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Efficiency of the Japanese Affiliates: Regional Economy Perspectives

CHEN-CHEN YONG[a*] AND SOK-GEE CHAN[b]

[a]*Department of Economics,Faculty of Economics and Administration, University of Malaya,50603 Kuala Lumpur, Malaysia*
[b]*Department of Finance and Banking, Faculty of Business and Accountancy, University of Malaya, 50603 Kuala Lumpur, Malaysia*

ABSTRACT

Japanese merger and acquisitions strategy to leverage country's cheap labour and establish long-term competitive advantage has been challenged by today's world economy that performed below the expected growth. This study explores the efficiency of the Japanese affiliates in the regions of North America, European Union, Newly Industrialized Economies (NIEs), ASEAN4 and China for manufacturing sub-sector from 1997 to 2012 that believe could help Japan to regain her competitiveness. Results found that the Japanese affiliates in North America and Europe are relatively efficient as compared to the rest of the regions. The efficiency for iron and steel industry is relatively higher as compared to other manufacturing industries in ASEAN4, NIEs and China. The efficiency for electrical machinery in Europe and transportation, electrical machinery and chemical in North America industry are relatively higher as compared to other manufacturing industries

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*Corresponding author: E-mail: ccyong@um.edu.my

INTRODUCTION

Efficiency inevitably reflects amplified profits. According to efficient performance hypothesis, efficient firms could further expand their businesses and compete healthily in order to capture the most of the market share in the economy. Therefore, efficiency is the paramount for survivability in today's challenging business environment. With small economy, the Japanese firms are hunting for opportunities abroad expand their market share abroad through Merger and Acquisitions (M&As) strategy. This strategy is widely adopted by foreign firms to expand their market shares abroad for production capacity expansion to fulfill both internal and external demand. Using this method, Japan has set up affiliates in North America, European Union, Newly Industrialized Economies (NIE3), China (including Hong Kong) and ASEAN-4(Indonesia, Thailand, Philippines and Malaysia) regions in order to expand their market shares in the world with the objectives to benefit from cheaper cost of production.

Nevertheless, the sluggish of the US growth, Eurozone downturn, rising labour cost in China and NIE3, weak supply chain in ASEAN-4 affect the sales expansion of the Japanese affiliates. The statistics reported by the Japanese Ministry of Economy, Trade and Industries (METI) show that the sales share of Japanese affiliates in North America decreased gradually from 45% in 1997 to 28% of the total sales of overseas Japanese affiliates in the third quarter of 2012. In addition, the sales share of the Japanese affiliates in NIE3 and EU has been stagnant at 6% and 10%-15% of total sales of overseas the Japanese affiliates respectively aftermath the global financial crisis. However, the sales share of the Japanese affiliates in ASEAN4 and China are catching up with the sales share of North America which constitute approximately 20% and 22% of the total sales of overseas Japanese affiliates respectively in the third quarter of 2012. Even though the sales had been increasing in the developing countries, the efficiency issue remains as the main concern due to increase in the cost of production, exhaustion of the availability of resources for production and lower purchasing power as compared to the developed regions.

In addition, lower purchasing power in these countries could be harmful because the countries might not be able to sustain the business performance and capture the desire market shares in the long-run. This might create unpromising M&As outcome for some industries because it resulted in a reduction in profit margin and more volatile business environment in the long run. Hence, such factors may further dampen the efficiency of the Japanese affiliates and lead to lower competitive advantage the Japanese affiliates abroad. Therefore, given the softening economic environment of these regions, efficiency is believed to be the prominent factor for sustainable business operations of the Japanese M&As activities.

Over the past few decades, production can be done cheaply in some far-flung corner of the world especially in developing (e.g. ASEAN4 and China) and emerging (NIE3) countries which offer a pool of cheap labour. Coupled with fast growing market demand of both developing and emerging countries, it has attracted the Japanese affiliates to locate their production to tap the market share and for resource utilization. However, labour costs have soared in both developing and emerging countries which have added to the upward pressure on manufacturing costs. On the other hand, labour cost in America and Europe has barely budged (Schmitt, 2012; Fernández *et al.*, 2004). This has narrowed the wage differentials among developed, emerging and developing countries. Hence, rock-bottom wages in developing and emerging countries is no longer the main reason on why the sales share of the Japanese affiliates in North America and EU is losing out but rather than the issues to remain efficient and competitive.

Given the increasing cost of production and fast growing market demand, it is believed that efficiency is the prominent factor in sustaining overseas business. This is because efficiency deals with the ability of the firms to fully utilize it factor of production in order to achieve the optimal output. This is important because over a period of time, the growth of market share will slow down with increasing cost of production. Therefore, firms need to remain efficient to deal with high cost of production. It is thus important for multinational firms to move away from low cost production model to fast growing market and thus efficiency model.

Efficiency could be achieved in two ways. First, emphasis on pure technical efficiency where a firm ability to utilize minimum inputs given the output level and scale. Second, firms may choose to emphasis on scale efficiency where a firm would benefit from the scale economies given the size of operation. The former strategy is more likely on operational and business strategic planning in utilizing the combination of inputs at a minimum level. The later focuses on how cost would spread over the large number of output quantity. For example, using specialized capital equipment that operates at high volume would add advantage in cost spreading. Besides that, high purchasing power can be one of the factors that facilitate the firm's economics of scale. Hence, this study attempts to examine the technical efficiency of the Japanese affiliates for manufacturing sub-sectors in respective region from 1997 to 2012 to gauge the efficiency of the Japanese affiliates through their M&As activity. The results of the study would respond to the following research questions: 1) What would be the extent of efficiency that the Japanese affiliates has achieved so far across manufacturing sub-sectors in different regions? 2) Would the efficiency of the Japanese affiliates diverse significantly across manufacturing sub-sectors in respective region? Furthermore, results of this study will able to serve as a guide whether the current investment of the Japanese affiliates across regions need to be further restructure in order to fully gauge the benefits of M&As in these regions.

