Impact of Labour Productivity of the National Key Economic Areas (NKEAs)

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Abstract

Under the Economic Transformation Program (ETP), three sub-sectors of National Key Economic Areas (NKEAs) have been identified, i.e. petroleum, oil palm and the electrical and electronics sub-sectors. The importance of NKEAs sub-sector to sustain the performance of the Malaysian economy inspired this study to examine the relationship between high skilled labour and its productivity level. Specifically, this paper focuses on the impact of highly skilled labour on productivity levels in sub-sectors of the NKEAs. Highly skilled labour consists of labour from the managerial and professional category, and, semi-skilled labour is the technical and supervisory category. This study utilizes data from Industrial Manufacturing Survey published by the Department of Statistics Malaysia, covering the period from 1985 to 2010. The results show that highly-skilled labour contributes significantly to the productivity of the overall NKEAs, and each sub-sector of the NKEA, except palm oil. Under the NKEAs sub-sectors, it shows only petroleum has a significant contribution to the productivity level both in the managerial and professional category also, technical and supervisory labour. Meanwhile, in the electrical and electronics industry, only managerial and professional labour has contributed significantly. However, in palm oil industry, unskilled labour has a significant contribution to the productivity level. In addition, this study also finds that capital intensity is important in affecting the productivity of the NKEAs sub sectors as well as the productivity of the manufacturing sector.

Keywords High skilled labour, labour productivity, National Key Economic Areas

INTRODUCTION

The rapid growth of the manufacturing sector in Malaysia has spurred development of the economy, as the sector is an important contributor to the Gross Domestic Product (GDP), employment and foreign exchange. In view of that, developing and ensuring the continued growth of the manufacturing sector is one of the main agenda for Malaysia. One notable approach to accelerate the growth of this sector is through increased productivity. Increase in labour productivity allows more output production by using the same amount of labour input. High labour productivity in the manufacturing sector will facilitate growth and development of a country's economy. Furthermore, to achieve a developed nation status, productivity must increase which is evident in developed countries such as Finland (5.5 percent), United States (4.3 percent), Sweden (4.3 percent) and the United Kingdom (3.4 percent), all of which recorded high average rate of annual productivity growth over the past thirty years. In fact, Taiwan and Singapore also registered high average growth ratesat6.1 percent and 4.1 percent, respectively (Bureau of Labour Statistics, 2011). Therefore, in order for Malaysia to achieve the targeted developed nation status by 2020, it must strive for continuous improvement in its labour productivity.

Transformation in the manufacturing sector in Malaysia from a labour-intensive sector to the use of modern technology and knowledge-based economy has also taken place. This situation is reflected in the increasing number of high-tech industries in the country and efforts to increase the use of modern technology and knowledge by local firms has been the new norm. The transformation from a labour-intensive industry to a more modern industry profile requires adequate support from highly educated human capital, as well as high skilled labour. The comparison of productivity between the United States and Europe shows the slow productivity growth in Europe is caused by a slower transformation to a knowledge-based economy (Ark, O' Mahony and Timmer, 2008). One of the successful approaches to increase labour productivity is through human capital development. Becker (1964, 1994) and Mincer (1974) state that human capital, referable as the level of education, has a direct relationship with productivity and consequently contributes to economic growth. As a result, the best strategy to increase economic growth is to produce a more highly skilled and educated workforce, particularly in the field of science and technology through the development of human resources.

In Malaysia, this is observable through increased enrolment in the public and private institutions of higher education every year. For example, enrolment at the tertiary level in 2005 was about 732.0 thousand and the total enrolment has increased to 1.026 million in 2009 (Malaysia, 2010). Moreover, Malaysia also sends its students overseas to increase the number of highly educated workers in the country, particularly in critical areas. Based on the research, study by Idris and Rahmah (2010) reveal that effective labour contributes positively to Malaysian economic growth, even though its contribution is smaller as compared to the total labour workforce. The high number of educated workers also facilitates the introduction and adoption of modern technologies in the economy. Thus, accelerates growth through knowledge-based economy. The statistics released by the Department of Statistics show the number of highly skilled workers employed in the management and professional, as well as technical and supervision levels in the manufacturing sector in Malaysia is growing every year. Labours in both job categories generally have education ranging from certificates to doctorate level. In 2008, a total of 347.6 thousand skilled workers were employed in the manufacturing sector compared to only 63.8 thousand of them in 1985 (DOS, various years).

