IMPACT OF INDUSTRIAL CLUSTER DEVELOPMENT ON TECHNOLOGICAL CAPABILITIES IN INDONESIA MANUFACTURING SECTOR

by Abdusy Syakur Amin -

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Foreword

Following the successes of the first International Seminar on Industrial Engineering and Management (ISIEM 2007), we are glad to organize the second event (ISIEM 2008). The theme raise to this year is supply chain management. Supply chain management is a cross-functional approach to managing the movement of raw materials into an organization, certain aspects of the internal processing of materials into finished goods, and then the movement of finished goods out of the organization toward the end-consumer. Supply chain management become more important as the competition in the global market and networked economy more intense and open. Organizations increasingly find that they must rely on effective supply chains, or networks, to successfully compete in the market. At the other hand, as organizations strive to focus on core competencies and becoming more flexible, they have reduced their ownership of raw materials sources and distribution channels. These functions are increasingly being outsourced to other entities that can perform the activities better or more cost effectively. The effect is to increase the number of organizations involved in satisfying customer demand, while reducing management control of daily logistics operations. Less control and more supply chain partners led to the creation of supply chain management concepts.

We accepted abstracts about 60 titles from Indonesia and abroad. Abstracts were reviewed by peer reviewers, and finally we published 40 titles.

We want to thank all those individuals or group who submitted papers for review and those whose papers were chosen for presentation at the seminar and those who submitted manuscripts to be published in this proceeding. We'd like also thanks reviewers specially, for their commitment, effort and dedication in undertaking the task of reviewing all the abstract that were submitted. Without their help and dedication, it would not be possible to proceeding in such a short time frame. We highly appreciate all members of committee director, steering committee and organizing committee for mutual efforts and invaluable contributions for the success of the seminar. Last but not the least, our greatest gratitude to Gunadarma University, Trisakti University, and Indonusa Esa Unggul University rectors, for their support and contribution for this seminar.

It is always a pleasure to host our colleagues from regional industrial engineering community to build networks and links that are essential parts for the development of industrial engineering in the future. For this reason, we plan to host this seminar every year with varies theme in industrial engineering and management. In the blessing of Lord, we expect your continually contribution for the coming year.

Rina Fitriana, ST., MT.
Seminar Chairwoman

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QUALITY MANAGEMENT

IMPACT OF INDUSTRIAL CLUSTER DEVELOPMENT ON TECHNOLOGICAL CAPABILITIES IN INDONESIA MANUFACTURING SECTOR

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ABSTRACT

Industrial cluster has been recognized a path for industrial development in some emerging countries. Indonesia as a late comer industrial country has also tried to follow the path. Manufacture sector especially automotive sector has been treated as an industrial cluster due to the nature of industries which mostly are located around Jakarta. The cluster has been enjoying rapid annual export growth after the economic crisis at the end of 90s. One of the efforts which really required for sustaining the export growth is improving the technological capability of the firms. Technological capability of the firms could not only provide better current production activities, but also shown the potential capability of the firm to improve their operation activities, human resources development activities and also research activities to become a technology frontier firms. The research intends to explain the nature of Indonesian manufacturing sector especially from the systemic quad industrial cluster development and the impact of those developments on the technological capability of the firms. The research also proposes to examine the nature for all firms also for foreign and local firms respectively as well as to examine the spill over effect of the foreign firm to local firms. The paper results show that foreign firms have superior network cohesion and global networking also enjoy superior economic performance compare to local firms namely export incidence and export percentage. Export percentage of Indonesian Automotive Cluster influenced by high tech infrastructure, global networking and technological capabilities.The technological capabilities of local firms are affected by global networking and Network Cohesion. This condition expresses that local firm have working hard to reach higher technological capabilities by using available resources.But for foreign firms, only network cohesion which has significant impact on its technological capabilities.

Key word : Systemic Quad Cluster Development, Technological capabilities, Economic performance

1. INTRODUCTION

Transition economies offered some incentives for foreign company to invest in the countries such as tax reduction, easy land ownership, investment procedure etc. and domestic market access, cheap labour. They are expecting FDI inflows bring much needed capital, new machines, new technologies and sciences, marketing techniques and management skills. All those potential benefits of FDI are expected increasing the productivity and competitiveness of the domestic industry. It is often expected that technology transfer resulting from FDI will go beyond actual projects undertaken by foreign investors, and through knowledge spill over will benefit local firms.

