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Sourcing complexity factors on contractual relationship: Chinese suppliers' perspective

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Over the last two decades original equipment manufacturers' around the world are aggressively sourcing from the suppliers in China to reduce cost and gain competitive advantage. However, OEMs face various tangible and intangible process complexity factors which influences their contractual relationship. Case studies have been carried out with seven Chinese suppliers belonging to various industries to understand their views on sourcing complexity and to prioritise complexity factors.

Keywords: Complexity, contractual relationship, sourcing, suppliers

1. Introduction

Original equipment manufacturers (OEM) gain competitive advantage mainly by sourcing most of their products from China, which is now regarded as a global factory. The major benefits of sourcing in china are reduction in material, labour, component service and capital investment cost and abundant market for their products. Besides these there are other motivations to these OEMs and they are to shorten product life cycle, reduce end product prices and total cost of ownership, reduce number of suppliers and establish strategic relationship. To certain extent these supply chains can improve their reliability and order lead time. Lanza et al. (2010) pointed out that few consequences from low-cost country sourcing process and they are increased risks and challenges such as not able to meet desired quality standards, product piracy and supply bottlenecks. However, supply chains are subjected to numerous challenges such as dependency on few suppliers, unable to react to uncertainties, type of relationship, preferred type of channel and various other constraints. This makes the sourcing process too complex and requires suitable strategy to overcome these complexities. Previous researches have highlighted the issues or complexities in sourcing from low-cost country with respect to OEMs' perspective and to the best of our knowledge there are no

studies to understand what suppliers think about these complexity factors. This is an attempt to identify the important complexity factors from the Chinese context through literature review and to categorise them into tangible and intangible factors. We carried out a case study in few firms under manufacturing sector to understand from the suppliers' perspective the influencing complexity tangible and intangible factors. Analytic hierarchy process has been used to prioritise the factors based on the views from the seven manufacturing companies located in Ningbo, China.

2. Sourcing complexity in China

Sourcing from China is done by almost all multinational corporations and big brand companies. Walmart is the biggest company in the world and has 2.1 million employees and \$419 billion revenue in financial year 2011. It has lengthiest and successful supply chain for more than 12,000 miles with more than 10,000 suppliers from China (Dauvergne and Lister, 2011). There are lot of risk to source from unregulated regions and they are mainly related to quality and reliable delivery. MNCs try to manage the complexities in sourcing such as defective, toxic and illegally produced products through proper policies and regulations with their suppliers and gain competitive advantage. However, few researchers have suggested that to source in China they should have an expertise to deal with key cultural and social pillars of the society such as *Xinren* (interpersonal trust), *zouhoumen* (back door or corrupt practices) and *guanxi* (Connections and relationship build around exchange of favours). China has a poor rating in a number of key areas such as institutions and policies related to aspects such as political stability, rule of law, intellectual property protection, flexibility and regulations that enable risk taking and entrepreneurship (Kriz, 2010). Table 1 show few studies which reports complexity issues related to sourcing from Chinese context. Most of the studies carried out in the past are case study oriented. The important complexity issues are

both tangible and intangible and they are quality, reduced visibility in operations, inter-relationship, cultural misunderstanding, regulations, coordination, infrastructure, employee training, tariff and taxes etc.

Table 1: Complexity issues in sourcing from China

Source	Aim of study	Method	Complexity/ Issue	Tangible/ Intangible
Tse and Tan (2011)	Vulnerability due to product quality risk in multi-layer supplier chain	Case study- single case	Quality of product Supply network. Decreased visibility in risk and operation processes-	Tangible
Ngai et al. (2011)	supply chain agility and supply chain competence and their impact on firm performance	Case study- multiple case	relationship from the perspective of inter-organizational collaboration	Tangible
Marucheck et al (2011)	Product safety and challenges in five main industries (food , pharmaceuticals, medical devices, consumer products and automobiles)	Content analysis	Relationship and cultural misunderstanding	Tangible and Intangible
Han et al. (2011)	Investigated inter-firm exchange relationship and quality management in china pork supply chain through integrated transactional and relational governance perspective	Empirical analysis	Relationship and quality	Tangible
Wu and Pagell (2011)	Decision making in sustainable supply chain management	Case study – single case	Regulations	Intangible
Lanza et al. (2010)	Interface between product design and production in low-cost sourcing countries	Case study – single case	Supply network, strategy, tariff and taxes, cultural aspect, cost for coordination and support, employee qualification and training, material requirement, long distances and regulations.	Tangible and intangible
Kriz (2010)	Highlights China’s innovative past, present and future	Conceptual	Emphasise more on cultural aspects and innovation. Ranks low in policies and regulations	Tangible and intangible