BACKGROUND OF STUDY

Japan's growth expansion model which aims to look beyond home country for customers through M&As has become the world business template. It is believed that the Japanese M&As could serve as the engine of growth for Japan to expand their production possibilities frontier which had been stagnant. Hence, it is essential to evaluate the efficiency of the Japanese affiliates operation in respective region.

Given the risks surrounding the world economic, the boost of the Japanese affiliates' sales in emerging market might not be the robust source of push to offset the slackening sales of the Japanese affiliates in advanced countries. Even though Japan has dramatically increased her presence in the world through M&As in order to perk up her economy, this action had been affected by different stages of economic development in respective region. Such factor would pose unprecedented challenges to the performance of the Japanese affiliates. Firstly, some of the developing countries such as Indonesia and the Philippines still offer low wages, but not scale, efficiency and supply chain as compared to China. Secondly, rising wages in emerging markets has reduced the likelihood of less-skilled domestic workers in host country to work abroad (Chao *et al*., 2006). Thus, the Japanese firm needs to invest in technology which could boost the productivity of less-skilled labour in host country. Thirdly, the firm's production expansion in one region will export to the shrinking firm in another region for an industry causing trade divergence rather than trade creation (Deardorff,2010). Fourthly, the more that firm spreads their operation around the world, the more vulnerable they would expose to unexpected events such as crisis and natural disasters (Lockamy *et al*.,2010; Treleven *et al*.,1988; Wagner etal.,2006). Lastly, the risk of intellectual property and imitation (Brozen, 1951; Ulhøi, 2012) cause research and development, and innovation works remain in Japan or in developed countries.

Based on METI's statistical reports, the Japanese affiliates located in China and ASEAN4 regions are mostly labour intensive industries given the percentage share of employee is greater than the percentage share of fixed assets acquisition (see table 1). On the other hand, the Japanese affiliates located in North America and Europe regions belong to capital intensive industries with the percentage share of fixed assets acquisition is greater than the percentage share of employee. The impressive sales growth in Asia from 29% in 1997 to 51% in third quarter of 2012 is mainly contributed by China followed by ASEAN4, NIE3 and others (India, Vietnam, Sri Lanka, Pakistan, Bangladesh, Myanmar and Laos). It is noticeable that the higher sales are complement with greater labour employment and asset utilization which refer to extensive growth. This has raised the concern on whether the growth of sales could be achieved with limited availability of labour and capital. The sales in NIE3 are hardly increased. This could be due to the limited skilled workers with high wages. The figure also illustrates that higher percentage share in capital utilization in Asia region especially China and ASEAN4 as compared to North America, Europe and NIE3 regions. This portrays that China and ASEAN4 are heavily relied on imported technology from Japan. It also reflects that most of the innovation and R&D works are mainly located in Japan and developed countries rather than the host countries of the developing and emerging regions (Manea and Pearce, 2004; and Manolopoulos, 2006).

This portrays the importance of technology in contributing towards firm's competitiveness despite reducing cost and failure of M&As (James *et al*., 1998; Bena and Li, 2014). Technology as one of the drivers for M&As where better cost saving can be targeted through efficiency achievement. As such, effective management of technology in expanding firm's innovation capacity through knowledge transfer (Kodama, 1991) will affect the merger and acquisition decision making on investment. Thus, it is believed that country with ineffective management of technology would more likely to cause the failure of M&As activity.

Generally, in order for Japan to be the world prominent investor to regain her competitiveness, it is crucial for the Japanese affiliates to minimize wastage and production inputs to achieve the optimum production frontier. Thus, efficiency will be the ultimate goal to achieve the right mixed of factor of production to enhance competitive of the Japanese affiliates to push their production possibilities frontier to the ultimate level.

Table 1. Percentage Share of Japanese Affiliates' Manufacturing Sales, Employment and Fixed Assets Acquisitions in Respective Regions

Year	North America	EU	NIE3	ASEAN4	China
1997	45	20	10	13	5
	52	16	7	15	3
	26	12	3	31	15
2000	46	7	9	13	20
	42	6	7	19	20
	23	19	7	32	11
2005	39	19	6	16	12
	33	17	5	21	13
	15	9	5	30	31
2010	28	14	6	20	22
	19	10	7	26	23
	12	9	14	28	35
2012	28	13	6	20	22
	22	8	4	32	18
	12	9	4	27	32

Note: Authors' calculation based on METI's reports. Figures in bold indicate sales, figures in italics indicate employment. Figures for 2012 as of the third quarter of the year. North America comprises United States and Canada; Europe comprises Ireland, United Kingdom, Italy, Ukraine, Austria, Netherlands, Greece, Sweden, Spain, Slovakia, Montenegro, Czech Republic, Denmark, Germany, Turkey Hungary, Finland, France, Bulgaria, Belgium, Poland, Portugal, Luxembourg, Romania and Russia; NIE3 comprises Singapore, Taiwan and Korea; China (including Hong Kong) and ASEAN-4 comprises Indonesia, Thailand, Philippines and Malaysia.