While there has been an increase in the number of high-level labours in the manufacturing sector, the percentage of workers in this category is still low compared to the total manufacturing workforce. For instance, in 2008, only 19.6 percent of total employees of the manufacturing sector are skilled workers. This percentage was lower for the year 1985 and 1995, which is at 13.4 per cent and 13.9 per cent respectively (DOS, various years).In this regard, this paper aims to examine the impact of highly skilled workers on the productivity of labour in the sub sectors of national key economic areas (NKEAs) of the manufacturing sector in Malaysia. The analysis in this paper focuses on the three sub-sectors that have been identified under NKEAs sector by the Economic Transformation Program (ETP). They are sub sector of electrical and electronics, petroleum and palm oil industries. This study expects highly skilled workers have a positive impact on the productivity of labour as these three sub sectors of NKEAs contribute to the performance of manufacturing sector and growth of the Malaysian economy as well.

The rest of this paper is organized as follows. Section 2 provides the review of the manufacturing sector. Section 3 discusses the literature review of the subject matter. Section 4 structures the methodology, which consists of model estimation and sources of data. Section 5 analyzes the findings of the study. Section 6 finishes with the conclusions.

REVIEW OF THE MANUFACTURING SECTOR

The planned development of the manufacturing sector in Malaysia began after independence with the strategic focus on import substitution industrialisation. This sector was emphasised in order to diversify the country's economic activity, which was at the time still strongly dependent on agriculture and mining, particularly on rubber and tin. The introduction of the New Economic Policy (NEP) in 1971 with the aim of reducing the income gap among the people and eradicating poverty has identified the manufacturing sector as among the main catalysts for the success of this policy. The focus of the strategy was on export-oriented manufacturing activities to generate national income. However, the manufacturing sector's contribution to the GDP was still small at around 18 percent at the end of the 1970s. The heavy and high-tech industries development phase in this country started with the establishment of HICOM in 1980 and the introduction of the national industrial policy. In achieving these goals, the Government has been directly involved in the planning, implementing, funding and managing of the heavy industries as there were constraints faced by the private sector to meet the high capital investment. The strategy implemented was also a form of import substitution, but focusing more on high-value products such as vehicles, steel and cement.

Despite the increase in the overall contribution of manufacturing sector to the national economy, structural weaknesses still exist in this sector. The country's manufacturing sector was still limited mostly to manufacturing activities focusing on the production of electrical and electronic goods, textiles, basic machinery and communications equipment. Malaysia's exports of manufactured goods were also still very much dependent on certain industries such as electric and electronics and textiles. Many industries have also low added value because most of them were focusing on assembling activities. To improve this situation, the Industrial Master Plan (PIP I) was launched in 1986. The strategies emphasised for the success of the PIP I was through the development of small and medium industries, shifting to high technology and skilled human capital development. The implementation of PIP allowed the manufacturing sector to grow rapidly, resulting in Malaysia being listed among the new industrialised countries and ranked among countries dubbed as the *East Asian Miracle* (World Bank, 1993).

Malaysian industrial development planning and improvement of the dynamic nature of industrial policy was conducted in accordance with the current challenges. This was reflected through new policies and strategies such as the PIP 2, which was launched in 1996 with the primary objectives of increasing productivity, creating linkages between industries, use of information technology, enhancing research and development, as well as to produce more knowledge workers. However, the Southeast Asian financial crisis in 1997-1998 affected the country's industrial sector. Growth in the manufacturing sector in 1997 and 1998 had decreased, as a result of the financial crisis. In 1998, manufacturing output had declined by 13.4 percent (Malaysia 2001). The Government then introduced the PIP 3 (2006-2020), which was a long-term strategy for manufacturing, particularly in facing the challenges of globalisation and economic liberalisation.