3. Process complexity factors

Process complexity refers to the supply base, which is made up of a number of suppliers, methods of supply, and methods of cost calculation, difference in capabilities, several operational practices, and different modes of connectivity. We classify process complexities into categories such as numerousness, differentiations and number of interacting pairs and level of inter-relationship (Choi and Krause, 2006; Kaluza et al., 2006). Intangible process complexities have been categorised as human capital, culture, infrastructure and policies and regulations, based on sourcing characteristics suggested by Fredriksson and Jonsson (2009). The tangible and intangible factors considered in this study are shown in Table 2.

Table 2: Tangible and intangible process complexity factors

Criteria	Sub-criteria	Details
Tangible	Numerousness	Number of suppliers, Various methods / channel of supply, Number of interfaces and systems
	Differentiations	Differences in technical capabilities and operational practices
	Number of interacting pair and level of inter-relationships	Different modes and number of interactions
Intangible	Human capital	Lack of skills and knowledge
	Culture	Criminality corruption, quality problems, language and cultural differences
	Infrastructure	Comparative price levels, opacity of sharing information, time zones, demarcating supply chains
	Policies and regulations	Currency, risk of supply, intellectual property risk and dynamic customer requirements

4. Research methodology

Case study has been carried out in seven companies in different manufacturing sectors such as automobile, electronics, food, plastics, leather, fashion and seat to identify the influence of sourcing complexity factors and to know how best the firms are aware about those issues. The case study used quantitative data to investigate few aspects related to tangible and intangible factors of sourcing complexity. The case data were gathered mainly through

interviews and authors on-site observations. Data collection took place during September – October 2011. Interviews were semi-structured and conducted at the respective companies'. We had a questionnaire with two parts. Part A consists of questions related to influence of tangible and intangible sourcing complexity factors with respect to contractual relationship. We requested the respondent to give their importance of factors for a pairwise comparison using Saaty's 9 point scale (Saaty, 1980). Part B had questions related to profile of respondent and the organization. Additional questions were asked by phone, email and follow-up interview was conducted with their respondents. Respondent characteristics and organizational characteristics are shown in Table 3.

Table 3: Case companies profile

Organization sector	Respondent and company profile					
	Position in organisation	Years of Experience in Reverse logistics & Return management	Age	Type of organisation	No. of staff in in Reverse logistics & Return management	Type of certification
Automobile company ABC	Senior manager	6	38	Joint venture	11-15	ISO 1400/1/2
Electronics company DEF	Senior manager	7	46	Private	11-15	ISO 9000/01/02
Food packaging company GHI	Head of Unit	3	37	Joint venture	30	ISO 9000/01/02
Plastics company JKL	Assistant manager	2	28	Joint venture	1-5	ISO 9000/01/02
Footwear company MNO	Director	7	26	MNC	6-10	ISO 9000/01/02
Fashion company PQR	Senior manager	10	48	Private	6-10	ISO 9000/01/02
Seat company STU	Head of Unit	6	27	Private	1-5	ISO 9000/01/02

