

Technology Spillover Effect of International Outsourcing to Outsourcing Suppliers -----Case Study on Ningbo Garment Cluster in China

Yejing Huang, Shanghai Academy of Social Sciences

Abstract: Outsourcing's technology spillover effect to local supplier enterprises is an important issue among the field of impact of China's involvement in global production network. Considering the fact that Ningbo garment industry is one of the leading export oriented garment industry in China, the paper outlined Ningbo garment cluster 's outsourcing and its impact to local supplier SME's technology upgrading based on field study in Ningbo in 2009. In terms of the result of questionnaires concerning on garment outsourcing using a sample of 91 local enterprises and corresponding interviews of selected typical enterprises, the impact of outsourcing behavior to enterprises' technology performance is under deep analysis using empirical methodology. We find there exist four sub effect of technology spillover effect including technology demonstration effect, technology diffusion effect based on personal mobility, R&D spillover effect and agglomeration effect. While, we fail to find significant correlation between outsourcing capacity of outsourcing suppliers and technology spillover performance. The paper also give explanation in terms of the concerning information from questionnaire on the issue of likelihood of upgrading of suppliers and their value chain governance characteristics.

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1. Literature Survey

International outsourcing is a approach of international production, and is an emerging method for developing countries to establish stable trade relations with foreign buyers at developed countries. In the real world, international outsourcing are primarily present as OEM production under OEM contract buyers (contract manufacturing) .

1.1 Perspective on issue of OEM development

Research with the case of Chinese Taiwan shows that about 70% OEM contract between Chinese Taiwan local firms and foreign buyers are characterized as technology transferring and Taiwan local firms gain product design capacity(San Gee,1990) . While, as a simple processing mode, scholars argue that engaging in OEM activities will also bring obstacle to upgrading of local firm of developing countries due to its “lock-in” effect behind (Ernst and O’connor 1992)。 It is difficult for local outsourcing suppliers to find capital for R&D input if suppliers are involved in OEM manufacturing for long term and will strengthen the position under current value chain, which hamper the procedure of enterprises to cultivate their own brand and networking.

1.2 Perspective on issue of export orientation

From macroeconomics perspective, the issue of international outsourcing is discussed under the framework of export orientation ‘s impact to developing countries. Concerning the linkage between export and developing countries’ labor of division position at global production system. It is widely acknowledged that the transition from production to higher-value added capabilities can be acquired in the course of exporting. The key message of the ‘Learning by Exporting’ paradigm is that exporting provides a superior way for developing country firms to learn and acquire capabilities to become globally competitive (Keesing & Lall, 1992; World Bank 1993 & 1998; Gereffi, 1994 & 1999). This view seems to be confirmed by the success of local OEM firms in Korea, Taiwan and Hong Kong which have excelled at export-oriented production eventually gain international competitiveness. Due to the fact that OEM is

a typical type of international for foreign buyers from developed countries, which play more and more important role for developing countries to scale expansion of the concerning industries. Current research by domestic scholars also argue that export based on international outsourcing is a practical channel for Chinese firms to be involved in global value chain. However, this harm to local factor cultivation environment oriented on self-innovation. The reasons is that local firms faced up with the highly competitive environment. Local firms suffer from the competition of “race to bottom” and gain very little profit on those labor intensive products processing export under outsourcing contract with MNC, which dominate international marketing network (Youwen Zhang, 2007) .

Other research progress argue the important of “non-technology” advantage do matter on outsourcing supplier’s upgrading experience. Under the background that leading companies of main manufacturing pay more effort on the business of distribution network building and service modernization, which is beyond “typical manufacturing” as before. Under those circumstances, “non-tech” competitive strategy is a key routine for strengthen international competitiveness for developing countries firms, which conclude variety of service activity innovation, such as logistics and operation management (Hildenbrand, Fleisch & Beckenbauer,2004)。

Current empirical research have get progress on outlining value chain for OEM local firms based on empirical studies on Asia economies including Chinese Taiwan and South Korea (UNCTAD). Two sets of forces determine an OEM's chances of success in their function upgrading via value chain (Liu et al.,2008). One set relates to competence in product design and development, and the second relates to constraints defined by customer structure, which limit contract manufacturer's design and development competence for own brand production. Further, the choice of geographic target market and the stage of product lifecycle also determine success. Under these circumstances, local outsource suppliers present “huge scale while low profit” and stick on low end of international value chain.

Technology spillover effect is widely discussed with object on FDI in developing

countries. Considering with theoretical analysis, the technology effect for outsourcing suppliers at developing countries can be analyzed by two aspects: one is outsourcing's macro feature under global production system, and second aspect is the difference of technology spillover effect between FDI and international outsourcing.

This paper try to answer “ How do local outsourcing supplier in China gain technology upgrading via outsourcing manufacturing?”. In this paper, the components of technology spillover effect and its determinants of outsourcing capacity's upgrading from microeconomic perspective will be explored. In order to get micro data based on first hand data collection, we make a filed work on Ningbo Cluster.

In this paper have two aspects, the first is make description on technology spillover effect of international outsourcing referring the trajortary of technology spillover of FDI. And the second is to explore the determinants of technology spillover effect via, and further explain the interrelation between value chain governance and the upgrading of outsourcing suppliers.

Quite a few study using empirical study methodology are made based on historical review on newly industrialized economies , especially in Asia economies.. Because international production under OEM manufacturing is widely adopted in Asia countries and economies, such as Chinese Taiwan and Korea, which is an important approach for them to gain international competitiveness. And the literature based on those economies experiences are reported to be a kind of international production with high quality yet low-cost manufacturing, which is an very important strategy for developing countries firms to promote production capabilities. Scholars argue that international production via OEM relationship have opportunity to have access of high value added capacity, which based on technological capabilities (Bell and Pavitt, 1992 and 1995; Lall, 1992 and 2001; Figueiredo 2006). From the perspective of Global Production Network theory, the key conclusion is the inter-action relationship can be observed among technology transfer from leading companies of developed countries, capacity of local suppliers and characteristics of production network(D. Ernst & Linsu. Kim, 2002). While the OEM manufacturers in developing countries 's opportunity to have the technology spillover effect transformed into real

competitiveness need other conditions, which is a basket of factors, including the accession of international market network and branding capacities establishment. Under those comprehensive conditions, technology spillover effect is assumed to evolve to innovative capabilities . Therefore, technology spillover effect acquired by outsourcing suppliers will develop into performance of competitiveness progress only if local OEM suppliers acquire other sourcing of non technology advantage (Hobday, M.,1995).

