THE IMPACT OF THE FOREIGN OWNERSHIP ON THE TECHNOLOGICAL CAPABILITIES IMPROVEMENT (CASE STUDY OF THE INDONESIAN AUTOMOTIVE SECTOR)

by Abdusy Syakur Amin -

Submission date: 30-Jan-2023 07:44PM (UTC+0700)
Submission ID: 2002454281
File name: 4._20091210_The_Impact_of_the_Foreign-ISIEM_2009.pdf (2.57M)
Word count: 5923
Character count: 33029

Vol. 3 Tahun 2009

ISSN : 1978 - 774X

ISIEM

INTERNATIONAL SEMINAR ON INDUSTRIAL ENGINEERING AND MANAGEMENT

December 10 - 11th, 2009, Inna Kuta Beach Hotel
Bali - Indonesia

Theme:

Quality, Competitiveness, and Value-Added Services in Solving Predetermined Global Crisis

Presented by :

Supported by :

ISSN: 1978-774x

FOREWORD

This issue is published in line with the third International Seminar on Industrial Engineering and Management (3rd ISIEM). The articles cover a broad spectrum of topics including Quality Function Deployment, Decision Support System and Artificial Intelligent, Ergonomics, Supply Chain Management, Production System, Operation Research, and Industrial Management. The articles provide an overview of critical research issues reflecting on past achievements and future challenges. Those papers were selected from 165 abstracts. This statistics shows the high competition to get published on this proceeding.

This issue and seminar become special as more delegates come and join from various country as well as universities. We host 86 delegates both from abroad and local. We are very happy as we gather more than thrice delegates this year compare to previous year. This could be happened since more universities join as committee. First and second ISIEM are hosted only with three universities, namely Trisakti, Gunadarma, and Indonusa Esa Unggul Universities. This year event, It's hosted by six universities, i.e. Gunadarma, Trisakti, Indonusa Esa Unggul, Bina Nusantara, Atma Jaya Catholic, and Petra Christian Universities. This becomes evident to us that with cooperation we will succeed.

It is then our expectation so that to the future more universities join us as organizing committee. In this occasion, let us give special thank to Prof. Dr. E.h. Dr.-Ing. habil. Josef Schlattmann from Hamburg University of Technology, Germany. Your contribution to this seminar as reviewer, and as keynote speaker makes this event more valuable. Allow us also to thank Prof. Emeritus Adnyana Manuaba and Ir. I. Made Dana M. Tangkas from *Direktur Teknik dan PIC. Toyata Motor Manufacturing Indonesia*, for their contribution as keynote speakers. We are also grateful to all reviewers, for their commitment, effort and dedication in undertaking the task of reviewing all of the abstracts and full papers. Reviewing a large number of submissions in a relatively short time frame is always challenging. Without their help and dedication, it would not be possible to produce this proceeding in such a short time frame. I highly appreciate all members of committees (advisory, steering, and organizing committees) for mutual efforts and invaluable contribution for the success of seminar.

As closing remarks, Let's say thanks to the Lord Almighty God for all His blessing on us.

Dr. Ir. Hotniar Siringoringo, M.Sc.
Chair

 ISSN: 1978-774X

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INDUSTRIAL MANAGEMENT

ISSN: 1978-774X

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Abdusy Syakur Amin[1]
[1]University of Malaya
[2]University of Pasundan
syakuramin@bdg.centrin.net.id

Tinneke Hermina[2]
[1]University of Padjadjaran
[2]University of Garut
tinneke.hermina@gmail.com

ABSTRACT

FDI inflows is expected bring much needed capital, new machines, new technologies and sciences, marketing techniques and management skills which lead to the increasing the productivity and competitiveness of the domestic industry. This paper seeks to examine how local automotive firms' technological capabilities have evolved vis-à-vis foreign firms following increased liberalization from the late 1990s. The evidence amassed shows that there were no obvious statistical differences in human resource and process technology capabilities between foreign and local firms in 2006. Although foreign firms enjoyed superior product technologies with access to their subsidiaries, local firms have invested more in R&D technology to compete with them. The results confirm that the liberalization experience has driven rather than discouraged stronger initiatives in local firms to raise technological capabilities, though, foreign firms still enjoy higher export-intensities.