4.1 Chinese manufacturing sector

Aided by relatively cheap, dedicated and skilled workforce in the manufacturing sector, everything from toys, trendy fashion goods such as ladies handbags to cars to some of the most sophisticated electronic goods are made in China. The significance of China's manufacturing sector can be comprehended by the statistics reported by Pinto (2005) and they are: continual increasing manufacturing prowess, significant cost advantage (beyond just labor cost), significant presence of their product in worldwide market-share (5% of cameras, 30% of air conditioners and television, 25% of washing machines, 20% of refrigerators). Furthermore, China is now the largest automobile producer in the world and a key market for global players in the automobile industry. The country also supplies world's leading automobile manufactures with high quality parts and components. China's vehicle production scale reached 18.26 million vehicles in 2010, an over 30% increase from 2009's 13.79 million units (FOURIN China Automobile Intelligence). China's local automobile companies are increasingly working as part of joint ventures with leading global brands; and important trends that are likely to dominate the development of the global automobile industry over the next decade will all have China playing a key role. Similarly the China's plastics manufacturing sector employs 2.6 million workers and generate a total export value of US \$14.40 billion in 2009. China's packaging market is the largest in the world and is predicted to grow to \$97bn per annum by 2012 (Wood, 2010). Food packaging alone accounts for 50% of the total demand for packaging with volume growth of more than 20% being common in most food sectors. It is a similar story for China's footwear industry with the total export value hitting US\$24b in 2009. These motivated our selection of seven firms in China's key manufacturing industry such as automobile, electronics, food packaging, plastics, footwear, fashion and seat for a case study to identify the influence of sourcing complexity factors and to know how best the firms are aware about those issues.

4.2 Case companies' profile

Automobile Company ABC: The Company is a leading manufacturer of tools sets, tools kit, spark plug wrench, oil filter wrench, ratchet wrench and other accessories for automobile sector and located at ZheJiang Province. The company started its business operation in 2003. It is a joint venture wholly locally owned with nearly 40 years' of manufacturing experience. The company currently has about 15 dedicated supply chain management and reverse logistics management employees and annual revenue of USD 5,000,001. The company is an ISO 14001/2 standard.

Electronics Company DEF: The Company is a leading manufacturer and exporter of various lighting sensor electronic in Ningbo, in Zhejiang Province, China. The products include: PIR sensor switch, M/W sensor switch, wireless remote control door bell, smoke alarm and multifunctional wireless home security alarm systems, amongst others. The company currently has about 15 dedicated supply chain management and reverse logistics management employees. The company has over 20 years' experience as an exporter of specialized sensor electronic systems. It currently employs over 300 lighting specialists. The company is an ISO 9000/01/02 standard and products are manufactured under quality standard of Most products have CE, GS, UL, BSI, VDS, approval.

Food packaging Company GHI: The Company is a leading manufacturer food and drug packaging products in Ningbo, in Zhejiang Province, China. The company specializes in food packaging pouch, medical disposable co-extrusion film, vacuum seal storage bag, films, amongst others. The company has international first-class co-extrusion film blowing production lines in a 1,900-square-meter workshop that meets the GMP standard. It is a joint venture company with more than 10 years of international business experience. The company currently has more than 21 dedicated supply chain management and reverse

logistics management employees with about 3 years of experience in logistics, SCM and return management. The company is an ISO 9000/01/02 standard.

Plastic Company JKL: The Company is established in 1997 and it specializes in designing and manufacturing molds for companies local and international clients and it is located Ninghai in Zhejiang Province, China. The company has a total staff strength of 128 of which 8 are senior engineers, 16 - designers, 37 - molding technicians and 65 high-skilled molding workers. This joint venture company currently has about 5 dedicated supply chain management and reverse logistics management employees. The company is an ISO 9000/01/02 standard and moldings are manufactured to high quality English, American, HASCO, and D-M-E standards.

Footwear Company MNO: The Company specializes in the manufacturing and exporter of various beach slippers, flip flops, indoor slippers, children slippers, amongst others in Ningbo, in Zhejiang Province, China. The company is an ISO 9000/01/02 standard and about 60% of its products are exported mainly to Europe and USA. It has a total annual sales volume of US\$10 – 50 million. The company is a MNC and currently has about 10 dedicated supply chain management and reverse logistics management employees with between 4-7 years of experience in logistics and SCM.

Fashion Company PQR: The Company is a leading manufacturer and exporter of various ladies fashionable handbags, cosmetic handbags, and backpack in Ningbo, in Zhejiang Province, China. The company is founded in 1997 and currently has about 10 dedicated supply chain management and reverse logistics management employees all of whom are university graduates that have spent between 8-10 years in the company. Each year, the company designs and manufactures around 1.5 million handbags with the entire outputs being exported to clients internationally. The company is privately owned and an ISO 9000/01/02 standard.