Because the literature mentioned above mainly focus on the description on OEM experience and its impact on industry competitiveness, while the deep determinants from micro-level factors is rare analyzed. This paper will focus on micro-level factors involved in technology performance of local outsourcing suppliers. Considering the practice of labor intensive industry, the performance of technology upgrading should be understood under diversified perspective including direct technology transfer from outsourcing buyers to outsourcing suppliers and indirect technology impact from outsourcing buyers.

2. Theoretical Framework

This paper will give a explanation on technology performance based on interaction between outsourcing buyers and outsourcing suppliers, as well as determinants on outsourcing suppliers' upgrading.

2.1 Micro-level approach of Technology spillover effect

In technology spillover effect, we refer the theory paradigm on “technology spillover effect based on FDI” and compose micro-level approach of technology spillover effect of international outsourcing. While, considering the difference of business operation mode of international outsourcing with FDI. This paper make adjustment and compose a new paradigm on micro-level mechanism of this effect.

The difference between FDI and international outsourcing in micro-level approach is the capital linkage. For technology spillover effect present, current literature emphasize on its nature of tacit& untouchable nature and indirect transmission procedure. Under the practice of international outsourcing between developed country

firms and developing country firms, outsourcing supplier company have no capital linkage with outsourcing buyers and their cooperation is implemented only via outsourcing contract. Under this kind of interrelationship, technology linkage is also a external effect, which is similar with the nature of FDI technology effect. In this paper, we refer theoretical progress of FDI technology spillover effect and compose the content of technology spillover effect. The search target include three aspects.

Considering the practical implementation process of outsourcing, outsourcing suppliers have accession of professional information and knowledge mobility between outsourcing buyers and are likely to have incentive to push self-studying aiming at higher production efficiency under the fierce competition within the industry. Under those process, technology linkage between outsourcing buyers and outsourcing suppliers can be outlined as technology learning, technology imitation and further self-fulfilled technology input by outsources. Those effect can be outlined as external technology effect of outsourcing and create indirect impact to outsourcing suppliers, which is similar with technology linkage under FDI context. Under those circumstance, we adopt theoretical framework on technology spillover of FDI based on current concerning literatures. On the issue of FDI technology spillover effect, four sub-effect can be concluded as sub-effect of technology spillover effect, which are also micro-level approach of technology link between investor company and local company (developing countries).

- “ technology transferring”.
- “technology demonstration”,
- ”personal mobility effect”
- “ R&D spillover”.

Consider the special nature and extraordinary linkage between outsourcing buyers and outsourcing suppliers, this paper will first decompose technology spillover effect under international outsourcing context. decompose technology spillover effect into a basket of sub effects referring FDI theory and outsourcing’s practice.

Here we refer the theory paradigm on technology spillover effect based on FDI and

compose a new research framework combined with the nature of international outsourcing, which is to make a description on micro-level mechanism of technology spillover effect of international outsourcing from the aspect of outsourcing supplies. In terms of literature survey and enterprises interview, three aspects need to be considered as the difference between technology spillover effect of FDI and international outsourcing.

First, technology transferring effect should not be included in technology spillover effect due to the relations between outsourcing buyers and outsourcing suppliers. Because there is no direct capital relations between outsourcing buyers and outsourcing suppliers, so direct technology transferring activities is very rare. While, during the operation of outsourcing production, outsourcing suppliers have more or less accession on professional information and knowledge accumulation between outsourcing buyers and are likely to bear intensive to make self-studying on business development aiming at upgrading production efficiency under the fierce competition. During this procedure, technology linkage between outsourcing buyers and outsourcing suppliers can be highlighted as technology learning, technology imitation and further self-fulfilled technology effort aiming at innovation. Those effect can be regarded as external effect due to its indirect transmission channel, which is similar with technology linkage under FDI context. Under those circumstances, we adopt theoretical framework of technology spillover of FDI literatures and make adjustment according to the literature .

Second, a new effect as “technology diffusion based on personal mobility” is composed due to the special business characteristics compared with FDI situation. Corresponding to the nature of personal communication under outsourcing business environment. Under international outsourcing environment, outsourcing buyers’ temporary stay for technology instruction can be observed during the business operation process, especially for long term outsourcing contract. In terms of the information collected from enterprises interviews, we find the communication on production technique and requirement between outsourcing buyers and outsourcing suppliers on outsourcing production play important role in enlightening outsourcing

suppliers to further their effort in innovation activities, which do have positive impact on technology learning of outsourcing suppliers via outsourcing process. Therefore, the” technology diffusion based on mobility” is introduced when we make a decomposition on technology spillover effect. Here four kinds of effects are highlighted as follows:

Third, “agglomeration effect” is added to describe the impact of outsourcing based on cluster to outsourcing suppliers’ market environment. It is an extraordinary situation for outsourcing compared with FDI framework. Due to the high specialization extend of industry within the cluster, local firms can easily find professional partner when they need further their professional advantage in manufacturing and business. Therefore, companies at cluster are likely to experience agglomeration during their business development. Under this context, agglomeration effect due to the cluster environment need to be considered when we consider the external technology effect of outsourcing.