Yet, there is no clear evidence whether the foreign investment can improve the productivity and competitiveness of that positive by conducting transfer technology to domestic firm only taking the benefit from government's incentives.

Indonesian automotive industries has been enjoying FDI inflows since the beginning 70s, when the Ministry of Industry and the Ministry of Trade launched the decree to introduce the important of vehicles,

both completely built up (CBU) and Completely Knock Down. Since the late 90s, the industries has been enjoying rapid growth of export. Most of the automotive are located in Jakarta area and they have strong relationship with each other, those firms can be recognized as an industrial cluster namely Jakarta Automotive Cluster.

Several studies concerning industrial cluster have been conducted in Indonesia. Most of the studies investigated the direct impact of the industrial cluster development in rural area. For example, Smyth (1992), Weijland (1999) and Sandee (2002) have examined positive effect of industrial cluster development in Indonesia, especially in the rural area. But only few studies on industrial development focused on what Alterburg and Meyer-Stamer (1999) called as clusters of transnational corporations such as automotive sector and electronic sector. For examples, Aswicahyono (2000) described the future challenge that would be overcome by Indonesian Manufacture. Rajah (2007) described that the weaknesses in the high-tech infrastructure in electronics cluster in Java-Batam reduced both foreign and local firm's capacity to undertake research and development activities in the region.

In order to maintain its rapid export growth, the firm must sustain the ability of the firm to compete in global market. Technically, the firm must be able to sustain its advancement. Firm level technological capabilities considered as an important factor influenced above condition. Technological capabilities are the information and skills-technical, managerial and institutional –that allow productive enterprises to utilize equipment and technology efficiently. While there is some constant such as capabilities are in general sector and firms specific, a form of institutional knowledge that consists of the combined skills accumulated by its member over time. Technological development is the process of building such capabilities.

Technological capabilities compromise a much broader range effort that every enterprise must itself undertake in order to absorb and build upon the knowledge that has to be utilized in production. Technological capability is more, however, than the simple sum of the education and training of a firm's employee. It includes the learning undergone by individuals in the course of working in the enterprise and the way in which the firms combines and motivates individuals to function as an organization. To some extent any enterprises that tries to use a new technology acquires some capabilities as an automatic result of production process.

Ernst, D., Ganiatsos, T. & Mytelka, L. (1998) has observed the correlation between Technological Capabilities and Export Success in some various countries in East Asia. Figueiredo (2002) concluded that learning processes features affected the technological capability accumulation in firm-level. Rasiah, R. (2004) has found the impact of technological capabilities on the economic performance in various countries in Africa, Asia and Latin America.

2. THEORETICAL BACKGROUND

2.1. Industrial Cluster

Industrial clusters, which Porter (2000:254) defines as "a geographically proximate group of inter-connected companies and associated institutions in a particular field, linked by commonalities and complementarities", have long attracted the attention of researchers and policy makers for the growth prospects they offer small and medium sized enterprises (SMEs).

Industrial clusters can make a potentially important contribution to development of industry. They can promote sustainable employment and incomes and thus better the situation for the working and also they enhance the ability of small firms to compete in global markets. Industrial cluster development has been developed by Porter namely Porter's Diamond. The essence of Porter's (1990) model of competitive advantage is the diamond, viz., one, factor conditions; two, firm strategy, structure and rivalry; three, demand conditions; and four, related and supporting industries. National competitive advantage is achieved when particular industries meet the four ingredients above. Because critical technologies (core competence) drive Porter's competitive clusters, specialization in particular goods and services are the drivers.

In contrast, Best (2002) provided different industrial cluster development model. Best provided idea three factors which drive the Industrial growth from the capabilities and innovation perspective, namely business model, production capability and skills formation. In addition Best argued that techno-diversity was a crucial element of dynamic cluster as it impulse the creation of new technology and new firms on one side, and differentiation and division of the labour on the other side.