Keywords : Technological capabilities, ownership, export, automotives, Indonesia

I. INTRODUCTION

Policy makers in many developing and transition economies striving to attract foreign direct investment (FDI) on their agenda, 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. Blomstrom and Persson (1983), Sjoholm (1997) and Kokko and Sjoholm (1998) provide evidence of positive spillovers from the presence of foreign firms.

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. 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 or 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. The decree was demanding the foreign firms to invest for local assembly and manufacture facilities, by providing lower tariff rates for semi-knockdown (SKD) and completely knocked down (CKD) kits as compared to completely built up units (CBU). Since that period, the Indonesian automotive

sector has been experiencing fluctuation condition. But generally, the sector claimed that it has been developing. The development of this sector can be seen as its contribution to Indonesian economic has been increasing, especially in term of export growth, labor absorbment and productivity. However, the value of import also has been increasing, and its value always higher that it's export.

In order to increase the contribution of the sector, some efforts must be taken especially to emerge the innovation activities. Improvement technological capabilities was considered as an effective alternative to emerge the innovation activities, as it can support the knowledge spillover which is regarded as the prime mover for the innovation.

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 various countries in East Asia. Figueiredo (2002) concluded that Learning processes features affected the and technological capability accumulation in firm-level. Rasiah (2004) has found the impact of technological capabilities on the economic performance in various countries in Africa, Asia and Latin America.

Only few studies in Indonesia focused on what transnational corporations such as automotive sector and electronic sector Alterburg and Meyer-Stamer (1999). 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. Although there are various research which subsequently studies the participation of FDI in Indonesian economy (Booth, 1998, 1999; Hill, 1988, 1995; Robinson, 1986 and Sjolhom, 2002) and only a few studies concerning spillover from FDI (Blomstorm and Sjolhom, 1999) and vertical spillovers in Indonesia (Blalock, 2002).

However, in order to maintain the sustainability of the competitive advantage of the industry, various efforts, especially which generate innovation activities and knowledge spillover should be taken immediately. These efforts can be done only if the cluster has sufficient technological capability. Therefore, the research focuses technological capability and economic performance of the cluster. As at the beginning section, the role of foreign firm has been described, the study also describes the impact of the firm's ownership.

Specifically, this paper describes and analysis the impact of the foreign ownership on the technological capability improvement in Indonesia automotive industry. Drawing on sample of 93 automotive firms in Indonesia, the paper seeks to to fill the void by using the technological capability typology to examine differences in technological capabilities between foreign and local firms in Indonesia.

Our paper is organized as follows. In the following section we provide some references concerning technological

capabilities and ownership. Section 3 presents methodology and data. Section 4 examines the statistical differences between foreign and local firms from various indicators. More over, this section observes the the influences of independence variables such export percentage, ownership and control variables such as wage, sige and age on the technological capabilities variables. Section 5 presents the conclusion.

2. LITERATURE REVIEW.

2.1 Technological Capabilities

Rosenberg and Firschtak (1985) defined Technological capability as a process of accumulating technical knowledge or a process of organizational learning. Technological capability must enable the enterprises to undertake a range of productive task, extending from pre-investment analysis to product and process engineering, manufacturing and the introduction of a new technologies as they appears. Technological capability can be assessed in terms of a firm's ability to (i) identify its technological needs and to search the technology to fulfill the need; (ii) Operate, maintain, modify and improve the selected technology; and (iii) promote technological learning. This may be done through the firm's internal learning mechanisms and by utilizing external learning mechanisms, for example, through collaboration with government's research technology or by networking with other firms.