In order to describe the complete micro level mechanism of tech spillover effect under international outsourcing, we compose four aspect of this effect born based on the practice of international outsourcing. They are :

- Technology demonstration effect
- Technology diffusion effect based on personal mobility
- R&D spillover effect
- Agglomeration effect

The performance of those four aspect is as follows:

Table 1 Decomposing on technology spillover effect and their performance

Decomposing Technology spillover effect	Performance of every sub-effect
Technology Demonstration effect	Stipulate Product Quality Standard and Delivery Control Specification given by Outsourcing contract
	Outsourcing suppliers make Purchase on Equipment or Production line recommended by Outsourcing buyers

Technology diffusion effect based on personal mobility	Outsourcing buyers give instruction of product Quality and Delivery Management
	Supervision and examination on production management system indicated by Outsourcing buyers
	Outsourcing buyers mentoring on-spot interior management on outsourcing suppliers
R&D Spillover effect	Outsourcing suppliers refer Design Drawings from outsourcing buyers and make further Renewal by themselves
	Outsourcing suppliers pursue cooperation on new product development and modern management strategy with MNC at targeting market
	Outsourcing suppliers outsource own design work to professional Design Workshop
	Outsourcing suppliers gain incentive to make more effort on innovation activities
Agglomeration effect	Firms specialized in different function link of product value chain agglomerate in the cluster and cooperate very closely to pursue the increase of production efficiency

2.2 Correlation between outsourcing suppliers and value chain governance type

As a approach of international production, the nature of international value chain behind international outsourcing need to be considered when we research the determinants of upgrading of outsourcing suppliers.

Referring the current literature with the topic of value chain upgrading, the interaction between value chain governance type and value chain upgrading is widely discussed. Based on search on current research progress on international value chain, we use the chain and upgrading distinctions(Humphrey and Schmitz,2000). And the upgrading

based on value chain is also diversified, which include product (moving into more sophisticated product lines), process (transforming inputs into outputs in more efficient ways) and functional upgrading (acquiring new, higher value added functions in the chain, i.e. branding, marketing, design). Research on value chain with the object of developing countries present the correlation between governance kind and upgrading kind. The conclusion is that companies operating in market-based value chains are more likely to achieve functional upgrading than producers in quasi-hierarchy. Product and process upgrading are actively encouraged and supported by quasi-hierarchical buyers. And the firm operating under network governance kind experience upgrading in the middle of above mentioned governance kinds. According to the experience of emerging economies, the mix of opportunities, combined with the producer's determination to upgrade appears to be the main factors explaining why some firms were able to progress into higher value added activities (functional upgrading). While, local company 's effort and proper international business strategy is also important to compose 'leveraging competencies', which increased their profile in international markets and made them less vulnerable(Lizbeth Navas-Aleman, 2003).

Second issue is the determinants of outsourcing suppliers' technology upgrading. Because the performance of technology progress is difficult to demonstrate directly, we adopt the trajectory of value chain upgrading to identify technology progress, and make further explanation on correlation between outsourcing capacity and value chain upgrading.

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3. Research Methodology of Statistics Analysis

In this paper, we compose two hypothesis under the above mentioned framework: the first is technology spillover a mix of direct and indirect technology linkage between outsourcing buyers and outsourcing suppliers. The second is the impact of value chain governance to upgrading of outsourcing suppliers. In the empirical part, we pursue first hand data from field work and make processing on data using statistic software

(mainly SPSS13.0)

3.1 Field work on Ningbo Garment Cluster:

This paper will use empirical studies to estimate technology spillover effect to developing countries. Considering the unavailability on outsourcing statistics in China, the quantitative analysis from macro perspective is very difficult so far, so we use enterprises field research to describe technology effect of international outsourcing. Considering the fact that technology linkage is difficult to be observed from enterprises statistics within China, we make field work by ourselves and collect first hand data based on questionnaire and face to face enterprises interview made last year. Due to the huge production capacity of garment industry in East China, both Yangzi Delta and Zhu Jiang Delta are the leading garment clusters with export orientation in China. In this paper, we choose Ningbo garment cluster as research object. The reasons we choose Ningbo garment industry as research target include three aspects:

First, Ningbo garment industry has huge export scale. Average exports based on Ningbo garment industry reach more than 5 billion USD and account for more than 15% in the whole garment industry nationwide. Considering the low concentration rate for garment industry in the whole China, Ningbo cluster is one of most export intensive garment cluster in the whole.

Second, the channel for export at Ningbo garment cluster have been deeply involved in manufacturing in terms of clients' specific design print (来样定做) and tap client's brand on the final products. This manufacture mode can be described as "garment OEM" and account for the majority of Ningbo's garment cluster. And foreign clients come from U.S, European and Japan market. Compared with Zhu Jiang compose the main export channel in Ningbo garment industry. Concerning the distribution networking of enterprises, most enterprises rely on local trader to arrange export affairs, which means that they do not know the whole channel under garment distribution network abroad. Therefore, Ningbo local manufactures locate at "material supplier and apparel manufacturing part" of the whole garment value chain, which apply with the micro feature of "manufacturing outsourcing" from foreign

buyers. Currently, garment export under that OEM mode account for more than 80% of all export of Ningbo garment.

Third, Ningbo garment industry have experienced transition of economic growth mode during the past five years. As one of the pillar industries in Ningbo, leading garment enterprises make effort on pursuing innovation and branding capacity building with the aim at branding capacity building. Ningbo. Governmental departments have issue incentive policy to encourage garment firms to make effort on building own brand in foreign markets. Therefore, Ningbo firms are faced up with positive environment on industry upgrading.

3.2 Data and Sample

The field work before theoretical analysis include two parts, one part is first hand data collection based on questionnaires and data statistics analysis, the other part is face to face enterprises interview from the samples, which are typical firm in outsourcing operation at Ningbo garment cluster. We spent three month to complete all the field work. Considering the research target on international outsourcing, Ningbo Economic Commission help us to search for local enterprises, which meet the requirement of “outsourcing supplier”. Finally, we find 150 firms apply with our requirement include apparel manufacturer and garment intermediate manufacturer. The final firms under the list can be divided into two groups, one group is pure OEM supplier(100% products for OEM contract), another group is manufacture with production for both foreign buyers (OEM) and self brand production. First, we choose firm that have been involved in OEM production for continuous 10 years. Second, for those firms oriented in two markets, ie firms having both international and domestic business, the criteria of choosing the firm is that OEM production of a firm is more than 80% of the whole sales income during the last three years.

3.3 Primary analysis from data processing of questionnaires

- **Private companies with small and media scale account for the majority**

In the sample, private company account for 58% of the whole sample, and the second largest group is limited liability company(33%), the third largest group is stock share cooperative company, and FIE's percent is 9%.