Best includes the capacity of a network and institution to drive differentiation and division of labour and new firm creation in his cluster's definition which leads to the amplification of network cohesion. As Best focuses on horizontal integration and reintegration, all firms in cluster must participate innovation. He emphasized the differentiation and division of labour and creation of new firms as central for the long term growth of the clusters.

Best connected the concept of geographic cluster and emphasized the necessity of knowledge flow and its diffusion among the economic agent in the clusters.

Piore and Sabel (1984) and Rasiah (1999, 2002, 2004) emphasized the significant of the presence of intermediary organizations which coordinated through the operation of the markets, government and trust loyalty. It could strengthened interdependence relationship between economic agents to resolve collective problem and coordinate effectively the allocation and performance of public and private goods provider. Hence, in the cluster, the synergy between buyer and seller offer better result rather than simple interaction between buyer and seller only.

Clusters in this paper is defined as a regionally networked set of economic agents (firms and institutions) that refer to localized systems connecting all critical economic agents necessary to drive learning, innovation and competitiveness. Clusters here are considered to produce the most synergies when all requisite institutions to drive learning, innovation and competitiveness and economic agents are horizontally connected (interdependent interface is important). Clusters can generate an egalitarian network if all participants are effectively networked so that all views are equally embodied in policy formulations. Governments in developing economies tend to accept the former because of the interest on growth not realizing that the effective pursuance of the latter is pertinent for balanced development.

Frontier clusters (high tech clusters in Porter's notion and any dynamic cluster in Best's definition) are characterized by innovation. The focal point of innovation in a dynamic cluster is essentially the interdependent and interactive flow of knowledge and information among people, enterprises and institutions. It must obviously include coordination between the critical economic and technological agents across value chains who are needed in order to turn an idea into a process, product or service on the market.

Lall (2001) was to assert that economies that failed to develop their technological capabilities become losers in globalization process. Central to the failure of EPZs and industrial estates in developing economies has been the lack of development of an effective enabling environment for technological upgrading, differentiation and division of labour, and new firm and industry creation. Figure 2.1 identifies the critical pillars that drive dynamic clustering.

A strong role by governments is the first central pillar of a dynamic cluster to provide stability (macroeconomic, political and security) and efficient basic infrastructure.

The second is vital for the continuous evolution of technological capabilities in the cluster. It is the environment where the institutions coordinating learning and innovation evolve effectively to stimulate technology acquisition through learning by doing, licensing, adaptation, training, standards appraisal mechanisms, a strong intellectual property right framework to prevent moral hazard problems facing innovators and research and development...

The third requires that the cluster be globally connected - markets and value chains. Global markets provide the economies of scale and scope and the competitive pressure to innovate. Global value chains assist economic agents in the cluster to orientate their strategies to the

critical dynamics that determine upgrading and value addition (see Gerrefi 2002; Gerrefi, Humphrey and Sturgeon 2005). Examples of such changes include the introduction of cutting edge just in time and flexible specialization techniques in electronics, and the proliferation of software technology in the use of cad-cam machines and the interface between firm's assembly activities and the major markets abroad. In Indonesia for example, Texmaco which is located in an EPZ in the outskirts of Jakarta responded to the changing nature of global value chains in the garment industry by integration assembly, fashion design, packaging and logistics to supply brand-name holders. Lacking in institutional support - both basic and high tech infrastructure - Texmaco has managed to compete globally despite facing tremendous transactions costs in Indonesia.

Lundvall (1988) expanded the elements of interdependence and interactiveness by articulating the role of producer-user relations in innovation. The nature of interface and coordination between vertically connected economic agents is vital in the horizontal evolution of innovation activities. Connectivity and coordination is critical for knowledge flows - beyond simply codified information that markets can coordinate. Intermediary organizations such as industry-government coordination councils and chambers of commerce play an important role to increase connectivity and coordination in dynamic clusters.