Seat Company STU: This Company is one of the pioneers and fastest growing baby car seats in Ningbo, China. The company is a privately owned business and started its business operation in 2004. The company is proud of having its products tested by the most authoritative agency, TNO laboratory, with approval by ECE R44/04 certificate. The company is an ISO 9000/01/02 standard and currently has about 5 dedicated supply chain management and reverse logistics management employees all of whom holds diploma qualifications.

4.3 AHP methodology

The Analytic Hierarchy Process (AHP) proposed by Saaty (1980) is a robust method for prioritizing alternatives and has been applied in wide variety of areas including prioritizing criteria, planning, selecting a best alternative, resource allocation and resolving conflicts (Vaidya and Kumar, 2006; Sipahi and Timor, 2010). The application of AHP to a decision problem involves four steps (Ramanathan 2006; Ho, 2008).

STEP 1: Structuring of the Decision Problem into a Hierarchical Model

It includes decomposition of the decision problem into elements according to their common characteristics and the formation of a hierarchical model having different levels. Our AHP model (Figure 1) has three levels (goal, criteria and sub criteria) though more complex models with more levels could be formulated.

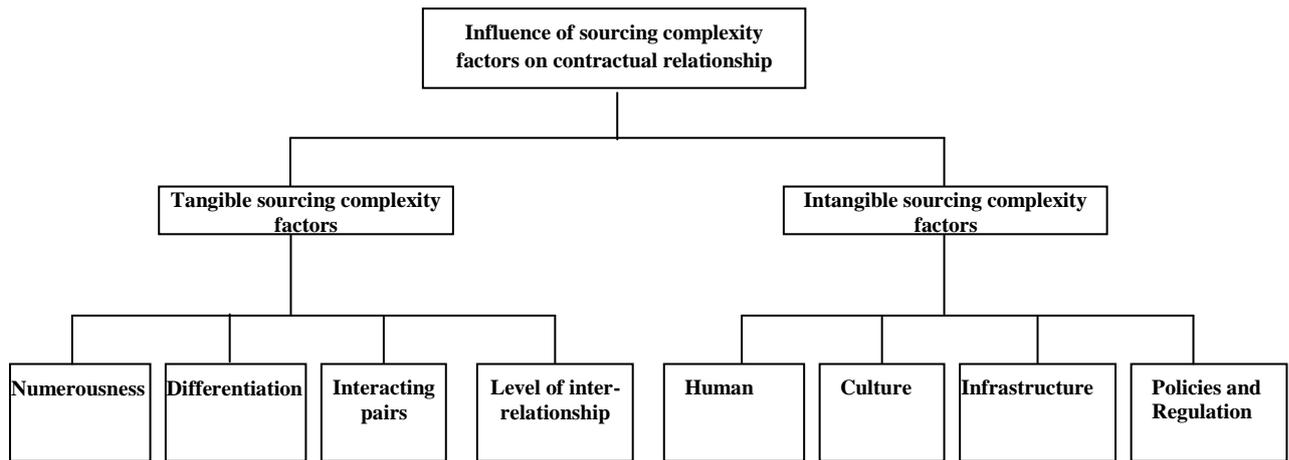


Figure 1: AHP model for sourcing complexity factors

STEP 2: Making Pair-wise Comparisons and Obtaining the Judgmental Matrix

In this step, the elements of a particular level are compared with respect to a specific element in the immediate upper level. The resulting weights of the elements may be called the local weights (to be contrasted with final weights, defined later).

The opinion of a decision-maker (DM) is elicited for comparing the elements. Elements are compared pair-wise and judgments on comparative attractiveness of elements are captured using a rating scale (1-9 scale in traditional AHP). Usually, an element receiving higher rating is viewed as superior (or more attractive) compared to another one that receives a lower rating. Each entry a_{ij} of the judgmental matrix are governed by the three rules: $a_{ij} > 0$; $a_{ij} = 1/a_{ji}$; and $a_{ii} = 1$ for all i . If the transitivity property holds, i.e., the $a_{ij} = a_{ik} * a_{kj}$, for all the entries of the matrix, then the matrix is said to be consistent. If the property does not hold for all the entries, the level of inconsistency can be captured by a measure called Consistency Ratio (Saaty, 1980). A value of CR less than 0.1 is considered acceptable because human judgments need not be always consistent, and there may be inconsistencies introduced because of the nature of scale used.