The influence of the manufacturing sector on the economy increased due to the impact of the plans implemented. This is reflected in the increased contribution of the manufacturing sector to the GDP. In 1970, the manufacturing sector accounted for only 12 percent of GDP, the nation's third largest sector after the services sector (38 percent) and agriculture (27 percent). In 1990, due to strategies implemented under the PIP 1, the manufacturing sector recorded a total output value of RM28.847 billion (MITI, 1996). This rapid growth of manufacturing sector enabled the sector to improve its contribution to the GDP to 26 percent that year. The importance of manufacturing to the economy was reflected in its role as the second most important sector in the economy, overtaking the agriculture sector. The value of manufacturing production in

2009 was RM138.809 billion with a share of GDP recorded at 27 percent as compared to only 8 percent by the agriculture sector (Malaysia, 2010).

The country's dependency on electrical and electronics industry in generating export earnings are so significant given the industries contribution to total exports of the overall manufacturing sector. The export value of electrical and electronic goods represented 53 percent of total exports for the year 2009. Exports of petroleum-based products accounted for 5.8 percent of total exports, while exports of food, beverages and tobacco products represented 4 percent. Chemical goods (chemical and plastic products)were the second most important export of manufactured goods exports, contributing 22 percent. The manufacturing sector was also important in providing employment opportunities. In 2009, a total of 3.209 million were employed in this sector, representing 28 percent of total employment (Malaysia, 2010).

In general, Table 1 shows that the manufacturing labour productivity increased during the study period from 1985 to 2008. In 1985, the number of workers in the manufacturing sector was about 476260 people with labour productivity level at RM25439and this further increased to RM88730 in 2008. The increase in productivity was in line with the increase in value added and manufacturing labours. The average annual growth rate of manufacturing productivity from 1985 to 2008 was at 5.21 percent. The Malaysian Productivity Corporation (2010)reported that the productivity of the manufacturing sector in Malaysia grew at 6.3 percent in 2008.This growth rate was higher than the productivity growth of 18 developed countries where South Korea, the United States, Norway, Belgium and the United Kingdom recorded productivity growth of only between 0.3 percent and 1.2 percent, while 12 other countries registered negative productivity growth. In this report, Malaysian manufacturing sector productivity is measured by value added per labour. Meanwhile, for other countries productivity refers to the manufacturing output of per hour worked.

Table 1 Labour Productivity of the Manufacturing Sector, 1985-2008

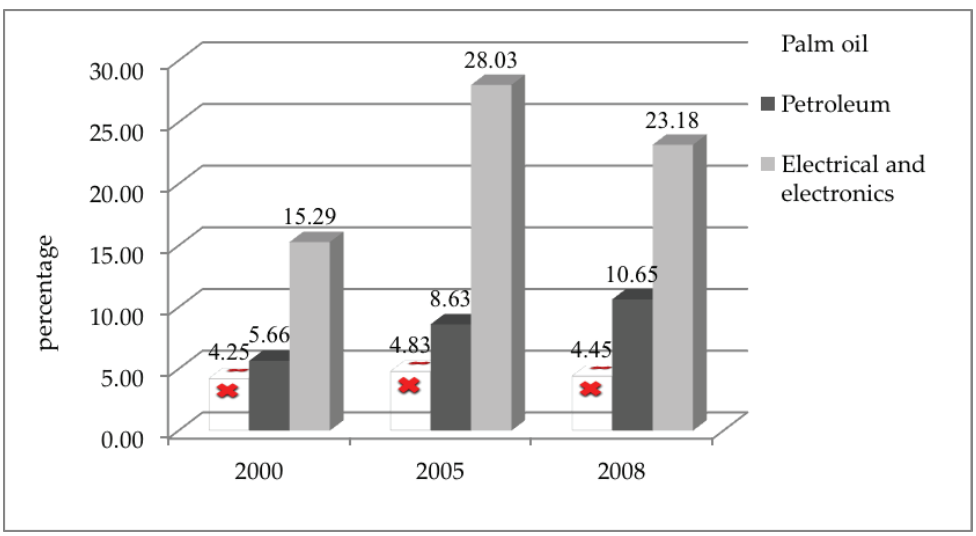
Year	Added value (RM'000) (current price)	Number of labour	Labour productivity (RM)
1985	12115431	476260	25439
1990	24529564	844733	29038
1995	59629113	1389418	42917
2000	88240321	1574797	56032
2005	118210257	1675163	70566
2008	157170339	1771331	88730