- **Small and Media Enterprises is the majority of the sample.**

The company with sales income lower than 5 million RMB account for 56% of the whole sample, and company with sales income between 5 to 10 million RMB account for 21%, and only 9% firm with sales income of more than 20 million RMB.

- **Outsourcing contract between local supplies and foreign buyers compose international value chain.**

Local companies with all production for foreign clients account for 41%. While ,the companies with production for both foreign buyers and domestic buyers account for 55%, therefore, the companies that involved in manufacturing for foreign buyers account for 96% totally. It means that Ningbo garment cluster present high internationalization marketing feature.

- **R&D intensity of Outsourcing Suppliers**

The overall R&D intensity is low, companies with R&D intensity between 1%-3% account for 28.9%, and companies with R&D intensity between 3%-5% account for 20.6%, and third largest group is R&D intensity below than 1%, this group account for only 14.4%.

Therefore, the overall R&D intensity is very weak, and the reason behind can be outlined as three aspect. First is that firms lack of capital to make R&D input; The second reason is local firms have little incentive to be involved in innovation activities, and the third is that local firms are not free to have innovation product due to the stipulation of outsourcing contract.

Table 2 R&D performance and relative importance for outsourcing suppliers (average level of sample firms)

	Type of R&D activities	Score presenting importance (1: least important 5: Most important)
R&D activities during international outsourcing	R&D based on imitation	3.66
	R&D based on own technology effort by themselves	3.14
	Collaborative R&D including R&D outsourcing and joint innovation project	2.95
	Cooperation with global MNC to upgrading business	2.93

From the information of the table, we find that R&D activities based on imitation, ie imitation innovation is the most important routine of R&D. The reason concerned including lakage in capital, weak innovation spirit and market environment under very low IP protection and etc. This situation compose a obstacle for outsourcing suppliers to persue upgrading.

4. Statistics Analysis: Principle Component Analysis and Correlation Analysis

In this paper, we make decomposition on technology spillover effect of international outsourcing. Based on the information of interview, we highlight varieties of items, which present the positive impact to outsourcing suppliers and extract principle component, which can explain technology spillover effect.

From interview, what impressed us is that the impact from outsourcing buyers in the aspect of technology present a comprehensive effect including technology diffusion from outsourcing buyers and technology learning by themselves via cooperation and in diversified approach, which is an indirect way for outsourcing suppliers to acquire technology. Therefore, the decomposing on technology spillover effect in terms of the

micro-level mechanism of technology linkage between outsourcing buyers and outsourcing suppliers are necessary. Combining the nature data, we adopt main principle analysis to make a detail description on technology spillover effect.

4.1. Data and Sample

Under the field work, we cooperate with local governmental department to hand out enterprise questionnaire, and they help us to communication with enterprises and hand out questionnaire to them.

For the choice of When we choose firm under investigation, we set up detail requirement, which meet the concept of “garment outsourcing supplier”. The requirement include two aspects, one is a firm is involved in garment and garment parts production for continuous 10 years the other is a firm is engaged in at least 80% of its output under contract with foreign buyers during the last three years.

We hand out 120 questionnaires and received back 102 questionnaires finally. In terms of the questionnaire survey, 91 questionnaires are found to be qualified and compose the sample of quantitative analysis and further empirical research. The available rate is 70%. Base on 91 available questionnaires, we compose a sample of statistics analysis. All the firms under the sample can be divided into two groups, one group is pure outsourcing supplier(100% output under contract with foreign buyers),the other group is manufacture ,whose production for both foreign buyers and self brand production. While for the later group, the concerning firms produce own brand probably for domestic buyers(domestic market).

The questionnaire with the topic“ OEM manufacturing and upgrading of firm” covering three aspects, and they are:1) the nature of international production 2); value chain governance type; 3) upgrading performance and technology effort.

In terms of the quantitative analysis using SPSS software, we find the data collected from questionnaire is primarily reliable. In terms of statistics result, the Cronbach's Alpha of questionnaire data is 0.561(N=9), therefore, the inner reliability of the data can be regarded as acceptable.

Apart from information of sample firms. The question on the topic of technology spillover effect is presented as “score model” using 5 point Likert scale.

Table 3 Measure of Variables

Main Variable	Items of measurement	Way of Measure	Source of Measurement
Outsourcing Supplier’s Capacity of Outsourcing operation	4	Likert Scale	Interview
Outsourcing Supplier’s Upgrading Performance	4	Likert Scale	Interview
Technology spillover effect			
Demonstration effort	3	Likert Scale	Literature survey and interview
Diffusion effect based on personal mobility	3		
R&D spillover effect	3		
Agglomeration Effect	2		

4.2 Factor Analysis and Explanations

After the data processing on questions answers, we use *SPSS 13.0 for windows* software to conduct 1 reliability analysis for the whole data. And the output of software is as follows:

Table 4 KMO and Bartlett’s Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.517
Bartlett's Test of Sphericity Sig.	0.000

In terms of the results t, value of KMO is 0.517, and it is high than 0.5, and the

significance of Bartlett's test of sphericity present as 0.000, and is smaller than 0.005, therefore, the how it means that they are proper to be make factor analysis.

For all the In term of the data under questionnaires describing technology spillover effect , We choose 11 items presenting technology spillover make factor analysis. And those 11 variables compose the initial variables under factor analysis using principle component analysis, We use include principle component analysis to find the variables which explain technology spillover effect and extract factors using rotation with varimax. Based on the results from the above analysis results. The initial eigenvalues and its cumulative eigenvalue are reported in the table. From the table, we find 4 factors with eigenvalue bigger than 1.0, therefore we choose those four factors to explain the 4 factors explain 63.699% of variance.

Table 5 Eigenvalues of Factors and its Variance Explained

Factors	Initial Eigenvalues	% of Variance	Cumulative %
F1:	2.877	26.154	26.154
F2:	1.595	14.502	40.656
F3:	1.355	12.317	52.973
F4:	1.180	10.726	63.699

In terms factor loading under rotated component matrix, we finally keep 9 items with factor loading more than 0.5 under 4 factors, which are significant for component analysis to present high reliability of those 4 factors. Table is the concerning rotated component matrix.