Technologies are transferred through various modes, such as direct foreign investment, joint venture, licensing, turnkey projects, purchase of capital goods and technical agreement and cooperation (Dunning, 1981, Katz, 1985).

The development of technological capabilities should not be through as the ability to undertake leading edge innovation, though innovative capabilities are an important element of technological 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. This involves buying some skills and information from the market and providing other in-house, the choice depending on the technology, market condition and firms strategies.

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. Such passive learning goes some way to developing the necessary capabilities. In simple industries, for example, the assembly of imported kits or garment manufacture for the domestic market, this may be all needed. The skills are easy learned on the job, and there are few linkages with supplier that involve technical problem and complex exchange of information. Product designs are provided by foreign suppliers of kits for assembly, or are easy adapted to local tastes in garment.

Dahlman and Westphal (1982) and Dahlman, Ross-Larses and Westphal (1987) emphasized the underlying concept of trajectory of deepening capability that moved from the technology-using production capabilities to innovation capabilities (Dahlman and Westphal, 1982). They developed sequence of capabilities running from production capability, via investment capability to innovation capability. Amseden (2001) used a framework that was broadly the same as that of Dahlman and Westphal in that it centers on different stages in the industrial project cycle. As With Dahlman and Westphal, Amseden sets these stages within a dynamic perspective that sees firms "building up" capabilities as they move trough time between the categories; from production function through project execution capabilities to innovation capabilities.

International technology transfer research provides also various typologies technological capabilities. Bell (1987)

grouped technology flows into three categories; Flow A consists of capital goods and technological, engineering and management services; Flow B consists of the skills and know-how to operate and maintain the newly established production technology; and Flow C consists of the knowledge and expertise for implementing technical change, or the know-why. In this framework, Flow A leads to improvement in production capability, Flow B contributes to technological capabilities at the basic, routine level, and Flow C enables the firm to generate dynamic technical and organizational changes.

Lall (1982) outlined a functional categorization of technological capabilities based on the task facing a manufacturing firm. The task and associated capabilities are characterized into two groups: investment capabilities and production capabilities. These are further divided into three levels. The first level is simple and experienced based, the intermediate level is adaptive and duplicative in nature but is research based, and the advanced level is innovative and risky but is also research based.

2.2 Ownership

Ownership is a critical variable because of the significance of foreign capital in the emergence and subsequent development of automotive production in developing economies such as Indonesia. Local firms operating in developing sites typically enter automotive manufacturing either through licensing technology from multinationals (e.g. Hyundai from Korea and Proton from Malaysia) from abroad or through subcontract relations with subsidiaries at host-sites (e.g. Astra from Indonesia, and Cofap, Freio Varga and Metal Leve from Brazil). An assessment of ownership is important to examine differences in technological capabilities in automotive manufacturing in Indonesia given that foreign firms have participated in the industry for over three decades.

Hymer (1975) stated that multinationals exist because of the economic advantages oligopolistic conduct offers them, and argued that the choice of relocation of operations abroad is strongly influenced by host-site advantages. Dunning's (1988) eclectic framework of ownership, location and internalization (OLI) provided an outline to explain internationalization of operations and hence the motives behind their conduct at host-sites. The importance of motives in the conduct of multinationals was advanced further by Narula and Dunning (2000) and Cantwell and Mudambi (2005). The flow of knowledge from foreign to local firms can take place through Greenfield direct ownership, browfield acquisitions, joint ventures, licensing, turnkey projects, purchase of capital goods, technical agreement and cooperation, and movement of human capital (Dunning, 1981, Katz, 2006; Rasiah, 1994).

Using Rasiah's (2004) typology, the choice of technology by foreign and local firms varies with taxonomies and trajectories. Because cutting edge human resource practices and process technology are essential to compete internationally in Indonesia's liberal environment foreign and local firms may not show much differences in technological capabilities once controlled for product type (see Rasiah, 2009b). Machinery and equipment are either largely acquired from complementary rather than competing firms, and human resource practices and process techniques largely evolve outside the domain of intellectual property rights, and buyers often provide these technologies to suppliers to ensure quality standards, not much differences can be expected between foreign and local firms.