Source: calculated from Annual Manufacturing Industry Survey Report, Department of Statistics (various years).

The ETP is part of the Government's initiatives to spur economic growth with the aim to become a high-income and sustainable country by the year

2020. To realise this program, ETP focuses on key growth stimulant or major economic areas of the country (NKEAs) to ensure that the gross national income (GNI) increases at an annual real growth rate of 6 percent between 2011 and 2020. The ETP focuses on the 12 NKEAs announced in the Tenth Malaysia Plan and these NKEAs are expected to contribute significantly to Malaysian economic performance. The 12 NKEAs are greater Kuala Lumpur, oil, gas and energy; financial services; wholesale and retail; palm oil; tourism; electrical and electronic; business services, communication content and infrastructure; education; agriculture; and health care. Of the 12 NKEAs above, 11 of the fields are of industries, while the greater Kuala Lumpur is a geographical territory.

Based on the expectations of the ETP, the oil, gas and energy sector will continue to be the largest sector in the economy by 2020, but the size of its contribution to the economy is expected to narrow because of rapid growth in other sectors such as financial services and palm oil. Wholesale and retail sector will also expand significantly to become the fourth largest sector in the economy. Electrical and electronics industry is expected to continue to contribute significantly at the targeted 7 percent to the national income in 2020. Three sub-industries in the manufacturing sectors are expected to benefit directly due to the implementation of the NKEAs. The sub-industries are the electrical and electronic, petroleum and palm oil sectors.



Source: DOS, various years.

Figure 1 Percentage of Managerial and Professional Labour for Palm Oil, Petroleum, and, Electrical and Electronics Sub-Sectors

Figure 1 shows the percentage of management and professional labour to total labour for the three sub-sectors of NKEAs. Based on the figure, the percentage of management and professional workers to total workforce in the palm oil industry is smaller than the other two sub-sectors. In 2000, only 4.25

per cent of the employees in the palm oil industry are from the management and professional group as compared to 5.66 per cent in the electrical and electronics, and 15.29 per cent in the petroleum industry. The number of management and professional labour increased significantly for electrical and electronics, and petroleum sectors in 2008, in which these groups represent 10.65 per cent and 23.18 per cent, respectively of the total workforce. Meanwhile, the palm oil industry only recorded 4.45 per cent of management and professional workforce in the same year (DOS, various years). This exhibits the industry that is based on agricultural raw materials and other raw materials is more likely to have workers with low skills.

LITERATURE REVIEW

The importance of human capital in economic development was proposed first by Shultz (1961), in an article titled *Investment in human capital* which led to the introduction of the human capital theory. The theory has furthered been developed by Becker (1964, 1994) through the publication of *Human capital: A theoretical and empirical analysis to special reference to education*. Apart from that, other economists such as Mincer (1976) also extend this theory. Human capital theory, in principle, suggests that investments in human capital, especially education and training, can improve labour productivity and efficiency, as a result, contributes to economic growth. In general, human capital can also be defined as the characteristics possessed by workers, which make them more productive. However, unlike physical capital, human capital is not easily transferred from one person to another. Nevertheless, human capital can be developed through investments in education, training before work, job training, health care, immigration and the search for information that can improve the living standard of individuals. Investment in education and training is one of the most important human capital investments as evidenced by Benhabib and Spiegel (1994) and Almedia and Carneiro (2008).