Table 6 Rotated Component Matrix (a)

Variables		Factors			
	Content	F1	F2	F3	F4
Q1	Outsourcing buyers stipulate Product Quality Standard and Procedure Management Requirements	0.825			
Q2	Outsourcing suppliers make Purchase on Equipment or Production line recommended by Outsourcer	0.786			
Q3	: Technology Instruction from outsourcer on Quality Management and Product Delivery		0.857		
Q4	: Instruction from Outsourcing buyers on Cost and Procedure Management within outsourcing suppliers		0.795		
Q5	: Outsourcing buyers arrange expert to residence at outsourcing suppliers to give faculty training		0.512		
Q6	: Outsourcing suppliers imitate new product design and pursue innovation after adjustments			0.720	
Q7	: Outsourcing suppliers carry outs R&D work by themselves			0.633	
Q8	: Outsourcing suppliers cooperate with professional design company to push product innovation			0.741	
Q9	Outsourcing suppliers focus on operation and brand establishment and outsource manufacturing to other company within cluster				0.832

(a) Rotation converged in 9 iterations.

Note: Only the variable with the factor loading more than 0.5 are reported in the table.

In terms of the result under the table, we can conclude common feather of the two variables of the first factor and name it as “Technology Demonstration effect”, while , three variables under the second factor can be named as “Technology Diffusion based on Personal Mobility” in terms of their common nature, and also three variables under third factor have common nature and can be named as “R&D spillover effect”, for the fourth factor, only one variable is significant and name as “ agglomeration effect”. Those four sub-effect of technology spillover effect also describe the micro-level approaches of technology spillover for outsourcing. So we get four effect to describe technology spillover effect and they are:

- 1). Technology demonstration effect
- 2). Technology diffusion effect based on personal mobility

- 3). R&D spillover effect
- 4.) Agglomeration effect

4.3 Correlations between outsourcing capacity and business upgrading

In order to find the determinant of upgrading for outsourcing suppliers, we compose correlation analysis between outsourcing capacity and outsourcing supplier’s upgrading. We test the correlation between outsourcing capacity and upgrading performance by two steps”.

First step: Test correlations between outsourcing capacity and upgrading.

Considering diversified presentation of outsourcing capacity and upgrading of analysis, we include several independent and dependent variables to describing different aspects of two variables. For independent variable describing outsourcing capacity, we divide this variable into three variables, they are product quality control capacity, product design capacity and manufacturing management capacity. Y, as dependent variable describing upgrading performance of outsourcing suppliers, we have three, which are management process upgrading

- X1: Product quality capacity
- X2 : Product Design capacity
- X3: Manufacturing management capacity
- Y1: Management process upgrading
- Y2: Product design upgrading
- Y3: International market networking upgrading

We make an analysis between X and Y using Pearson Correlation approach and the result of their correlation are reported in the table.

Table7 Correlation between outsourcing capacity and

Correlation 1 (x1 and Y):			
	Y1	Y2	Y3

Pearson Correlation	-0.003	0.086	0.293(**)
Sig. (2-tailed)	0.981	0.418	0.005
N	91	91	91
Correlation 2 (x2 and Y)			
Pearson Correlation	0.139	0.361(**)	0.089
Sig. (2-tailed)	0.189	0.000	0.400
N	91	91	91
Correlation 3(x3 and Y)			
Pearson Correlation	0.184	0.225(*)	0.260(*)
Sig. (2-tailed)	0.081	0.032	0.013
N	91	91	91

Note: * Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

From the result of the table, we can see that the correlation between X and Y is positive, but coefficient failed to show their significant, therefore, there is no significant correlation between X and Y.

Second Step: Test correlation between outsourcing capacity and four factors of technology spillover born from principle component analysis. The coefficients under correlation analysis show that the correlation is very weak, which fail to present correlation between outsourcing and four sub effect of technology spillover effects.

Table 8 Correlation between outsourcing capacity variable and fours sub-effect of technology spillover effect

		F1	F2	F3	F4
X1	Pearson Correlation	0.198	-0.019	0.064	0.153
	Sig. (2-tailed)	0.060	0.856	0.544	0.147
	N	91	91	91	91
X2	Pearson Correlation	0.076	0.264(*)	0.135	0.069
	Sig. (2-tailed)	0.475	0.012	0.201	0.519
	N	91	91	91	91
X3	Pearson Correlation	0.013	0.124	0.233(*)	0.150
	Sig. (2-tailed)	0.900	0.242	0.026	0.156
	N	91	91	91	91

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

From the table, we can see that the coefficients under most items are not significant, which means that the correlation between X and F1(and F2,F3,F4)is very weak. Therefore, outsourcing capacity and four sub effect under technology spillover effect do not have significant correlation from statistics perspective.

5. Explanation on correlation analysis result

The correlation analysis above mentioned shows that there is no significant correlation between outsourcing capacity and business upgrading under this statistics methodology. Due to the complicated reason including the nature of sample and the methodology, we cannot deny the correlation between those two variables. Take into account other factors that influence outsourcing performance from questionnaires, we make further description on the issue and compose other evidence of technology spillover effect to outsourcing suppliers.

Considering the theoretical relationship between value chain governance and value chain upgrading, we introduce analysis on value chain nature and value chain governance and make a description on the impact of current value chain governance nature to the upgrading performance.