METHODOLOGY

This study aims to estimate the performance of the Japanese overseas affiliates with their major trading partners, namely, North America, Europe, NIE3, ASEAN4 and China using the efficiency level analysis. The Data Envelopment Analysis (DEA) is employed to estimate the technical efficiency scores for all the affiliates. Technical analysis is estimated based on the assumption of how the firms minimize it inputs usage given the level of output. Furthermore the use of DEA allows the estimation of efficiency scores based on multiple inputs and outputs.

In this study, we employed the DEA model based on Banker, Charnes and Cooper (1984) because it allows us to further decompose the technical efficiency of the firms into pure technical efficiency and scale efficiency. This is crucial in order to identify the main factor that contributes to the efficiency level of the Japanese firms.

The technical efficiency of the VRS model is estimated based on Equation (1).

$$\begin{aligned}
&\max \theta \\
&\text{subject to} \\
&\sum_{j=1}^{n} \lambda_j x_{ij} \le x_{io} \qquad i = 1,2,\ldots,m \\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge \theta y_{ro} \qquad r = 1,2,\ldots,s \\
&\sum_{j=1}^{n} \lambda_j = 1 \\
&\lambda_j \ge 0 \qquad j = 1,2,\ldots,n
\end{aligned} \tag{1}$$

where DMU_0 represents one of the n DMUs (Decision Making Units) under evaluation, x_{io} and y_{io} and are the ith input and rth output for DMU_0, respectively. λ_j are unknown weights, and j = 1, 2, …n represents the number of DMUs. The optimal value of Θ^* represents the distance of the firms from the efficient frontier, therefore, the most technical efficient firms is said to have $\Theta^* =1$ and the inefficient firms will have a $\Theta^* <1$. The VRS model is a better representation of efficiency analysis with the assumption that the output levels cannot be reduced proportionately with the levels of input. Based on the firm's production theoretical framework, DEA is a non-parametric method which widely used in operational research and economics for operation management benchmarking. Linear programming is employed based on a combination of inputs and outputs which represent the production process which make the distinction and add more advantages as compared to partial regression analysis. The main advantage of DEA compared to econometrics approach is that it does not require a priori functional specification of the unknown technology (Fukuyama 1993; Favero and Papi 1995).

The sample of study consists of the Japanese affiliates operated in North America, Europe, NIE3, ASEAN4 and China during the period 1997 to 2011. The study period covers year 1997 to 2012 where Asian Financial Crises occurred and led to the increase of Japanese Affiliates leverage on cheaper cost of production and expand their market share abroad. In addition, this study intended to look into the efficiency of Japanese affiliates abroad resulted from the global financial crises. It is well noted that Japanese investment in the rest of the world has gradually shrunk away back to home country in order to re-develop the country's economy resulted from the 2011 Tsunami disaster. Therefore, there is a need to isolate the impact of Tsunami on Japanese Affiliates' efficiency to paint a better picture on the efficiency with the aim of Japanese affiliates in looking for opportunities abroad to expand their market share. The data of this study is obtained from various issues of the Quarterly Survey of Overseas Affiliates published by the METI in Japan. The output vector for this study is sales measures in million Yen. Sales are used as the proxy for output for the firm because it represents the value of total production of the firms in their respective region. The input vectors employed in this study are fixed assets (million Yen) and number of employees. The selection of inputs and outputs is based on the economic assumption where firms are believed to use their capital and labour efficiently given the level of production measured by the sales figures.

RESULTS AND DISCUSSION

The estimated results of the efficiency level for the Japanese affiliates operated in all the region is summarized in Table 2.

Table 2. Summary Efficiency Scores For Japanese Affiliates in All Regions from Year 1997 To 2012

Summary Statistics	Efficiency	CSC	Che	EM	TE	FM	FT	GPB	IS	NF	LPP	Man	Pre	Tex	Misc
Mean	Technical Efficiency	0.369	0.635	0.389	0.743	0.273	0.423	0.540	0.723	0.364	0.449	0.452	0.408	0.188	0.454
	Pure Technical Efficiency	0.415	0.657	0.627	0.865	0.378	0.481	0.657	0.822	0.440	0.653	0.745	0.446	0.200	0.577
	Scale efficiency	0.887	0.962	0.645	0.857	0.746	0.885	0.842	0.875	0.830	0.696	0.627	0.915	0.935	0.796
Standard Deviation	Technical Efficiency	0.106	0.151	0.044	0.125	0.062	0.063	0.110	0.128	0.085	0.109	0.034	0.137	0.035	0.111
	Pure Technical Efficiency	0.111	0.141	0.139	0.075	0.095	0.081	0.164	0.101	0.083	0.165	0.149	0.144	0.031	0.138
	Scale efficiency	0.053	0.028	0.101	0.103	0.178	0.051	0.089	0.078	0.129	0.125	0.107	0.050	0.056	0.056
Minimum	Technical Efficiency	0.264	0.392	0.315	0.520	0.170	0.294	0.379	0.525	0.215	0.250	0.388	0.197	0.140	0.272
	Pure Technical Efficiency	0.290	0.424	0.407	0.721	0.270	0.359	0.416	0.679	0.337	0.423	0.484	0.205	0.161	0.287
	Scale efficiency	0.795	0.919	0.544	0.691	0.452	0.797	0.696	0.720	0.626	0.472	0.521	0.821	0.822	0.700
Maximum	Technical Efficiency	0.640	0.889	0.481	0.929	0.437	0.548	0.684	0.934	0.570	0.671	0.511	0.674	0.267	0.730
	Pure Technical Efficiency	0.693	0.899	0.863	0.945	0.514	0.640	0.867	0.969	0.651	0.991	0.980	0.683	0.270	0.876
	Scale efficiency	0.950	0.993	0.830	0.999	0.956	0.962	0.998	0.975	0.957	0.868	0.810	0.981	0.989	0.944