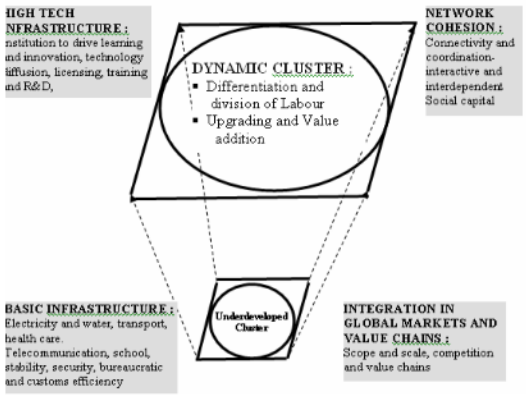

Figure 1. The Quad System Pillars for Industrial Cluster Development

2.2. Technological capabilities at the firm level

Technology has been described as the systematic application of specific and other organized knowledge to practical task. Technological capabilities are the information and skills-technical, managerial and institutional –that allow productive enterprises to utilize equipment and technology efficiently. While there is some constant such as capabilities are in general sector and firms specific, a form of institutional knowledge that consists of the combined skills accumulated by its member over time. Technological development is the process of building such capabilities.

Technological capability is more, however, than the simple sum of the education and training of a firm's employee. It includes the learning undergone by individuals in the course of working in the enterprise and the way in which the firms combines and motivates individuals to function as an organization. The skill are easy learned on the job, and there are few linkages with supplier that involve technical problem and complex exchange of information. Product design are provided by foreign suppliers of kits for assembly, or are easy adapted to local tastes in garment.

Lall (1987, 1992) developed a framework that more clearly distinguished between function and levels of capability. He did so in two steps. First, in his 1987 book on Learning to Industrialize: The acquisition of technological capability by India, he took a significant step forward in emphasizing the importance of distinguishing capabilities in particular technological function such as process engineering, product engineering and project execution. He then also elaborated a set of differences in capabilities within each of these kinds of function

- First, He retained the functional categories as the main columns in his framework though he slightly re-arranged the six categories.
- Second, he identified 'levels' capability much more clearly as the main dimension of difference reflected in the row cutting across these functions. The rows were explicitly ordered in term of a degree of complexity.

3. RESEARCH METHOD

The research approach in this study will be primarily based on empirical data. The primary data will be collected through a structured questionnaire survey of automotive firm in Indonesia. The survey was conducted in Jakarta cluster which encompassed Jakarta, Bekasi, Karawang and Purwakarta. 93 firms have responded for the survey, submitting the fulfilled structured questionnaire which was designed to explore deeply the nature of the firms in the cluster.

The research applies the quad system cluster development approach to explore the nature of Jakarta automotive clusters. Rajah (2004, 2007) has applied this approach to explain the nature of Electronics Industries in Penang, Johor Bahru, and Batam. In addition, the research uses a methodology that measures technological capabilities assigning indexes normalized from related proxies. The use of indexes in examining the technological capability of firms can be traced to Lall (1992), Bell and Pavitt (1995), Westphal *et al.* (19 90), Wignaraja (2002) and Rasiah (2004, 2007).

3.1 Specification of variables

The variables which are used in this paper can be shown in Table 1. The table also contains the components of variables, method of variables measurement and source of data. For example, first pillar of systemic quad namely basic infrastructure was measured by averaging the respond of the firm concerning the quality, availability and delivery of transportation facilities, power, water, health service, basic government service, access to capital, primary school and training institution. More detail can bee seen in table 1.

From preliminary calculation, the research no strong correlation between export percentage and export incidence with productivity and log productivity. Therefore the research applied those indicators namely export percentage, export incidence and log productivity as economic performance indicators of Indonesia automotive sector. More detailed concerning variables used for the research can be found as follows.

