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Information Sharing with Suppliers to Improve Mass Customization Capability: A Trust Perspective

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ABSTRACT

Trust is essential for business relationships within a supply chain. On the basis of over 200 responses from suppliers in the U.S. and China, this study empirically tests the relationship between trust and manufacturer-supplier information sharing. High trust can lead to frequent information sharing between suppliers and manufacturers. Frequent information sharing causes high mass customization capabilities. The moderating effect of country culture is also found for the relationship between trust and financial information sharing.

Key Words: Information Sharing; Trust; Mass Customization; Supply Chain

1. INTRODUCTION

A supply chain mainly includes material and information flows. Information sharing is a key success factor for supply chain management for the following reasons. First, information sharing allows exchanging daily operation information to coordinate regular production, inventory, logistics and quality management. Second, it exchanges knowledge transfer in new product development. Third, by sharing financial information it allows the supply chain members to lower their investment risks. All these reasons result in high mass customization capability, which is defined as better service to customers in high order-fulfill rate, high quality, and more varieties of products while maintaining low operating costs in production, inventory and logistics [1].

Many factors may cause frequent information sharing between buyers and suppliers in a supply chain. Trust is a significant success factor for information sharing in a supply chain. For the downstream of a supply chain, trust plays a critical role for attracting business for retailers [2]. Consumers' trust greatly affects decisions on purchasing from merchants [3]. For the upstream supply chain, trust is also a success factor for information sharing between manufacturers and their suppliers [4]. Information sharing exists in many dimensions including new product development, manufacturing process, logistics, quality management and financial management.

This research aims to answer the following research questions: (1) Can high trust lead to frequent information sharing in each of the dimensions between manufacturers and suppliers, and (2) can information sharing lead to high mass customization capability?

Section 2 reviews prior literature in trust and information sharing in supply chain management and further develops hypotheses. Data is collected from suppliers in the automobile industry in the U.S. and China. The research method is introduced in Section 3 and hypothesis testing is conducted in Section 4, followed by discussions and conclusions in Section 5.

2. THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

Trust is a main part of social capital theory. Social capital is a popular theory since it treats social relationships of individuals, groups and organizations as capital [5]. Trust is "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control the other party" [6, p. 712]. The research of trust is at team [6], within organization [7], and inter-organization levels [8]. In the context of supply chain management, many research articles are on trust including those on supply chain strategy [9] and purchasing techniques [10]. Trust between manufacturer and supplier is defined as that "the buyer is honest, reliable, open, and respects the confidentiality of information to a supplier" [11]. In order to gain the potential benefits from trust, information sharing between buyers and suppliers is critical within a supply chain [12]. Information sharing has its theoretical foundations in the resource-based view (RBV) which identifies four characteristics (i.e., value, rarity, imperfect imitability and imperfect substitutability) of critical resources to a firm to achieve competitive advantages [13] [14]. Lavie (2006) extends RBV to the interconnection of firms to gain competitive advantage for the network of firms [15]. On the basis of the extended RBV, the resources such as information and knowledge owned by partner firms, such as buyer or supplier in a supply chain, can also be considered critical for a firm. With trust, the resources of the supply chain can be shared. With solid foundations on social capital and resource-based view theories, this study proposes the following research model in Figure 1. Trust between the manufacturer and supplier increases the level of information sharing, which leads to a higher level of mass customization.

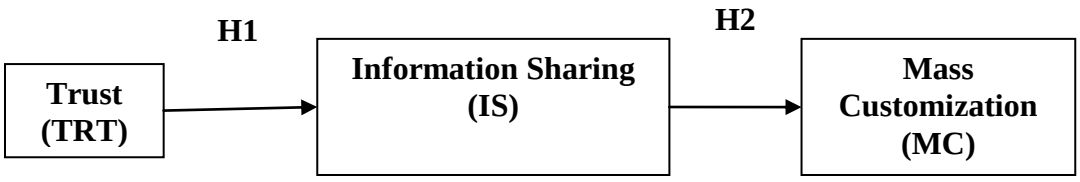

Figure 1: Research Model

Information sharing not only includes daily operation information sharing about production, quality, logistics and payment, but also includes in-depth knowledge transfer in new product development and financial planning. Researchers have found that frequent and deep information

sharing can improve both manufacturers' and suppliers' performance. Lambert and Knemeyer (2004) remind firms to identify the true partnerships, which have high trust and highly frequent and deep knowledge sharing, from "so-called partnerships", which tend to have low trust[16]. Narayanan and Raman (2004) emphasize the importance of information sharing through failed cases of supply chain management, in which supply chain members hide information for their own purposes [17]. Lee (2004) focuses on information sharing and knowledge transfer between suppliers and manufacturers in building up effective and efficient supply chains [12]. Liker and Choi (2004) propose a "supplier-partnering hierarchy" package. They argue that a good way to effectively share information is to share information intensively [18]. Liker and Choi (2004) state that trust between manufacturers and suppliers encourages extensive knowledge sharing between manufacturers and suppliers and builds up "deep supplier relationships" [18]. Information sharing is valuable in different aspects of supply chain management including product development, manufacturing process, logistics, quality management and financial management. Therefore, this study proposes the following hypotheses:

H1: the greater trust between manufacturers and their suppliers leads to higher level information sharing between the manufacturers and suppliers.