Vernon's (1966) argument on national factors is still important in explaining the internationalization of innovation activities as the OECD (1998) and Amsden, Tschang and Goto (2001: 5) showed evidence of low incidence and intensity of R&D investment outside national borders. This also suggests that local firms tend to undertake more R&D activities than foreign firms once the requisite institutional support evolves as the latter can still rely on R&D support from home sites. However, this does not mean that foreign firms will not at all undertake R&D activities at host-sites. Government incentives and grants, and the development

specialized expertise in particular sites have been instrumental in the growth of R&D activities by foreign firms in Singapore and Bangalore.

Hence, the paper examines two hypotheses, viz., one, local and foreign firms are not expected to show significant differences in HR and PT intensities, and two, local firms are expected show higher RD intensity than foreign firms. Given the 38 years history of industrial promotion and around 30 year promotion of localization in the automotive industry, and the reasonable size of the domestic market one can expect that local firms will be capable of hiring employees relocating, and absorbing the non-proprietary aspects of technology from multinationals.

3. Methodology and data

Three aspects are identified as important factors in the analysis undertaken in the paper, such as technological capability, explanatory and control variables.

3.1 Specification of variables

The dependent variables of technological capabilities, the explanatory and the control variables are specified in this sub-section.

3.1.1.Technological Capabilities

Following the typology presented in the theoretical guide, three types of technological capabilities are examined in this paper, *viz.*, human resource, process technology and R&D. Firm-level technologies include human resource practices, machinery and equipment, inventory and quality control systems and R&D expenditure and personnel. Because there are no prior reasons to attach greater significance to any of the proxies used, the normalization procedure used is not weighted. The following technological intensities are specified:

Human Resource

Human resource (HR) capability was estimated as follows:

$$HR_i = 1/3[TE_i, CEHRP_i, SIi] \quad (1)$$

TE, CEHRP and SI refer to training expense as a share of payroll, cutting edge HR practices (estimation formula: a score of one was added to anyone of the cutting practices of small group activities, team-working, quality control circles, stock sharing and performance-based rewards and promotions), and skill-intensity (estimation formula: professionals, technicians, machinists and skilled workers divided by total workforce) of firm i. Because the proxies were evenly weighted HR was divided by 3 to take account of the three proxies used.

Process Technology

Process technology (PT) capability was estimated as follows:

$$PT_i = 1/3[PTE_i, IQCS_i, K/L_i] \quad (2)$$

PTE, IQCS and K/L refer to process technology expenditure, cutting edge inventory and quality control systems, and capital intensity (fixed capital divided by workforce) of firm i respectively. PTE was calculated by dividing process technology expenditure with sales. A score of one was added to anyone of the cutting practices of just in time, quality standards (QS) or ISO 9000 series, statistical process control, total quality management, defect tolerance rate in parts per million and total preventive maintenance. K/L was calculated by dividing fixed assets value with employment. Because the proxies were evenly weighted PT was divided by 3 to take account of the number of proxies used.

R&D Capability

R&D (RD) intensity was measured as follows:

$$RD_i = 1/2[RDexp_i, RDemp_i] \quad ..(3)$$

Where RD_{exp} and RD_{emp} refer to R&D expenditure in sales and R&D personnel respectively of firm i. Because the proxies were evenly weighted, RD was divided by 2.

3.1.2 Explanatory Variables

The two explanatory variables are defined in this sub-section, i.e. export-intensity (and export incidence) and foreign ownership.