*CSC=Ceramic, stone and clay products; Che=Chemicals; EM= Electrical machinery; TE= Transportation equipment; FM= Fabricated metal products; FT= Food and tobacco; GPB= General purpose, production and business oriented machinery; IS= Iron and steel; NF=Non-ferrous metal; LPP= Lumber, pulp, paper and paper products; Man= Manufacturing; Pre= Precision instruments; Tex=Textiles; Misc=Miscellaneous manufacturing industries

From the table, it shows that the transportation equipment industry is relatively more efficient as compared to the other industries with the reported efficiency score of 74.3%. This shows that this industry is relatively efficient in managing it inputs in order to generate the sales volume. The affiliates can further reduce it inputs mixed by 25.7% to achieve the same level of output. In addition, the iron and steel industry is also found to be efficient with an average efficiency score of 72.3%. This means that the Japanese affiliates had been relatively efficient in managing it inputs mix as well as exhibit economies of scale as their operation expanded in iron and steel industry where energy consumption efficiency as one of the enzyme in achieving higher efficiency in this industry (The Japan Iron and Steel Federation).

Results further show that the Japanese affiliates operated in the textiles, fabricated metal products, electrical machinery and non-ferrous metals industries had been relatively inefficient with a reported efficiency scores of less than 40%. This served as a serious problem because the Japanese affiliates could have further reduce their inputs mix by more than 60% in order to achieve the given sales volume This indicates the failure for the Japanese affiliates in minimizing the usage of inputs in these industries at a given level of output and the given scale of operation.

Next, the efficiency level of the Japanese affiliates operated in each region is being estimated separately. Unlike the Japanese investment in other regions and countries, the Japanese affiliate's investment in the North America mainly focuses on the heavy industries (Table 3).

Table 3. Summary Efficiency Scores for Japanese Affiliates in North America from Year 1997 To 2012

Summary Statistics	Efficiency	CSC	Che	EM	TE	FM	GPB	IS	NF	Pre	Misc
Mean	Technical Efficiency	0.321	0.616	0.629	0.781	0.337	0.590	0.597	0.281	0.548	0.386
	Pure Technical Efficiency	0.357	0.639	0.661	0.795	0.807	0.598	0.713	0.501	0.746	0.492
	Scale efficiency	0.890	0.957	0.956	0.982	0.422	0.985	0.844	0.578	0.730	0.840
Standard Deviation	Technical Efficiency	0.084	0.181	0.176	0.111	0.099	0.130	0.151	0.044	0.148	0.068
	Pure Technical Efficiency	0.075	0.174	0.177	0.105	0.084	0.125	0.191	0.111	0.129	0.140
	Scale efficiency	0.060	0.031	0.037	0.034	0.126	0.018	0.074	0.096	0.116	0.128
Minimum	Technical Efficiency	0.204	0.343	0.382	0.571	0.249	0.400	0.351	0.190	0.396	0.274
	Pure Technical Efficiency	0.256	0.371	0.406	0.603	0.667	0.422	0.431	0.269	0.590	0.277
	Scale efficiency	0.797	0.888	0.874	0.874	0.276	0.947	0.700	0.409	0.495	0.578
Maximum	Technical Efficiency	0.479	0.913	0.910	0.961	0.636	0.819	0.824	0.363	0.866	0.491
	Pure Technical Efficiency	0.508	0.931	0.913	0.964	0.956	0.821	0.959	0.695	0.957	0.689
	Scale efficiency	0.968	0.993	1.000	1.000	0.742	0.999	0.968	0.707	0.914	0.996

*CSC=Ceramic, stone and clay products; Che=Chemicals; EM= Electrical machinery; TE= Transportation equipment; FM= Fabricated metal products; GPB= General purpose, production and business oriented machinery; IS= Iron and steel; NF=Non-ferrous metal; Pre= Precision instruments; Misc=Miscellaneous manufacturing industries

The estimated technical efficiency level of the Japanese affiliates shows that the firms are relatively technically efficient in the transportation equipment industry followed by the electrical machinery industry and chemical product with the average efficiency score of 78.1%, 62.9% and 61.6% respectively. Surprisingly the iron and steel industry in this region reported an average technical efficiency score of only 59.7% which are the lowest among all the regions. It is suggested that the scale efficiency could be increase with the implementation of Kaizen (Watanabe, 2011). However, as pointed out by Watanabe (2011) that the organizational and knowledge preconditions of Kaizen should be recognized in this purpose.

As compared to other regions and countries, the Japanese affiliate's investment in the Europe did not invest in the iron and steel industry and non-ferrous metals (Table 4). The estimated efficiency scores show that on average the Japanese affiliates are relatively low in terms of their operation in the Europe with the average scores of less than 50% except for electrical machinery industry with a reported average efficiency level of 65.1%.