Table 1. Variables, proxies, Acronym, and measure

Variables and proxies	Acronym	Measures
Export Percentage	X	Export/Total Sales
Export Incidence	EI	Export > 0 ➔1
Basic Infrastructure	BI	1/9[$TRANS_i$, $POWER_i$, $WATER_i$, $TELCOMM_i$, $HEALTH_i$, $BASICGOV_i$, $CAPTLACCES_i$, $PRIMARYSCHO_i$, $TRAININST_i$]
High Technology Infrastructure	HTI	1/9[$UNIVEDU_i$ $RDSCIENT_i$, $RDINCENT_i$, $RDGRANT_i$, $RDINST_i$, $TESTFAC_i$,IPR_i, ICT_i,$VENCAP_i$].
Network Cohesion	NC	1/11 [$RDREL_i$, $FINANREL_i$, $DISTREL_i$, $SUPPLREL_i$, $CUSTREL_i$, $TECHREL_i$, $BUSSREL_i$, $ASSOCREL_i$,$ALLIANREL_i$, $LABORGREL_i$,$ENVORGREL_i$]
Global Networking	GN	¼ *{$ALLIACT_i$, $JITINV_i$, $MRKTRES_i$, $OVSEAPROM_i$]
Technological Capabilities	TC	$HR_i + PPT_i + RD_i$.
Human resource capabilities	HR_i	1/3 [TM,TE,CHR]
Process and Product Technology capabilities	PPT_i	½[Proc,Prod]
Research Development capabilities	RD_i.	½[RDexp,RDemp]
Training Mode	TM	
Training Expense	TE	% in payroll
Cutting edge HR practices	CHR	
Process advancement	PROC	
Product advancement	PRODC	
Foreign Ownership	OWN	

Basic infrastructure. BI was calculated using the formula:

BI_i=1/9[$TRANS_i$, $POWER_i$, $WATER_i$, $TELCOMM_i$, $HEALTH_i$, $BASICGOV_i$, $CAPTLACCES_i$,$PRIMARYSCHO_i$,$TRAININS T_i$]. (1)

$TRANS_i$,$POWER_i$,$WATER_i$,$TELCOMM_i$,$HEAL TH_i$, $BASICGOV_i$, $CAPTLACCES_i$,

$PRIMARYSCHO_i$ and $TRAININST_i$ refer to the quality transport services, power supply, water supply, telecommunication network, public health facilities, basic government institution, access to capital, primary schools and Technical training institutions. Likert scale scores ranging from 1 to 5 (weak to strong) were used to measure above factors. The proxies were normalized using the following formula :

$$\text{Normalization score} = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}} \quad (2)$$

X_i, X_{min} and X_{max} refer to the ith, minimum and maximum values of the proxy. Caution must be taken when extreme data appear as result of survey. Also, it sould be aware while interpreting the normalized data since that procedure generate the highest observation of each proxy to one, and lowest one to zero.

High Tech Infrastructure. HTI was calculated using the formula:

HTI = 1/9[$UNIVEDU_i$ $RDSCIENT_i$, $RDINCENT_i$, $RDGRANT_i$, $RDINST_i$, $TESTFAC_i$,IPR_i, ICT_i,$VENCAP_i$]. (3)

$UNIVEDU_i$ $RDSCIENT_i$, $RDINCENT_i$, $RDGRANT_i$, $RDINST_i$, $TESTFAC_i$,IPR_i, ICT_i and $VENCAP_i$ refer to the quality of University education, R&D scientists and engineers Incentives for R&D activities R&D grants R&D institutions Testing and quality evaluation facilities IPR governance Quality of ICT services. Likert scale scores ranging from 1 to 5 (weak to strong) were used to measure above factors. The proxies were normalized using the above formula.

Network Cohesion. NC was calculated using the formula:

NC = 1/11 [$RDREL_i$, $FINANREL_i$, $DISTREL_i$, $SUPPLREL_i$, $CUSTREL_i$, $TECHREL_i$, $BUSSREL_i$, $ASSOCREL_i$, $ALLIANREL_i$, $LABORGREL_i$, $ENVORGREL_i$] (4)

$RDREL_i$, $FINANREL_i$, $DISTREL_i$, $SUPPLREL_i$, $CUSTREL_i$, $TECHREL_i$, $BUSSREL_i$, $ASSOCREL_i$, $ALLIANREL_i$, $LABORGREL_i$ and $ENVORGREL_i$ refer to R&D organizations (labs, Universities), financial services institutions (bank,etc), distributors, supplier of materials and components, customer / end user, technical service providers, business service providers, relationship in industry associations, strength of strategic alliances, labour organizations (including unions) and environment organizations (inc. NGOs). Likert scale scores ranging from 1 to 5 (weak to strong) were used to measure above factors. The proxies were normalized using the above formula.

