place, such as machinery and automotive etc.

IV. Analysis and Results

In this section, the analysis of the empirical data collection and corresponding results is elaborated. The analysis procedure was divided into two steps. First, the measurement model was assessed, followed by testing of the structural model itself.

Measurement Model

For this study, an approach suggested by Jarvis (2003) was deployed. In case of ambiguity, existing theory, previously defined constructs and the pre-study were used to determine the optimal operationalization of the constructs (Hulland, 1999; Chin and Gopal, 1995; Barclay et al., 1995). As the constructs measure attitudes and beliefs of respondents, the constructs should ideally be operationalized using reflective

items (Coltman et al., 2007). In other words, the constructs are considered as overarching latent variables where construct items share a common theme and hence co-vary.

In order to verify convergent validity, a factor analysis was performed. The results show that all items loaded strongly onto their respective constructs, hence providing strong evidence of convergent validity. The resulting constructs were then used for PLS modeling.

Next, reliability was assessed by calculating Cronbach's alpha and Fornell and Larcker's (1981) measure of internal consistency for each construct. All the corresponding values were well above the threshold of 0.70 as recommended by Nunnally (1978). In order to verify convergent validity, assessment of factor loadings (>0.36) and statistical significance of construct item loadings are recommended (Falk and Miller, 1992). Furthermore, average variance extracted (AVE), should also exceed the threshold value of 0.50 (Barclay et al., 1995). All these criteria are met and exceeded with a good margin. As a next step, discriminate validity was examined by comparing the square root of latent variable AVE with latent variable correlations. The correlation matrix shows that the square root of AVE is larger than the off-diagonal values, which is an indicator of discriminate validity (Hulland, 1999).

Structural Model

The structural model was evaluated by using the software SmartPLS 10.0 (Ringle, 2006). Partial least squares regression is advantageous since it does not require normally distributed data, it is stable against multicollinearity, and performs well under circumstances where the number of indicator variables is large in comparison with the sample size (Abdi, 2003).

In terms of minimum sample size, an approach suggested by Cohen (1998) was applied. By selecting a desired significance level of 0.05 and a desired statistical power level of 0.8, the minimum sample size is given by the largest of this set of numbers generated. In retrospect, the minimum sample size turned out to be 35, which is well accomplished with an actual sample size of 88 in this case.

In order to evaluate the path coefficients, bootstrapping technique with one hundred resamples was used. The results showed that 25.0 percent of the variance in OPINT was collectively explained by COLLCAP, CONTDEV and QUALMIND. However, the paths from COLLCAP and QUALMIND were insignificant. Hence, hypotheses H1a and H1c were rejected whereas H2b was accepted, whose path coefficient was 0.30. Elimination of the paths corresponding to the rejected hypotheses showed that CONTDEV alone accounted for 8 percent of the variance in OPINT.

For the latent variable FININT, 21.1 percent of its variance was explained by COLLCAP, CONTDEV and QUALMIND. The path from CONTDEV proved insignificant, whereas the other two were significant. As a result, hypotheses H2a and H2c were accepted whereas H2b

was rejected. The two significant path coefficients were both 0.27. Elimination of the path leading from CONTDEV did not affect the variance explained in the construct.

In terms of the latent variable STRATINT, 43.3 percent of its variance was explained by COLLCAP, CONTDEV and QUALMIND. However, the path leading from QUALMIND proved insignificant and was thus eliminated from the model. Doing so only decreased the amount of variance explained to 40.8 percent. In sum, hypotheses H3a and H3b were accepted whereas H3c was rejected, where the two significant path coefficients were 0.28 and 0.41, respectively.

The latent variables COLLCAP, CONTDEV and QUALMIND proved to be positively influenced by TOPMAN, with corresponding amounts of variance explained at 20.1, 29.7 and 32.6 percent, respectively. All three paths were significant at the 0.1 percent level, and the corresponding path coefficients were 0.44, 0.54 and 0.57, respectively. Consequently, H4a, H4b and H4c were all accepted.

The latent variable TOPMAN proved to be significantly and positively influenced by BUYLEAD at the 0.1 percent level, with a path coefficient of 0.43, and 18.9 percent of variance explained. BUYLEAD in turn proved to be positively affected by INTSUP at the 0.1 percent level, with a path coefficient of 0.65 and 42 percent variance explained. In sum, ten out of the fourteen hypotheses postulated were accepted. With this in mind, the overall validity of the model can be considered satisfactory.