Table 4. Summary Efficiency Scores for Japanese Affiliates in Europe from Year 1997 To 2012

Summary Statistics	Efficiency	CSC	Che	EM	TE	FM	FT	GPB	LPP	Man	Pre	Tex	Misc
Mean	Technical Efficiency	0.137	0.334	0.651	0.354	0.230	0.425	0.364	0.325	0.323	0.259	0.210	0.431
	Pure Technical Efficiency	0.140	0.339	0.656	0.357	0.390	0.469	0.369	0.660	0.612	0.283	0.256	0.450
	Scale efficiency	0.975	0.983	0.994	0.992	0.688	0.891	0.988	0.561	0.587	0.907	0.810	0.965
Standard Deviation	Technical Efficiency	0.027	0.096	0.180	0.120	0.084	0.148	0.092	0.043	0.049	0.060	0.059	0.199
	Pure Technical Efficiency	0.027	0.095	0.181	0.121	0.162	0.131	0.092	0.258	0.214	0.060	0.064	0.212
	Scale efficiency	0.005	0.009	0.007	0.011	0.346	0.109	0.002	0.201	0.181	0.036	0.053	0.020
Minimum	Technical Efficiency	0.097	0.165	0.373	0.216	0.097	0.193	0.276	0.269	0.265	0.190	0.131	0.145
	Pure Technical Efficiency	0.101	0.170	0.376	0.216	0.188	0.313	0.279	0.421	0.320	0.224	0.172	0.153
	Scale efficiency	0.968	0.964	0.979	0.955	0.268	0.587	0.985	0.269	0.380	0.831	0.726	0.930
Maximum	Technical Efficiency	0.171	0.493	0.899	0.618	0.358	0.812	0.509	0.390	0.433	0.395	0.314	0.830
	Pure Technical Efficiency	0.174	0.497	0.900	0.622	0.714	0.821	0.514	1.000	0.973	0.432	0.367	0.879
	Scale efficiency	0.981	0.993	1.000	0.999	0.990	0.979	0.990	0.766	0.935	0.957	0.878	0.993

*CSC=Ceramic, stone and clay products; Che=Chemicals; EM= Electrical machinery; TE= Transportation equipment; FM= Fabricated metal products; FT= Food and tobacco; GPB= General purpose, production and business oriented machinery; IS= Iron and steel; NF=Non-ferrous metal; LPP= Lumber, pulp, paper and paper products; Man= Manufacturing; Pre= Precision instruments; Tex=Textiles; Misc=Miscellaneous manufacturing industries

In a similar vein, the efficiency estimation also shows a relatively inefficient level of performance of the Japanese affiliates in most of the industries in the NIE3 countries except for the iron and steel industries which reported an average technical efficiency score of 62.2% (Table 5). The results presented in Table 5 indicates that most of the firms are having a high wastage in terms of utilization of their factors of production especially in the food and tobacco industry that reported an average technical efficiency scores of 17%. This indicates that the firms could have saved 83% of their factors of production in producing the given level of output. It is found that the Japanese affiliates in the iron and steel industry is relatively efficient as compared to the other industries.

Table 5. Summary Efficiency Scores for Japanese Affiliates in NIE3 from Year 1997 To 2012

Summary Statistics	Efficiency	CSC	Che	EM	TE	FM	FT	GPB	IS	NF	Man	Pre	Tex	Misc
Mean	Technical Efficiency	0.247	0.351	0.174	0.202	0.098	0.170	0.113	0.622	0.203	0.183	0.097	0.133	0.102
	Pure Technical Efficiency	0.392	0.556	0.581	0.289	0.643	0.212	0.148	0.802	0.410	0.799	0.205	0.370	0.162
	Scale efficiency	0.625	0.721	0.312	0.720	0.230	0.800	0.801	0.747	0.495	0.232	0.471	0.330	0.656
Standard Deviation	Technical Efficiency	0.087	0.129	0.016	0.022	0.011	0.013	0.029	0.303	0.053	0.020	0.025	0.090	0.024
	Pure Technical Efficiency	0.096	0.298	0.083	0.059	0.341	0.013	0.056	0.148	0.069	0.103	0.037	0.123	0.048
	Scale efficiency	0.167	0.180	0.034	0.081	0.161	0.059	0.103	0.228	0.097	0.018	0.089	0.130	0.120
Minimum	Technical Efficiency	0.119	0.189	0.139	0.158	0.076	0.146	0.080	0.408	0.132	0.157	0.036	0.068	0.062
	Pure Technical Efficiency	0.308	0.203	0.429	0.177	0.228	0.188	0.095	0.697	0.333	0.604	0.162	0.164	0.082
	Scale efficiency	0.365	0.559	0.248	0.620	0.078	0.717	0.638	0.585	0.332	0.193	0.220	0.168	0.504
Maximum	Technical Efficiency	0.426	0.528	0.198	0.242	0.118	0.198	0.175	0.836	0.291	0.220	0.133	0.382	0.150
	Pure Technical Efficiency	0.674	0.946	0.722	0.389	0.979	0.236	0.274	0.907	0.506	0.962	0.282	0.526	0.229
	Scale efficiency	0.860	0.966	0.394	0.896	0.460	0.921	0.952	0.908	0.599	0.261	0.570	0.558	0.872