Global Networking. Global Network was expected to show a positive relationship with economic performance. GN was calculated using the formula:

GN = ¼ *{$ALLIACT_i$, $JITINV_i$, $MRKTRES_i$, $OVSEAPROM_i$] (5)

The overall Technological Capabilities (TC) was measured by averaging the variables of HR (technology embodied in humans), PPT (technology embodied in machinery and equipment and intangible processes) and RD (technology development focus embodied in products, processes and humans). TC was measured as:

$$TC = HR_i + PPT_i + RD_i. \quad (6)$$

Human Resource capability. Human Resource (HR) capability was measured as:

HRi = 1/3[TMi, TEi, CHRi] (7)

Process and Product Technology capability. Data on three proxies facilitated the computation of PT, which was calculated using the formula:

PT = 1/3[EMi, ITCi, QCi] (8)

RDi = 1/2[Rdexpi, Rdempi] (9)

OWNi = 1 if foreign equity ownership of the firm i was above 50%,
OWN = 0 otherwise. (10)

3.2. Statistical Model

The following basic model was specified to estimate the statistical determinants of Export intensity (X), Export Incidence (EI) and independent variables, this paper preferred Tobit and Logit regression respectively as some of dependent variable of the model has zero value and also binary value.

$$X = \alpha + \beta_1 BI + \beta_2 HTI + \beta_3 NC + \beta_4 GN + \beta_5 TC + \mu \quad (11)$$

Logit

$$EI = \alpha + \beta_1 BI + \beta_2 HTI + \beta_3 NC + \beta_4 GN + \beta_5 TC + \mu \quad (12):$$

$$TC = \alpha + \beta_1 BI + \beta_2 HTI + \beta_3 NC + \beta_4 GN \quad (13)$$

4. RESULT AND DISCUSSION

At the beginning, this section compares the nature of foreign and local firms. Following by the comparison between foreign and local firms for their economic performance. Thereafter comparison of the quad system pillars of foreign and local firm's pillars then examined. The paper examined the pillars in quad system. Moreover, this paper will examine the influence of quad system pillar and technological capabilities on economic performance. Finally, this paper will examine the impact of quad system pillars on technological capabilities.

4.1. Statistical Differences

Two-tail *t* statistics were used to examine the statistical significance of The Quad system pillars of Indonesian automotive firms and technological capability.

Table 2. Two-tail test of The Quad system pillars, Foreign and local firms, 2006

	All	Foreign	Local	t
Basic Infrastructure	2.36	2.35	2.37	-0.35
High Tech Infrastructure	2.23	2.25	2.18	1.79***
Network Cohesion	3.48	3.56	3.34	5.43*
Global Networking	0.62	0.71	0.48	5.73*
TC	1.07	1.07	1.07	-0.08
N	93	58	35	

Source : Survey Indonesia Automotive firms 2006, computed by SPSS 16

As expected, the superior of the foreign firms are strongly reflected in Network Cohesion and Global Networking. Moreover, the foreign firms also experiencing slight better high tech infrastructure (see table 2). There is no significant superiority of foreign firms in terms of technological capability.

Table3. Two-tail test of economic performance, Foreign and local firms, 2006

	All	Foreign	Local	t
Export percentage	0.1916	.2252	.1360	1.762***
Export incidence	0.8280	0.9828	0.5714	5.931*
N	93	58	35	

Significance level of *1%,**5% and 10%.
Source : Survey Indonesia Automotive firms 2006, computed by SPSS 16

As expected, foreign firms enjoying significant superior economic performance compare to local firms except for export percentage which has only slight better economic performance.