Mass customization is "the ability of a firm to quickly produce customized products on a large scale at a cost comparable to non-customized products" [19]. Each dimension of joint operation activities can result in higher customer services mainly in mass customization. Mass customization needs more careful design of information flow to ensure that (1) on-going coordination information is conducted through linkages of each operations dimensions (i.e., manufacturing process, logistics, and billing & payments), and (2) knowledge sharing in product development and quality improvement to achieve the advantage of synergies of operations including more varieties of products, low overall inventory cost for the supply chain and high level responsiveness of the supply chain.

Information sharing in product development allows a manufacturer to convey customer demands to suppliers to increase design quality as well as speed to product introduction through concurrent engineering [20]. Information sharing in production, such as manufacturing, logistics and quality control, allows the supply chain to coordinate daily operations and responds to maintain low costs, high varieties and fast responses to customers [11]. Financial information sharing increases the strategic integration with suppliers to serve customers better with mass customization [21]. Thus, the following hypothesis is proposed:

H2: more frequent information sharing between manufacturers and suppliers leads to higher level of mass customization.

3. RESEARCH METHODOLOGY

The data are collected in the U.S. and China through survey. Of 480 mailed or emailed questionnaires, 24 did not reach the targeted respondents because of wrong addresses or names. The number of people who received the questionnaire is 456. The number of respondents who completed and provided usable responses was 208. The response rate is 45.6%. There is no non-response bias using a chi-square test [22]. The measurement of trust was adopted from Li's study

[23]. The measurement of Mass Customization is adopted from Tu et al. (2004) [24]. The final survey instruments are described in Appendix A. The trust, joint operations activities, and mass customization use a five-point scale ranging from 1 = "strongly disagree" to 5 = "strongly agree".

Measurement and hypotheses are tested using structural equation modeling AMOS software. Measurement instruments are assessed for convergent validity with item reliability, discriminant validity, and construct reliability using confirmatory factor analysis (CFA) methodology [25]. The whole dataset is randomly divided into two samples, each of which has 104 responses. One is the calibration sample and the other is the validation one for measurement development [25]. The measurement model is tested using the calibration sample first. The t-values of the items are from 3.33 to 6.32, satisfying the 2.0 criterion for convergent validity. Six items (i.e., TRT2, TRT3, ISP2, ISP3, ISP4, and MC2) do not meet the 0.50 criterion for the item reliability. The contents of all items are examined for the modification of measurements. ISP5 (i.e., financial information sharing) has a very low reliability score of 0.13 and it is not the daily operations between manufacturers and their suppliers as other four dimensions of information sharing. Therefore, it is eliminated from the measurement of Information sharing. Due to the fact that TRT2, TRT3, ISP2, ISP3, and MC2 are very important to its construct, all of them are kept for further measurement evaluation using the validation sample.

The trimmed measurements includes three items for trust (i.e., TRT1, TRT2, and TRT3), four items for information sharing (i.e., ISP1, ISP2, ISP3, and ISP4), and three items for mass customization (MC1, MC2, and MC3). The trimmed measurements are validated using the validation sample (n=104). The results are in Table 1. In sum, the measurement model is validated to be fit, and the measurements have acceptable convergent validity and item reliability.

The next step is to validate discriminant validity and construct reliability of the measurements using the whole dataset (n=208). Discriminant validity can be assessed using χ^2 difference of fixed and free solutions between each pair of latent variables. All differences of χ^2 are significant at 0.001 level (i.e., the minimum $\chi^2 = 70.5$, $p < 0.001$, 1*df*). These indicate good discriminant validity for the measurements in this study. Reliability is estimated by the indices of composite reliability and average variance extracted (AVE). The acceptable composite reliability could be higher than 0.70 [26]. The composite reliability for the trust, information sharing, and mass customization are 0.75, 0.84, and 0.81, respectively. All of them exceed the acceptable level. The acceptable AVE is higher than 0.50. The values of AVE are 0.52, 0.62, and 0.61, respectively, for the trust, information sharing, and mass customization. The composite reliability and AVE for each construct in this study indicate a good reliability of each construct.