*CSC=Ceramic, stone and clay products; Che=Chemicals; EM= Electrical machinery; TE= Transportation equipment; FM= Fabricated metal products; FT= Food and tobacco; GPB= General purpose, production and business oriented machinery; IS= Iron and steel; NF=Non-ferrous metal; LPP= Lumber, pulp, paper and paper products; Man= Manufacturing; Pre= Precision instruments; Tex=Textiles; Misc=Miscellaneous manufacturing industries

In the ASEAN 4 region, it is found that the iron and steel industry exhibit a relatively high efficiency level with a reported score of 52.1% as compared to the other industries. The finding suggests that the Japanese affiliates may further reduce the input combination by 47.9% to achieve the given level of sales volume. In addition, Table 6 also shows that most of the industries have an efficiency level which is below 50%. This is an alarming issue for the Japanese firms in this region because they are not able to allocate their inputs efficiently in their production process.. This means that the management failed to choose the correct mix or amount of inputs in generating a given level of sales volume. The management therefore needs to come out with a better strategy to control the employment of inputs in the production process in order to reduce the wastage of inputs used in the production process.

Table 6. Summary Efficiency Scores for Japanese Affiliates in ASEAN 4 Region from Year 1997 To 2012

Summary Statistics	Efficiency	CSC	Che	EM	TE	FM	FT	GPB	IS	NF	LPP	Man	Pre	Tex	Misc
Mean	Technical Efficiency	0.228	0.420	0.198	0.406	0.168	0.272	0.248	0.521	0.479	0.208	0.245	0.218	0.369	0.145
	Pure Technical Efficiency	0.409	0.502	0.396	0.654	0.427	0.539	0.304	0.785	0.620	0.594	0.614	0.319	0.415	0.174
	Scale efficiency	0.570	0.832	0.519	0.674	0.437	0.541	0.821	0.664	0.716	0.359	0.435	0.713	0.887	0.835
Standard Deviation	Technical Efficiency	0.053	0.134	0.024	0.092	0.056	0.107	0.042	0.092	0.268	0.044	0.058	0.068	0.106	0.024
	Pure Technical Efficiency	0.097	0.128	0.099	0.249	0.181	0.262	0.053	0.132	0.171	0.059	0.252	0.093	0.111	0.013
	Scale efficiency	0.126	0.122	0.066	0.155	0.143	0.137	0.085	0.064	0.249	0.102	0.092	0.111	0.053	0.133
Minimum	Technical Efficiency	0.164	0.257	0.156	0.245	0.104	0.152	0.185	0.386	0.159	0.146	0.164	0.094	0.264	0.100
	Pure Technical Efficiency	0.300	0.346	0.257	0.275	0.212	0.333	0.201	0.620	0.382	0.497	0.287	0.151	0.290	0.155
	Scale efficiency	0.341	0.610	0.419	0.529	0.218	0.234	0.685	0.569	0.326	0.226	0.323	0.504	0.795	0.577
Maximum	Technical Efficiency	0.336	0.605	0.244	0.536	0.300	0.508	0.346	0.640	0.934	0.267	0.322	0.334	0.640	0.175
	Pure Technical Efficiency	0.648	0.713	0.621	1.000	0.717	0.977	0.407	0.943	0.949	0.670	0.995	0.455	0.693	0.216
	Scale efficiency	0.816	0.984	0.608	0.986	0.628	0.687	0.926	0.752	0.983	0.541	0.572	0.885	0.950	0.986

*CSC=Ceramic, stone and clay products; Che=Chemicals; EM= Electrical machinery; TE= Transportation equipment; FM= Fabricated metal products; FT= Food and tobacco; GPB= General purpose, production and business oriented machinery; IS= Iron and steel; NF=Non-ferrous metal; LPP= Lumber, pulp, paper and paper products; Man= Manufacturing; Pre= Precision instruments; Tex=Textiles; Misc=Miscellaneous manufacturing industries

The study of the efficiency level of the Japanese affiliates operation in China also found that the firms are relatively efficient in the iron and steel industry as compared to other industries in the region with an average overall technical efficiency score of 76.7%. Similar to the results found in the ASEAN4, the firms in China seems to have relatively low efficiency level which is below 30% in most of the industries as presented in Table 7.

Table 7. Summary Efficiency Scores for Japanese Affiliates in China from Year 1997 To 2012

Summary Statistics	Efficiency	CSC	Che	EM	TE	FM	FT	GPB	IS	NF	LPP	Man	Pre	Tex	Misc
Mean	Technical Efficiency	0.232	0.305	0.237	0.363	0.186	0.162	0.465	0.767	0.213	0.229	0.280	0.318	0.147	0.247
	Pure Technical Efficiency	0.379	0.343	0.331	0.502	0.384	0.207	0.538	0.832	0.368	0.526	0.548	0.349	0.172	0.288
	Scale efficiency	0.669	0.873	0.735	0.674	0.561	0.815	0.882	0.924	0.693	0.457	0.582	0.944	0.866	0.864
Standard Deviation	Technical Efficiency	0.043	0.127	0.020	0.241	0.098	0.032	0.072	0.083	0.087	0.081	0.064	0.070	0.037	0.090
	Pure Technical Efficiency	0.161	0.119	0.047	0.296	0.155	0.064	0.101	0.087	0.228	0.090	0.262	0.104	0.040	0.106

Table 7 (Cont.)