STEP 3: Local weights and Consistency of Comparisons

In this step, local weights of the elements are calculated using the eigenvector method (EVM). The normalised eigenvector corresponding to the principal eigenvalue of the judgmental matrix provides the weights of the corresponding elements. Though EVM is followed widely in traditional AHP computations When EVM is used, Consistency Ratio (CR) can be computed. For a consistent matrix $CR = 0$, and if CR for a matrix is more than 0.1, then judgments should be elicited once again from the decision-maker till he gives more consistent judgments.

STEP 4: Aggregation of Weights across Various Levels to obtain the final weights of alternatives

Once the local weights of elements of different levels are obtained as outlined in Step 3, they are aggregated to obtain final weights of the decision alternatives (elements at the lowest level). For example, the final weight of alternative F1 is computed using the following hierarchical (arithmetic) aggregation rule.

$$\text{Final Weight of } F_1 = \sum_j \left[\left(\text{Weight of } F_1 \text{ with respect to Criterion } C_j \right) \times \left(\text{Importance of Criterion } C_j \right) \right]$$

By definition, the weights of alternatives and importance of criteria are normalized so that they sum to unity.

5. Results and Discussion

The final weight obtained by AHP method for the seven companies selected for our study is shown in Table 4. The important findings from the analysis are discussed below

- All the companies believe that tangible sourcing complexity factors are more important than intangible factors for contractual relationship.

Table 4: Final weight of sourcing complexity factors

Factor	Final weight						
	Automobile company ABC	Electronics company DEF	Food packaging company GHI	Plastics company JKL	Foot wear company MNO	Fashion company PQR	Seat company STU
Tangible							
Numerousness	0.59	0.35	0.50	0.50	0.40	0.50	0.5
Differentiation	0.12	0.06	0.17	0.14	0.24	0.13	0.13
Interacting pairs	0.07	0.05	0.17	0.09	0.10	0.07	0.07
Level of interrelationship	0.04	0.03	0.07	0.08	0.07	0.05	0.05
Intangible							
Human	0.07	0.16	0.03	0.08	0.10	0.08	0.08
Culture	0.06	0.10	0.03	0.04	0.06	0.06	0.06
Infrastructure	0.09	0.18	0.02	0.03	0.03	0.10	0.10
Policies and regulations	0.03	0.07	0.02	0.03	0.02	0.02	0.01

- Numerousness gains importance than the other four factors in tangible complexity category. Suppliers feel that presence of too many competitors induces complexity with OEMs.
- Differentiation in technical capabilities and operational practices between OEM and suppliers is the second biggest issue among the seven companies. In terms of weightage all firms considers it as an important except Electronics Company.
- Interactions among the suppliers connected to a single OEM are considered to be somewhat important and their intensity does not have big impact.
- Four firms (automobile, electronics, fashion and seat company) out of seven firms believe that infrastructure as a major issue in intangible category than others. They believe that opacity of information, comparative price level and demarcating supply chain as the biggest intangible complexity factor.
- Food packaging, plastics and footwear companies think that human skills and knowledge is more important than other intangible complexity factors.

- We thought culture that comprises of criminality corruption and language differences between Chinese suppliers and OEM would have a serious impact on contractual relationship but it was not the case. Almost all the companies rated it third among the four intangible factors.
- Policies and regulations that includes currency, risk of supply, intellectual property risk and dynamic customer requirements is one of the major issues from OEM perspective is not given due importance from suppliers perspective of all firms.

6. Conclusion

It is well known from the previous studies that sourcing complexity factors plays a vital role in contractual relationship between low-cost country suppliers and OEMs. Most of the studies were done previously to highlight the benefits, motivations and challenges from OEM perspective. We aim in this paper to understand the influence of tangible and intangible factors on contractual relationship from Chinese suppliers' perspective. Our finding revealed that tangible complexity factors are most important than intangible complexity factors. Our AHP analysis suggests that tangible complexity factor numerousness and intangible complexity factor infrastructure plays a vital role in governing contractual relationship with OEM from suppliers' perspective. In future the above study could be extended to analyse the inter relationship among the factors considered and to generalise the findings through empirical analysis. This study considers manufacturing sector since it is a major sector in China. In future possibility is there to study other sectors.

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