Export-intensity

Export intensity was measured as follows:

$$\text{Export intensity} = X_i/Y_i. \quad (4)$$

Where X and Y refer to export and gross output of firm i in 2006. Because foreign

automobile firms in Southeast Asia use production networks to supply the bulk of domestic assembly demand from within borders, local automotive firms are likely to show higher export-intensities. The incidence of export experience was also calculated separately for use in descriptive statistics and the two-tail t tests. Export incidence was calculated as:
$Xinc_i$ = 1 if firm i exports;
$Xinc_i$ = 0 otherwise

Ownership

Foreign ownership (FO) was estimated in two ways. The first, i.e. FO1 is used for the descriptive two-tail t tests and was measured as follows:

$FO1_i$ = 1 if the share of foreign equity in total equity is 50% or more;
FO1i = 0 otherwise.
The foreign ownership measure is used in the Tobit regressions and was measured as follows:

$FO2_i$ = Foreign equity/total equity.
Interviews show that foreign supplier firms in Indonesia are technologically superior to local firms but the latter has invested more on R&D to compete both domestically and in regional foreign markets. The assembly plant of Toyota is an exception where the Kijang (Innova) model is reported to have been developed in Indonesia.

3.1.3 Control Variables

Size, wage and age were the control variables included in the Tobit regressions.

Size

Size could not be measured on the basis of employment because econometric convergence could not be achieved and hence it was measured as follows as a dummy:

S_i = 1 when S > 250 employees;
S_i = 0 otherwise.

Where S refers to size of firm i.

Wage

Wages was introduced as the labor market variable in the equation since its skill-intensity and cost can have a bearing on the choice of technology. Wage (W) was measured as follows:

W = Monthly salary in US$ divided by the employment of firm i.
Where W refers to the mean monthly wage per employee of firm i in 2006.

Age

Age was measured as follows:

A_i = years in operation of firm i.
Where A refers to the age of operation of firm i.

3.2 Data

The primary data were collected through a structured questionnaire survey of automotive firm in Indonesia. The survey was conducted in Jakarta's area 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 Jakarta's area covers more than 79 per cent number of automotive industries, and also covers almost 90 per cent of the employment absorbent, production and exports of Indonesian automotive industries respectively (Gaikindo, 2006).

The secondary data were collected from various institution either government institutions such as Ministry of Industry, Ministry of Trade and Statistic Center Agency or non government institutions namely GAIKINDO, GIAMM and HKI etc.

3.3. Statistical Model

This section introduces the two statistical exercises carried out in the paper, *viz.*, two tail t-tests to examine simple differences in means, and tobit regressions to evaluate differences after controlling for explanatory and other variables. Tobit regressions were preferred over ordinary least squares (OLS) regressions because

the dependent technological capability variables are censored on the right and the left side of the data sets so that they take a minimum possible value of zero and a maximum possible value of one.

Tobit: HR = α + β1X/Y + β2FO + β3S + β4A + β5W + μ (5)
Tobit: PT = α + β1X/Y + β2FO + β3S + β4A + β5W + μ (6)
Tobit: RD = α + β1X/Y + β2FO + β3S + β4A + β5W + μ (7)

The specifications passed the multi-colinearity tests as shown in Appendix 1, and the Cooke Wiesberg test for heteroskedasticity.

4. Statistical Analysis

The statistical results are examined by three categories, *viz.*, descriptive, two-tail differences in means and tobit regressions controlling for other effects. The analysis in sub-sections 1 and 2 go deeper to examine the components of HR, PT and RD.

4.1 Descriptive statistics

The results of the univariate tests of means and standard deviation by ownership are shown in Table 1. Foreign firms show significantly higher X/Y and RDP means than local firms. Local firms enjoy a fairly higher K/L and RDE mean than foreign firms. There are no obvious differences in the HR and PT means, and only a marginally higher RD mean enjoyed by local firms over foreign firms.