	Scale efficiency	0.180	0.127	0.083	0.199	0.293	0.161	0.084	0.078	0.287	0.210	0.155	0.050	0.128	0.119
Minimum	Technical Efficiency	0.189	0.156	0.208	0.066	0.096	0.117	0.347	0.674	0.139	0.126	0.197	0.187	0.098	0.182
	Pure Technical Efficiency	0.236	0.228	0.242	0.127	0.192	0.148	0.349	0.721	0.179	0.444	0.249	0.189	0.114	0.215
	Scale efficiency	0.339	0.638	0.604	0.306	0.164	0.450	0.759	0.773	0.221	0.224	0.395	0.861	0.590	0.615
Maximum	Technical Efficiency	0.359	0.517	0.274	0.709	0.458	0.236	0.561	0.905	0.390	0.366	0.393	0.467	0.221	0.503
	Pure Technical Efficiency	0.848	0.555	0.407	0.950	0.715	0.367	0.690	0.956	0.998	0.734	0.975	0.571	0.262	0.577
	Scale efficiency	0.860	0.984	0.884	0.940	0.973	0.972	0.995	0.988	0.990	0.765	0.804	0.996	0.989	0.980

*CSC=Ceramic, stone and clay products; Che=Chemicals; EM= Electrical machinery; TE= Transportation equipment; FM= Fabricated metal products; FT= Food and tobacco; GPB= General purpose, production and business oriented machinery; IS= Iron and steel; NF=Non-ferrous metal; LPP= Lumber, pulp, paper and paper products; Man= Manufacturing; Pre= Precision instruments; Tex=Textiles; Misc=Miscellaneous manufacturing industries

The maximum technical efficiency score attained by the Japanese affiliates is 90.5% in the iron and steel and this is followed by the transportation equipment, general purpose, production and business orientation machinery, and chemical with the maximum technical efficiency score of 70.9%, 56.1% and 51.7% respectively. Results further confirmed that the non-performance of the Japanese affiliates in the Chinese market due to high wastage of inputs in their production process that is relatively low pure technical efficiency scores (Table 7).

As reported by Filippov and Kalotay (2011) that different type of subsidiary is associated with different behavior. Based on their elaboration on the typology of subsidiaries, the Japanese affiliates located in North America for transportation equipment, electrical machinery and chemicals; Europe for electrical machinery; NIE3 for iron and steel; ASEAN4 for iron and steel, chemicals, non-ferrous metal, transportation equipment and textiles; China for transportation equipment, general purpose, production and business oriented machinery, and chemicals are with efficiency seeking motive.

In addition, based on METI's statistical reports, among all manufacturing sub-sectors, the sales for transportation equipment industry capture the highest percentage share. As of third quarter of 2012, it constitutes 49% in total Japanese affiliates manufacturing sales in all regions followed by electrical machinery (19%), general-purpose, production and business oriented machinery (9%) and chemicals (7%). This illustrates that the Japanese affiliates might face the trade-off between sales and efficiency in general purpose, production and business oriented machinery in North America and Europe while electrical machinery, and general purpose, production and business oriented machinery in ASEAN4 and China.

The statistics from METI shows that China topped the list with highest sales share for electrical machinery and, general-purpose, production and business oriented machinery industries, while EU for chemicals industry and North America for transportation equipments industry. The percentage share for sales, fixed asset acquisition and employment shrunk in North America and EU while it is expanding in ASEAN4 and China. Although the sales share for industries in ASEAN4 and China show an increasing trend, the percentage share of fixed asset acquisition and employment for industries in China and ASEAN4 are far higher as compared to North America and EU (see Table 1), rekindling concerns that nascent sales growth is stalling. From the results, it is concluded that pure technical efficiency rather than economies of scales is the main contributor to the sales growth.

The relatively inability in allocating appropriate mixture of inputs in production might due to several reasons which widely documented in previous literature. For instance, Singh (2012) found that the strategy and structure decisions for MNCs in emerging economies are depending on whether the target emerging economy's institutional environment is characterized by a rule based or a relationship based governance structure. On the other hand, He and Cui(2012), Sun *et al*. (2015), Kim and Lu (2013), Li and Qian (2013) revealed that governance quality at home (i.e., political stability, government effectiveness, regulatory quality, rule of law, and control of competition) can facilitate MNE's expansion into foreign markets. Besides that, pure technical inefficiency might be influenced by organizational capability which covers a wide range of perspectives such as operational management (Ng *et al*.,1999; Carney, 2015), core competency development (Prahalad and Hamel, 1990; Lin and Lee, 2008), sourcing strategy (McDonald *et al*, 2011; Wei *et al*., 2012;Kang *et al*., 2009), distribution structures (Lorentz *et al*., 2007), and internal and external integrations (Huo, 2012; Young *et al*., 2014).

Recent evidence which demonstrate that the importance of supply chain (Lorentz *et al*., 2007 and McDonald *et al*., 2011) and source of technology (Manea and Pearce, 2004 and Manolopoulos, 2006) for firm's performance in Europe. The lessons that we could learn from these studies are 1) echelon elimination, information sharing, increasing networking, location in an industrial cluster and autonomy will improve the European markets distribution by MNEs while there is no evidence that host country (Europe) sourcing is associated with European markets supply; 2) subsidiaries are generally dependent upon existing knowledge come from the MNEs group. Hence, it is believed that in-house R&D and supply chain strategy could foster the pure technical efficiency.