4.2. Statistical Relationship

Table 4 Statistical relationship involving The Quad system pillars, technological capability and economic performance others

	Export percentage			Export incidence		
	All	Foreign	Local	All	Foreign	Local
Constant	-0.730 (-3.854)*	0.109 (0.431)	-1.777 (-5.921)*	-14.274 (-2.12)**	0.676 (5.726)*	-1.018 (-4.147)*
BI	0.156 (1.349)	0.133 (0.948)	0.332 (2.437)**	3.970 (1.4461)	0.012 (-.185)	0.272 (1.654)**
HTI	0.611 (2.574)*	0.241 (0.861)	1.353 (3.91)*	15.537 (1.917)**	0.071 (0.540)	1.933 (4.875)*
NC	0.145 (0.834)	-0.116 (-.514)	0.623 (2.65)*	9.575 (1.556)	-0.034 -(0.3220	0.026 (0.070)
GN	0.381 (2.017)*	-.244 (-.917)	0.756 (2.452)*	5.773 (2.261)**	0.300 (2.367)*	0.680 (2.36)*
TC	0.660 (1.97)**	0.426 (0.954)	1.400 (2.309)**	6.728 (0.873	0.199 (0.937)	1.084 (1.195)
N	93	58	35	93	58	35

Source : Survey Indonesian Automotive firms 2006, computed by Eviews 5.0

This section examinees the statistical relationship involving economic performance and the quad system pillars. All the regression has passed the Whitney test for heteroskedacity, and the model fit (chi-square statistics) was also statistically significant. The result generally does not against the expectation.

Table 5 Statistical relationship involving The Quad system pillars, and technological capability,

	TC (Tobit)		
	All	Foreign	Local
Constant	0.235 (6.100)*	0.172 (2.365)**	0.181 (4.939)*
BI	0.009 (0.280	0.015 (0.342)	-0.008 (-0.254)
HTI	0.069 (1.064)	0.119 (1.430)	0.091 (1.170)
NC	0.112 (2.445)*	0.210 (3.312)*	0.195 (3.090)*
GN	0.092 (1.980)**	0.047 (0.571)	0.212 (4.935)*
N	93	58	35

Significance level of *1%,**5%
Source : Survey Indonesian Automotive firms 2006, computed by SPSS. 16

For all firms, technological capabilities is influenced significantly by network cohesion, followed by global networking. Similarly to local firms, its technological capabilities is affected by network cohesion and global networking. The result from foreign firms has shown expected relationship.

5. CONCLUSION

Foreign firms in Automotive sector Indonesia enjoying significant superiority in various areas such as network cohesion and global networking. Also they present moderate better infrastructure. Those superiorities tend to influence the superiority of foreign firms to the local firms in various economic performance indicators.

The technological capabilities of local firms are affected by global networking and Network Cohesion. This condition expresses that local firm have working hard to reach higher technological capabilities by using available resources. But for foreign firms, only network cohesion which has significant impact on its technological capabilities.

We may conclude that the existence of foreign firms have not been not optimal. However, as they could perform better than local firm, local firms still must learn from foreign firms..

6. REFERENCES

(a) Amsden, A. Tschang, T. & Goto, A. (2001) *Do Foreign Companies Conduct R&D in Developing Countries*, Working Paper No. 14, Asian Development Bank Institute, Tokyo.
(b) Badan Pusat Statistik Indonesia, (2004) "Large and Medium Manufacturing Indicators",2004"
(c) Bell, M. & Pavitt, K. (1995) The development of technological capabilities, in: I.U. Haque (Ed.) *Trade, Technological and International Competitiveness* (Washington, DC, World Bank).
(d) Blomstorm, M & Persson, H. (1983) Foreign Investment and spillover efficiency in an under-develop economy: evidence from Mexican manufacturing industry, World Development, 11, pp. 493-501.
(e) Dalhman, C & Frischtak, C. (1993) National system supporting technical advance in industry: the Brazilian experience, in: R.R.
(f) Dosi, G. (1982) Technological paradigms and technological trajectories, Research Policy, 11, pp. 147-162.
(g) Ernst, D., Ganiatsos, T. & Mytelka, L. (Eds) (1998) *Technological Capabilities and Export Success: Lesson from East Asia* (London, Routledge).
(h) Figueiredo, P.N. (2002) Learning processes features and technological capability accumulation: explaining inter-firm differences, *Technovation*, 22, pp. 607-698.
(i) Figueiredo, P.N. (2003) Learning, capability accumulation and firms differences: evidence from latecomer steel, *Industrial and Corporate Change*, 12, pp. 607-643.

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