5.1 The explanation on impact from value chain governance to the nature and likelihood of technology spillover effect

5.1.1 Nature of value chain in Ningbo garment cluster

In order to describe value chain governance type , the nature of garment industry value chain need to be demonstrate at first. Due to the highly export orientation of Ningbo garment industry, industry value chain present the feature of international value chain. In terms of second hand information on Ningbo garment industry and the result from face-to-face interview in the field work, we highlight the international value chain as follows:

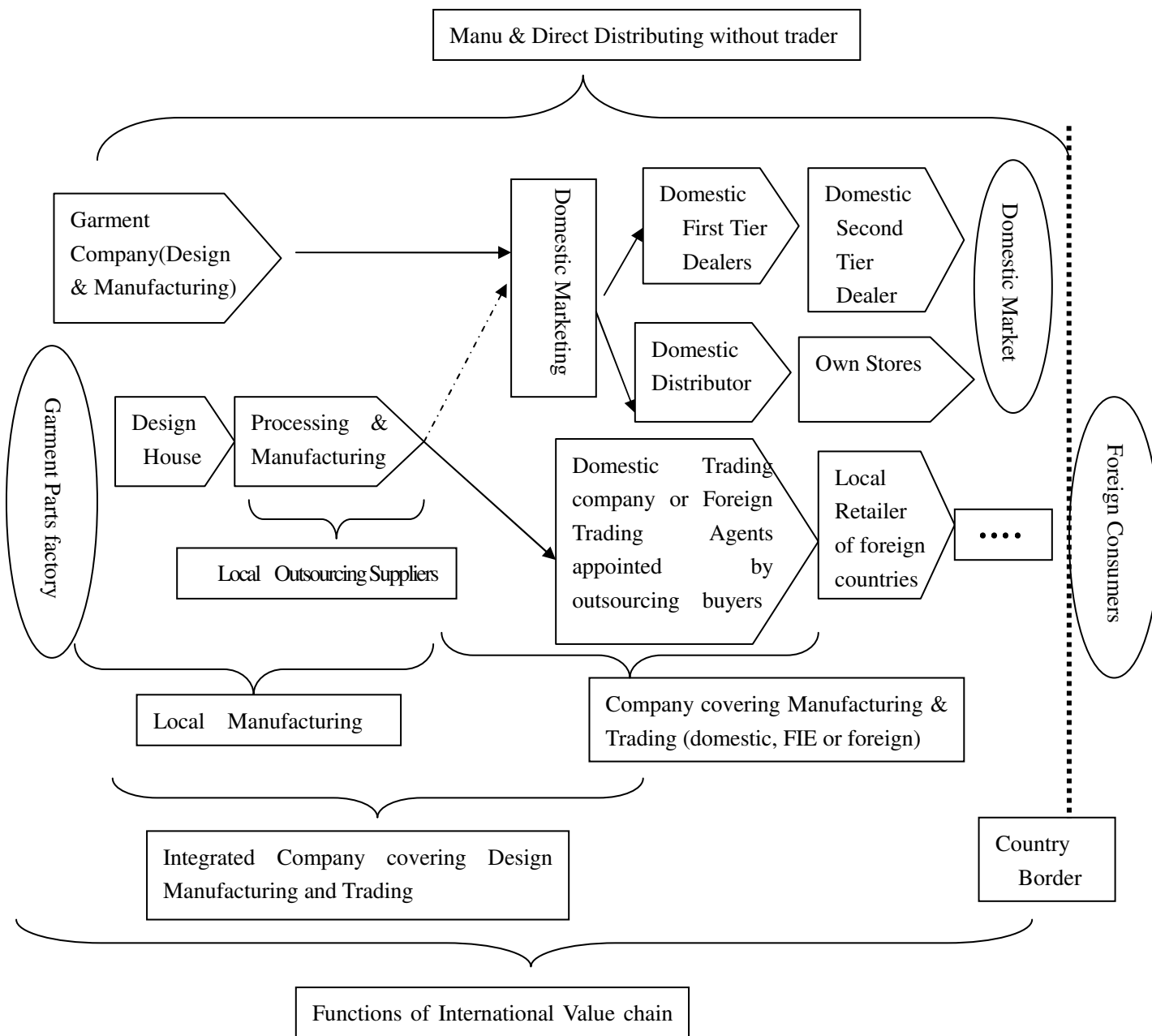


Chart1: Value chain under international outsourcing

Source: Processed from interview with Typical firms from sample

5.1.2 Function link under Value chain at Ningbo garment cluster

With garment industry value chain, we find four main link, and they are “design”, “manufacturing”, “Trading” and “distribution in international market”.

Under the concerning activities under those four links, we find one “end of local factory and the other “end” of consumers at foreign markets. Therefore, we conclude value chain function corresponding to every link into several “function group”, which present the width of value chain, which means how wide company’s business cover under garment manufacturing value chain. Here four kinds of value chain width are highlighted and they are :1) Pure manufacturing in terms of OEM contact 2.) Apparel Design and Manufacturing; 3). Apparel manufacturing and trading on export business 4). Full value chain function covering apparel design, manufacturing and export business.

We highlight the function of sample firms into four types of “function width” in terms of their business operation nature. Those four and they are manufacturing, design,. trading and brand promotion. From the table, the cluster is highly specialized cluster, and outsourcing suppliers have only one function account for 63%, and firms specialized in garment manufacturing account for 76%, while firms have two function(dual-function) account for 26%, and most prevailing function combination is manufacturing & design (70% among the firms with two functions) .The firms with three kinds of function account for 7%, and the combination nature of three functions include design, manufacturing and trading, or design, manufacturing and branding operation. In a word, most local outsourcing suppliers have advantage in a specific “business field” at value chain and present highly professional technique and experience for business operation.

Table 9 Firms business covered by value chain as “Width” of function link

Function of value chain covered	Percentage of sample firms
Single function	63%
Two functions	26%
Three functions	7 %
Four function	1 %

Source: Enterprise Interview

As a typical buyer-driven value chain, garment industry present as an unbalanced situation between manufacturing firms and buyers. Buyers at final consumer market are likely have strong bargaining power over outsourcing suppliers because the resource of distribution networking and branding are critical for marketing competitiveness and enjoy high profit. In terms of interview, we find the majority of sample firms have little information on the whole distribution network of their product abroad. Normally, the firms are familiar with local distribution network including local trading company, while have no idea of trading company and distributor abroad. Generally, the information of distributor and final retailers can not be reached by local firm, therefore local firms cannot contact with distributor and retailers abroad. This situation is assumed to have impact to outsourcing suppliers. Under this situation, local suppliers rely on foreign buyers in export-oriented development. The source of international trading network is at critical position in the whole value chain, so outsourcing buyers have strong bargaining power with local suppliers. Moreover, huge local manufacturing capacity lead to fierce market competition within local garment industry, which intensify the unbalanced situation between outsourcing manufacturing suppliers and trading company. Therefore, outsourcing suppliers in Ningbo cluster suffer from very weak price decision power under outsourcing contract. We can see that value added earned by local suppliers are very small, which compose the obstacle for local firms to “clime up” via value chain.