The METI's statistics also show that the percentage share of sales, fixed asset acquisition and employment for transportation equipment, electrical machinery and general-purpose, production and business oriented machinery industries in NIE3 are the least as compared to other regions. It is noticeable that the sales share for these industries remains relatively stable in 2010 given the share of fixed asset acquisition and employment are shrinking from 2005. The figures attribute that NIEs look relatively well-placed to manage any sudden reversal in capital flows. This could be due to the Japanese affiliates in NIEs are of asset-seeking motive rather than market and efficiency seeking motives (Filippov and Kalotay, 2011). This also portrays that NIEs markets have created opportunity for MNEs in developing competitive advantage (Enderwick, 2009).

The results show that economies of scale have contributed to the overall efficiency of Japanese affiliates in ASEAN4. This finding is supported by Schiling (2005) and Sears and Hoetker (2014) that economies of scale allow centralized R&D to manage the deployment of new technologies, improve coherence of knowledge-related activities and avoid the possibility of underutilized valuable new technologies throughout the firm. On the other hand, the ability to work across functional organizational boundaries (Prahalad and Hamel, 1990; Lin *et al*., 2008) could improve pure technical efficiency of the Japanese affiliates.

From the studies by Wei *et al*. (2012), Huo (2012) and Kang *et al*., (2009), who emphasized on sourcing strategy and integration of MNEs in China, we found that the sourcing strategy is quite different from what MNEs have practiced in Europe. Wei *et al* (2012) pointed out that MNEs in China tend to source more locally if they are export-oriented, joint venture, networking with local suppliers, and small and autonomous MNEs. In addition, MNEs in China managing insourcing for high risk and high profit items while outsourcing low risk and high profit leveraging items (Kang *et al*., 2009). More importantly, internal integration of an organization will improve external integration (customer and supplier) which in turn enhance company's performance in China (Huo, 2012). Hence, the understanding of the supply chain strategy and integration of an organization are believed could contribute to pure technical efficiency of Japanese affiliates in China.

CONCLUSION

This study clearly shows that the Japanese affiliates are relatively inefficient in terms of pure technical efficiency across the all regions in this study. This result is conclusive across different region. The results found that the Japanese affiliates are relatively inefficient in the ASEAN4, China and NIE3 regions for all the industries with the reported average efficiency levels of less than 50% except for iron and steel industry. The results suggest that it is essential for the Japanese affiliates to adopt the intensive growth strategy (empowerment of discovery of better way in labour and resource utilization with limited availability of skilled worker and resouces) rather than extensive growth strategy (growth by adding more resources, capital and labour). This can be improved through the development of firm's core competencies and enhancement of ability to work across functional organizational boundaries (Prahalad and Hamel, 1990; Lin and Lee, 2008); outsourcing strategy (Wei *et al*., 2012 and Kang, *et al*., 2009); and internal and external integration of an organization (Huo, 2012). The share of capital utilization in China and ASEAN4 is relatively higher as compared to other regions which implies that these regions are heavily dependent on the imported technology from Japan. Therefore, given higher inefficiency of Japanese affiliates in these regions, it is quite difficult to sustain the investment from Japan in these regions. Thus, this could be one of the reasons to provide the evidence support for the swift in Japanese investment back to their home country for re-building their economy after the incident of Tsunami despite soaring of labour costs in these regions.

The results of relative inefficiency level of the Japanese affiliates in the developing countries highlight the implication of possible failure of the firms in capturing the market shares. In this case, venturing their capital into the developing countries may create intense competition that lower economic profit in the long run. (Harwit, 2013). The relative inefficiency of the Japanese affiliates in this region further provides room for firms with better competitive advantage to enter into the market (Haruna, 2011; Mankiw *et al*., 1986). This again will further reduce the profit and market share for the Japanese firms in this region.

Results further suggest that, the performance of Japanese firms in developed countries such as the North America rather as compared to the EU, ASEAN4, NIE3 and China. This might due to the reason that the countries in North America are characterized with lofty innovation works. This might further enhance the efficiency of the foreign affiliates in this region as they able to provide better facilities in terms of skill workers, technology advancement and Kaizen implementation in building up the efficiency level of the foreign firms. Bringing jobs back to the developed countries is as much as vogue these days as sending them to China was a decade ago as developed countries are easier to absorb capital inflows given high innovation level and large market. A relatively higher efficiency level in the developed region of North America further gives room for better focus on the Japanese affiliates in these regions. By pulling their capital investment in these countries, the Japanese firms will be able to benefits by employing better skilled workers (Lundberg and Wiker,1997) and higher technology in their production (WIPO). Hence, this will allow them to further improve their efficiency level and capture the market shares in these regions as pointed out by the efficient performance hypothesis (Azzam *et al*., 2001).

In order to sustain Japanese investment in respective regions, it is important to identify the niche industry in respective region. Similarly, Japan could also regain her economy momentum through penetrating market abroad using M&A strategy by focusing on the niche industry in respective region. Based on the results, the identified niche industry that could sustain and expand market share through Japanese M&A strategy in North America is the transportation, electrical machinery and chemical industries. While, electrical machinery is the niche industry for Europe, and iron and steel industry for ASEAN4, NIEs and China. From the results, it is learnt that internal capacity building despite of having relatively low labour cost in ASEAN4 and China is important to facilitate and promote Japanese M&A activities in these regions.

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