Latent variable	Item	Unstandardized Factor Loading	Standardized Factor Loading	Standard Error	t-value	R2 (item Reliability)
ξ1	TRT1	1.00	0.78	-[a]	-[a]	0.61
	TRT2	0.85	0.59	0.16	5.23	**0.35**
	TRT3	0.98	0.77	0.16	6.15	0.59
ξ2	ISP1	1.00	0.74	-[a]	-[a]	0.55
	ISP2	1.04	0.79	0.14	7.55	0.62
	ISP3	0.97	0.75	0.13	7.25	0.57
	ISP4	1.12	0.83	0.14	7.92	0.70
ξ3	MC1	1.00	0.84	-[a]	-[a]	0.71
	MC2	0.91	0.75	0.13	7.26	0.57
	MC3	0.82	0.75	0.11	7.24	0.56

[a] Indicate a parameter fixed at 1.0 in the original solution

Fit Indices: $\chi 2$=49.35, df=32, $\chi 2$/df=1.54, NNFI=0.89, CFI=0.96.

Table 2: Convergent Validity and Item Reliability (Validation Sample, n=104)

4. HYPOTHESIS TESTING AND DISCUSSIONS

AMOS structured equation modeling (SEM) framework was used to test the hypotheses of the current study. The AMOS algorithm provides several goodness-of-fit statistics to evaluate the hypothesized model and also suggests ways in which the model might be modified given sufficient theoretical justification. The structural model fit was very good with all indices meeting the recommended criteria: $\chi 2$/df=1.68, NNFI=0.92, CFI=0.97 and RMSEA = 0.057 (LO90=0.029 and HI90=0.083). The AMOS path coefficients resemble those derived through multiple regressions. The path coefficients for H1 is 0.57, which is significant at the 0.001 level, indicating that high trust leads to high information sharing in product development, manufacturing process, logistics, and quality management. The path coefficient for H2 is 0.42, which is also significant at the 0.001 level, supporting that high information sharing lead to high mass customization capacity.

In order to identify why financial information sharing is different from other dimensions of information sharing, mean values of the three items for trust is used to conduct correlation test between trust and each item of information sharing. The results indicate that high trust leads to high information sharing in product development, manufacturing process, logistics, and quality control. However, high trust does not lead to high information sharing in finance.

The responses (n=208) are from suppliers for four different types of auto makers: US brand (e.g., GM, Ford, and Chrysler) manufactured in North America (n=40), Japanese brand (e.g., Honda and Toyota) manufactured in China (n=63), US brand (e.g., GM) manufactured in China (n=41), and Chinese brand (e.g., Yuchai) manufactured in China (n=64). An in-depth analysis is further conducted for the four groups' responses in the sample. The correlations for Group 2 suppliers (i.e., Japanese Brand in China) and Group 4 suppliers (i.e., Chinese brands in China) are

significant at the 0.01 level and the 0.05 level, respectively, while the correlations for Group 1 suppliers (i.e., U.S. brands in North America) and Group 3 suppliers (i.e., U.S. brands in China) are not significant (p = 0.620 and p = 0.257, respectively). This situation implies that the link between trust and finance information sharing is effective for eastern brand supply chains while not for U.S. brand supply chains. One possible reason for this result might be the culture difference between the eastern and western buyer-supplier relationships in terms of financial information transparency.

Culture includes four dimensions: power distance, collectivism versus individualism, femininity versus masculinity, and uncertainty avoidance [27]. Buttery and Leung (1998) adds the fifth dimension of long-term versus short-term orientation, and they conduct empirical research between Chinese culture and western culture; they also find that there are significant differences in individualism, long-term orientation and power distance between Chinese culture and western culture [28]. Compared to western people, Chinese people tend to be group-oriented, have a long-term orientation, and accept a larger power difference among people at different levels. Trust is closely related to the group and long-term orientations for the buyer and the supplier. With group orientation and long-term relationship view, eastern suppliers are more willing to share the financial information to the manufacturer. For the same reason, the manufacturer, which has more parental attitude towards their suppliers, has more desire to get financial information to help suppliers lower their financial risks as well as to lower their product prices. Therefore, the culture difference between the eastern and western supply chains moderates the relationship of trust and financial information sharing.

5. CONCLUSIONS

This study empirically examines the relationship of trust and information sharing between manufacturers and suppliers on the basis of 208 responses from suppliers in the U.S. and China. Also, the empirical results show that frequent information sharing leads to high mass customization capabilities. However, the high trust cannot cause high information sharing in finance for the 208 responses as a whole. With a further in-depth analysis for each of the four groups of suppliers within the sample of 208 responses we find that high trust leads to frequent finance information sharing between buyers and suppliers for Chinese and Japanese brand supply chains while it is not supported by U.S. brand supply chains. The former two groups of suppliers are in eastern supply chains, while the latter two groups of suppliers are in western supply chains. This finding reveals that the culture difference may affect financial information sharing. The financial information is very sensitive in supply chain because suppliers would lose their power in price negotiations with buyers if they allowed buyers to get some of their sensitive financial information. The willingness of sharing sensitive financial information for eastern (e.g., Chinese and Japanese) supply chains is probably because of the parental relationship between the manufacturer and their suppliers.

References available upon request from Kun Liao at LiaoK@cwu.edu