V. Conclusions

Supplier integration has become increasingly important as a means to reduce product life cycle costs, improve quality and improve time-to-market. In this section, contributions to theory and implications for managers are discussed.

Theoretical Contributions

This study examined antecedents to supplier integration in the Chinese industry. The results from the study support the hypothesized causal linkages in terms of internal support, buyer leadership, supplier top management support, continuous supplier development, quality mindset and collaborative supplier capabilities. The results were in line with expectations to a large extent, where ten out of fourteen hypotheses were confirmed. The causal linkages that were rejected were between H1a (collaborative supplier capabilities → operational integration), H2b (continuous supplier development → financial integration), H3a (supplier quality mindset → operational integration), and H3c (supplier quality mindset → strategic integration). One can speculate to the reasons for the rejection of these hypotheses, but the most plausible ones are as follows.

For H1a, collaborative supplier capabilities have been conceptualized and operationalized as very strategic and high-level in terms of project management capabilities,

communication capabilities, ability to exploit innovations from supply chain partners etc. As a consequence, it is not likely that they translate directly into operational performance improvements, but rather do this via mediation.

For H2b, it is also clear that continuous supplier development activities focus on rather short-term performance improvements, such as implementation of TQM principles, factory layout optimization etc., by dispatching supplier quality engineers from the buyers, a fact that has became clear already during the pre-study. Although it makes sense to hypothesize that such operational improvement measures could translate into higher-level financial integration, this turned out to not be the case. This can be explained especially if senior management of the supplier is not directly involved in such improvement activities, hence an "organizational separation" between operations and strategy exist on such an instance.

Concerning H3a and H3c, again, it is clear that quality mindset refer to rather high-level aspects, such as performance measurement, policy adoption etc. As a result, it appears that these factors do not directly influence operational or strategic integration. The fact that H3b was supported (supplier quality mindset $\rightarrow$ financial integration) can be interpreted as an enabling factor for buyer firms to dare to integrate financially with their suppliers in terms of provision of financing, acquisition of equity stakes etc.

Managerial Implications

As discussed above, companies continue to focus on core competencies and outsource non-strategic business activities. As a result, the dependency on suppliers for creation of customer value and competitive advantage has accordingly increased to an equal extent. This has become an even more strategic topic as companies today strive to reduce their supplier bases, consolidate spend, and develop relationships with preferred suppliers. Moreover, as a shift has taken place in purchasing from cost-orientation to value-orientation, companies nowadays leverage suppliers in order to tap into their innovative capabilities for joint product development.

Despite the widespread adoption of supplier integration approaches in the West, there are several idiosyncratic challenges in China, most notably the need for continuity of supplier development activities, and the support from corporate headquarters, as local purchasing teams cannot do this in isolation. Put simply, the local purchasing organization (in China) serves as a bridge and extended arm of the global purchasing organization, by providing relevant expertise in terms of know-how, language and cultural understanding. As can be seen from the study results, it is also clear that the collective organizational leadership play a key role in creating alignment between the buyer organization and the suppliers in terms of operations, strategy and financial investments.

In sum, the overall conclusion from a practitioner's perspective is that management must work in tandem with operations to make supplier integration happen. And

leadership is not a concept solely exerted within one's own organization, but clearly across firm boundaries. Only in this way supplier integration can drive transparency across the supply chain and facilitate an optimal balance between production costs vis-à-vis transaction costs, ultimately reducing total costs.

Limitations of the Study and Suggestions for Future Research

This is a cross-sectional study whereby the results only provide a static picture of the current situation. Thus, it fails to capture the dynamic nature of the supply markets in emerging economies such as China. In addition to cross-sectional studies, a longitudinal study could strengthen the arguments about causality. Secondly, due to the relatively small sample size, it was not possible to make cross-industry comparisons. However, this opens up a window of opportunity for future research in order to detect industry-specific differences and similarities. Thirdly, the specific context of the Chinese industry might limit the generalization of the conceptual framework for other geographical areas. However, this study is a critical step in developing such conceptual frameworks for large and fast growing economies and industry sectors.

VI. References

Please contact the author to get the reference lists.