Table 1: Descriptive Statistics, Automotive Firms, Indonesia, 2006

	Foreign				*Local*			
	Min	**Max**	**Mean**	***SD***	**Min**	**Max**	**Mean**	***SD***
X/Y(%)	0.00	100.00	24.30	28.10	0.00	82.00	14.67	21.80
TE(%)	2.00	3.00	2.35	0.48	2.00	3.00	2.31	0.47
SI(%)	81.00	90.00	85.19	1.39	85.00	95.00	85.72	1.78
CEHRP	2.38	3.75	2.77	0.26	2.38	3.13	2.76	0.20
HR	0.44	0.57	0.48	0.02	0.45	0.52	0.48	0.02
PTE(%)	2.00	5.00	3.15	0.76	2.00	5.00	3.49	0.76
IQCS	0.33	0.80	0.60	0.10	0.47	0.73	0.58	0.08
K/L('000RP)	0.01	261.65	19.52	38.42	0.25	2,027.03	66.48	323.66
PT	0.21	0.40	0.30	0.04	0.24	0.41	0.31	0.04
RDE(%)	2.00	5.00	3.11	0.74	2.00	5.00	3.41	0.68
RDP	2.00	80.00	14.96	14.24	2.00	26.00	9.67	5.89
RD	0.13	0.38	0.23	0.05	0.18	0.37	0.25	0.04
N			54				39	

Source: Computed from Authors Survey (2008) using SPSS 11.50 package

4.2 Statistical Differences

Foreign firms largely enjoyed higher export-intensity, export incidence and productivity means than local firms (see Table 2). The export incidence difference between foreign and local firms was statistically highly significant. Almost all foreign firms enjoyed export experience by benefitting from production networks with assembly firms. The share of foreign suppliers exporting in 2006 was 98.3 percent whereas only 57.1 percent of local firms enjoyed export experience. The mean export

intensity of foreign firms of 24.3 percent was significantly higher than the 14.7 percent of local firms, though it was only statistically significant at 10 percent level. Interviews show that Korean and American assemblers have adopted the typical Japanese practice of specializing on particular components, CKDs and CBUs and then engaging in regional trade across Southeast Asia.

combined effect of the two components has left local firms with a statistically significant (at 5 %) but marginally higher RD mean than foreign firms. Foreign firms appear to hire bigger numbers of R&D personnel but local firms seeking to catch up with their foreign competitors have been investing more in

Table 2: Two Tail T Tests of Means, Automotive Firms, Indonesia, 2006

	FO	*LO*	*t*
X/Y(%)	24.30	14.70	1.76***
X Incidence	98.28	57.14	5.93*
TE(%)	2.35	2.31	0.44
SI(%)	85.19	85.72	1.62
CEHRP	2.77	2.76	0.33
HR	0.48	0.48	0.15
PTE(%)	3.15	3.49	2.12**
IQCS	0.60	0.58	1.03
K/L	19.52	66.48	1.06
PT	0.30	0.31	0.60
RDE(%)	3.11	3.41	-1.99**
RDP(%)	14.96	9.67	2.19**
RD	0.23	0.25	-2.26**

Note: *, ** and ** refer to statistical significance at 1%, 5% and 10% respectively.
Source: Computed from Authors' Survey (2008) using SPSS 11.50 package

As expected the technology variables of HR and its components of TE, SI, CEHRP were statistically insignificant thereby reflecting the impact of competition and its consequent effect on the diffusion of best practices in HR activities. The PTE component of PT activity was statistically significant at 5 percent whereas the other components of IQCS and K/L showed no statistically meaningful difference. Interviews showed that local firms invested more on acquiring process technology compared foreign firms that transferred a considerable proportion of such technologies from their subsidiaries abroad. Nevertheless, as expected the overall PT showed no obvious differences as local firms installed similar best practices to compete.

Whereas foreign firms showed a significantly higher RDP mean than local firms, which was statistically significant at 5 percent, the converse is the case with RDE. The

R&D activities. Foreign firms clearly enjoy higher export experience and intensities than local firms. The statistical differences involving technological capabilities are not very obvious with local firms enjoying higher PTE, RDE and RD means while foreign firms enjoying higher RDP means. It will be useful to examine if these differences remain after controlling for export-intensity, size, wages and age – which is carried out in the next sub-section.