Table 10 Width of Value Chain Function of Sample firms

Function “covering” under value chain	Main Content
Parts(accessories) and apparel manufacturing	Professional manufacturing under outsourcing contract in terms of drawings
Both Manufacturing and Design	Make design work by themselves and

work	corresponding manufacturing activities (as ODM contract) or Apparel design and
Export agents (or dealers)	Export Trading company cooperated with foreign distributors
Design work, apparel manufacturing and trading agents	“Integrated” company on manufacturing and trading
Operating on branding capacity building	Strategy focus on distribution networking and branding building using wide outsourcing strategy

Source: interview with Ningbo local outsourcing suppliers, 2009, September & October.

5.1.3 Value chain governance type

Due to the fact that garment industry is a typical industry with buyer-driven value chain. And the distribution network play key role in value added extend of the whole value chain. In terms of the literature survey and enterprises interview, we investigate the relation between manufacturing suppliers and distributing companies(dealers) , in terms of the nature of the relations between upstream link and downstream link at value chain of Ningbo garment cluster and compose four kinds of value chain governance type as followed.

In terms of paradigm on value chain governance, we find it exist four value chain governance types in Ningbo garment cluster. And they are quasi-hierarchy (buyers have a high degree of control over suppliers); network governance (Hierarchy-more); network governance(Market-more) and market governance.

Table 11 Type of value chain governance and their percentage

Type of value chain governance	Percentage at the sample
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Hierarchy governance (buyers take direct ownership of some operations).	19%
Network governance (Hierarchy-more)	56%
Network governance(Market-more)	13%
Market governance	12%

Source: data from questionnaires and processed

From the nature of value chain governance, we find that the network governance (hierarchy-more) account for the majority of the sample. In terms of the value chain governance type paradigm, product and process upgrading is more likely to happen compared with function upgrading under this value chain governance. Therefore, local suppliers are difficult to upgrade themselves to the function of “distribution”, especially in target market in developed countries. In terms the interview, we observe that outsourcing buyers present high concentration degree and have strong market advantage, which give high pricing pressure to outsourcing suppliers. And due to the very stable and secure “structure” of distribution network abroad, it is very difficult for outsourcing supplier to “jump over” the current trading agent and contact with distributor company in targeting market. Under those situation, Ningbo local suppliers face up “invisible obstacle” to further its business with the accession into world market and pursue high value added operation. From the data, we can see Ningbo local supplies suffer from low profit rate and have little capital to do R&D input.

5.2 Description on impact from outsourcing to firm’s business capacity

In terms of the analysis on value chain upgrading, we find the local firm have less likelihood to pursue upgrading on high end function link. In terms of the summery of the questions concerning with the impact of outsourcing, we can find the priority of outsourcing suppliers under their current strategy, which correspond to the statistics analysis result above mentioned.

- **Direct impact from outsourcing to outsourcing suppliers**

Based on the data from questionnaire, we can find the concerning the impact of outsourcing activity on outsourcing capacity of outsourcing supplier, which can be regarded as an evidence of the weak correlation between outsourcing capacity and upgrading. In the paper, four items are composed and evaluated how importance of every item compared with the other three ones using liker 5 point scale. Via the data according to average score under every item, we rank the order from most important to least important item as follows:

Increase product quality > enhance advanced management technique > acquire international distribution network> help to renew current equipment > increase design and R&D capacity > help to accessing international market reputation.

Therefore, increase products quality become the most important benefit for outsourcing suppliers, and this finding is totally same as the result from out interviews with typical outsourcing suppliers. In the real world, high and stable product quality is a key component in outsourcing contract, which is the most important determinant for furthering outsourcing cooperation relation between outsourcing buyers and suppliers. Therefore, local outsourcing suppliers focus on product quality under enterprise operation strategy and have limited interest in upgrading product and keeping on high product quality is the biggest positive impact to outsourcing suppliers, which is the key determinants for continuing long term cooperation between outsourcing suppliers and outsourcing buyers. Under this context, local suppliers have limited incentive and limited capital to push their innovation activities, and face up huge challenge to have function upgrading along with value chain to high value added “end”.

● **Indirect impact from outsourcing on outsourcing suppliers:**

Apart from the Concerning “ what do you learned from outsourcing business” ,the answer on “ value chain function upgrading is also diversified. Most firms think answer that hey have learned something positive, which do help to the access of value chain function upgrading. The detail result is 29.4% firms choose “ acquire new production technique and design idea”, 27.4% firms choose “strengthen current manufacturing management and delivery indication”, 17.1% firm choose “ have

opportunity to access in international distribution network”, and 14.2% firms choose “ increase reputation of own brand in market”.

According to the results mentioned above, we find the nature of the impact present more on manufacturing, which still aim at keeping current outsourcing contract. Referring the paradigm of value chain upgrading we include the items mentioned above as upgrading on product manufacturing link, upgrading on distribution networking link, upgrading on branding link. The background of this result is local firm do pursue product and process upgrading, which can help firms to decrease cost and further the close relations with outsourcing buyers.

Here the choice technology impact from outsourcing buyers is summarized in terms of the value chain governance type , the table of the result is as follows:

Table 12 The important of different way under linkage

	Technology Demonstration			Technology Diffusion based on personal mobility		
	Production Quality Standard	Supervision by inspection and examination	Renewing Equipment	On-Spot instruction by Buyers	Inner-man agement Model suggestion	Training on suppliers' Faculty
Quasi-hierarchy governance	3.9	3.1	2.6	2.4	2.2	2.2
Network governance (Hierarchy-more)	4.3	3.6	2.7	2.8	2.4	2.4
Network governance(Market-	3.1	2.7	1.7	2.2	2.0	2.1

more)						
Market governance	3.6	2.7	1.3	1.2	1.3	1.7

Source : data from questionnaires and processed

Note: the score of the table stand for the extend of “how important of every item”, and 1 stand for least important and 5 stand for highest important.

From the data reported in the table, we can find that firm choose “ quality standard” as the most important approach of acquiring technology in average level, which means that local suppliers focus on manufacturing link itself during the outsourcing process, which do have enough emphasis on further technology learning based on personal communication with outsourcing buyers. Therefore, local suppliers have little likelihood to gain value chain upgrading to high end of value chain.

5.3 R&D performance: focus on imitation innovation

Apart from the performance of upgrading likelihood from the questions on the impact from outsourcing buyers, we can also make a survey on R&D performance, which is also a evidence to demonstrate the upgrading nature of outsourcing suppliers. Concerning the nature of R&D activities for local outsourcing suppliers, it is difficult to distinguish specific “R&D” activity in terms of innovative content. Under the context of garment manufacturing and business, new apparel designing, developing new material and new manufacturing technique can be regarded as R&D activities, and the concerning innovation presented as the combination of imitative innovation, self innovation and collaborative innovation.

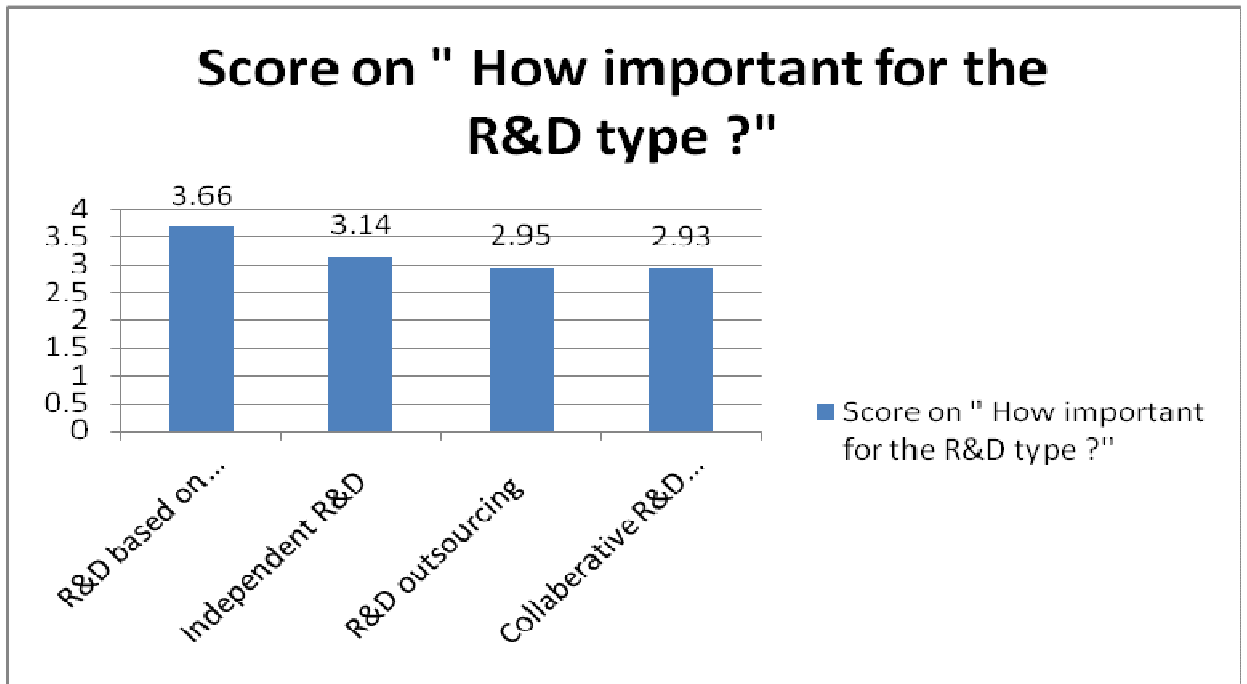
According to the information from interviews with Ningbo outsourcing suppliers, we can outline four types of R&D activities. They are R&D based on imitation and integration, independent R&D, R&D outsourcing Cooperation with companies specialized in innovative work by outsourcing and collaborative R&D. The meaning of those four R&D is as follows(Table)

Table 13 Four type of R&D and their content in terms of interview

Type of R&D	Content
R&D based on imitation and integration	Referring to apparel designs with high market reputation and make modification
Independent R&D	Development new apparel design and new material by own input
R&D outsourcing	Outsource apparel design work to professional design company at target market
Collaborative R&D	Employee famous designer from leading apparel company or explore co-design project with well-known MNC

Those two types of innovation work including R&D outsourcing and collaborative R&D are important channels of “open innovation”, which present the prevailing competition strategy adopted by some leading local outsourcing suppliers. From this perspective, some local firm is experience “frog jumping” from production under OEM to production under ODM, under which outsourcing buyers began to accept design progress from local suppliers and pursue long term cooperation with local suppliers. This is a emerging orientation of value chain upgrading for local outsourcing suppliers, while it is still happened for a very small part of sample firms.

Chart 2 Four types of R&D activities and their importance rank



Source: Interview

From the highest score to lowest score, the type of R&D rank by importance as

1. R&D based on imitation and integration
- 2,. Independent R&D
3. R&D outsourcing
4. Collaborative R&D with MNC that have high market reputation

Table 14 R&D performance under four types of value chain governance

	R&D based on own effort	R&D based on imitation and integration	R&D outsourcing	Collaborative R&D
Hierarchy governance (buyers take direct ownership of some operations).	2.9	3.7	2.9	3.2
Network governance (Hierarchy-more)	2.7	3.6	1.6	2.8

Network governance(Market-more)	3.2	3.1	1.7	2.4
Market governance	3.2	3.7	1.8	1.9

Source: enterprises governance

Note: 1 stand for least important ; 5 stand for most important

From the table, we find that firm under four kinds of value chain governance pay relative high importance attitude on R&D based on imitation and integration. The likelihood of independent R&D is the second position. While due to the fact the firms under network governance (hierarchy-more) account for the majority of sample firm, the nature of four R&D type present the main feature of sample, ie , imitation and integration on product design is the prevailing way for local firms to operate R&D. Under those circumstance, local firms have less opportunity to upgrade themselves from current business mode.