Table 3: Tobit Regressions of Technological Capabilities, Automotive Firms, Indonesia, 2006

	HR	*PT*	*RD*
X/Y	-0.012 (-0.72)	-0.00 (-0.22)	0.034 (2.01)**
FO	-0.001 (-0.006)	-0.001 (-0.46)	-0.003 (-2.68)*
S	-0.002 (-0.77)	-0.002 (-0.22)	-0.042 (-4.57)*
A	-0.000 (-1.11)	0.000 (0.45)	-0.003 (-2.28)**
W	0.001 (2.01)**	0.001 (0.44)	0.001 (1.70)***
μ	0.492 (85.93)*	0.312 (26.15)*	0.291 (24.51)*
N	93	93	93

Note: figures in parentheses refer to "z" statistics; *, ** and *** refer to statistical significance at 1, 5 and 10% respectively.
Source: Computed from data collected) survey using E-views 7.0 package.

4.3 Statistical Analysis

This sub-section examines ownership-based statistical differences in technological capabilities after controlling for export intensity, size, wages and age. The results of the tobit regressions passed the model fit (X^2) test.
The results confirm that there are no obvious differences in HR and PT activities between foreign and local firms (see Table 3). However, there are ownership-based differences in RD activities. Although the coefficient of FO is marginal it is statistically highly significant. Interviews show that local firms invest more than their foreign competitors located in Indonesia to compete. Foreign firms continue to enjoy significant technological support from their subsidiaries abroad.

The results also confirm the positive effect of export-orientation in R&D activities but show no differences when involving HR and PT capabilities. Deregulation in Indonesia since particularly 2000 has driven automotive firms to acquire similar HR and PT capabilities.

The control variables of S, A and W were significant in the RD regressions. Smaller, newer and better wage offering firms show stronger participation in R&D activities than larger, older and low wage offering firms. Wages was also significant in the HR regressions, which obviously means that higher HR capabilities are associated with better wage offering firms.

5. Conclusion

The empirical results of the paper interestingly shows that the liberalization that took place after the fall of the Suharto regime has had a positive impact on local firms there were no obvious statistical difference in human resource and process technology capabilities them and foreign supplier firms in the automotive industry in Indonesia. Despite the excesses that took place during the period of localization policies since 1971, sufficient capabilities seem to have evolved to enable local firms to compete with foreign firms in a more even playing field following deregulation from the late 1990s.

Ownership did not matter in HR and PT capabilities as both the two-tail t test of

means, and the tobit regressions controlling for other variables did not show any statistically significant difference between foreign and local firms. Local firms enjoyed a slightly higher RD mean than foreign firms but that seems to be because of higher investment in R&D by the former to offset the access the latter enjoys from abroad. Foreign firms enjoyed higher export intensities and export experience than local firms, which seems to be a consequence of regional production networks established by foreign multinational assemblers in Southeast Asia.

Because they are supplier firms, size did not seem to matter in HR and PT capabilities, while smaller and medium firms enjoyed higher RD capabilities than large firms. Low wages also did not appear as a competitive instrument in the regressions where the only statistically significant result showed that better wage paying firms enjoyed higher HR capabilities.

However, various policies must be taken by Indonesian Government, especially for foreign firms, so they will be imposed to improve significantly their technological capabilities which expected giving multiplier effect such as techcnology spill over to the local firms.

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Appendix 1: Correlation Coefficient Matrix of Independent Variables, 2006

	X/Y	FO	W	A	S
X/Y	1.000	0.109	-0.039	-0.042	-0.016
FO	0.109	1.000	-0.036	0.002	0.165
W	-0.039	-0.036	1.000	0.137	-0.183
A	-0.042	0.002	0.137	1.000	0.145
S	-	0.165	-	0.145	1.000
	0.016		0.183		

Note: None of the variables showed colinearity problems.

Source: Computed from survey data using E-views 7.0 package.

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