Since productivity is one of the indicators that measure the competitiveness of an economy, sector and organisation, many studies have been conducted so as to identify factors that affect the productivity of workers, including the influence and relationship of human capital on productivity. Aggrey *et al.* (2010) carry out a study on the relationship and the importance of human capital in explaining the productivity of workers in three countries, namely Kenya, Uganda and Tanzania. This study is conducted using the firm level panel data and generalized least squares method. Human capital variables-the ratio of skilled workers, workers' average years of education, training and management education levels are used in this study. Results show different findings among the countries where the ratio of skilled workers and the average years of education have positive relationship with the productivity of workers in Uganda. In Tanzania, productivity is affected by training, proportion of skilled workers and education level of managers. As for Kenya, the average years of education and training is the important factor affecting productivity.

Ballot *et al.* (2001) analyze the impact of human capital and technological capital on samples of large firms in France and Sweden. Technological capital is measured by total research and development (R&D), and human capital by training expenses of a firm. The study also attempts to see whether there is a positive relationship between training and R&D. The findings prove that training and R&D are significant in affecting the productivity of firms in both countries, though their influences are different. However, this study could not confirm if there is a connection between training with R&D, except for the training of managers and engineers in France.

Mahmood's (2008) study is similar to Ballot *et al.* (2001). The study attempts to identify the relationship between the productivity of workers in small and medium enterprises (SMEs) manufacturing firms in Australia. In general, the study reveals that the productivity level of SMEs in Australia has increased in 1999-2000 as compared to 1994-1995 covering all industry classifications. There are many factors that explain the productivity improvements including increased competitive pressure, as a result, of an open economy; the introduction of new technologies; and changes in management. Employment level in the manufacturing sector grew during the same time-period, but the amount of increment varied depending on the type of industries. The correlation test between productivity growth and employment level fail to show a significant relationship between these factors although the relationship is positive.

Another study on the productivity of the Japanese software industry was done by Minetaki and Takemura (2010). The study examined the impact of human capital - the percentage of workers with the approval of the *Information Technology Engineers Examination* - on the firms' performance. The study was conducted due to the problem that the software industry in Japan was not very competitive compared to other producing countries such as India. In general, the Japanese software industry structure consisting of several large contractor companies such as Fujitsu, NEC and Hitachi, and many sub-contractor companies supplying computer hardware and software, with contractor labour productivity (6.415) exceeding the sub-contractor labour productivity by nearly twice (3.722). Cobb-Douglas production function and data from the *Survey of Companies Information Service 2008* are used in this study with the focus on studying the effects of workers with qualifications in the know-how software development field in improving the value-added for the industry. The research has also shown that knowledgeable human capital in the field of software development has a significant relationship to improving the value added of the sub-contractor firms, while the opposite was true for the contractor firms. Based on this empirical evidence, the sub-contractor firms' productivity level can be improved by recruiting more knowledgeable workers in the field of software development.

Food-based industries are among the important industries in Iran. Study by Afrooz et al. (2010) confirms that human capital is the most important factor in affecting the productivity of food-based manufacturing workers in Iran. This study uses the ratio of educated man-power and the ratio of skilled employment to total employment as a proxy of human capital. Cobb-Douglas production function is used in describing the relationship between the independent variables and the dependent variable. In addition to human capital, the capital-labour ratio also showed positive and significant relationship with productivity.

THE METHODOLOGY

To study the influence of human capital on the productivity of the manufacturing sector, this study employs the Cobb-Douglas production function in which human capital related variables will be used in the equation. The method used is as described by Afrooz *et al.* (2010) as follows:

$$Y = AK^{\alpha}L^{(1-\alpha)}\varepsilon \qquad (1)$$

Where, Y is gross output, K is capital, L is total labour, A is the technical change/technology and ε is an error term. When the above equation is divided by the total labour, the following equation will be formed, where y is the labour productivity (Y/L), and k represents the capitallabour ratio (K/L).

$$y = Ak^{\alpha(1-\alpha)}\varepsilon \qquad (2)$$

Assuming constant returns to scale $(a + \beta = 1)$, equation (2) above can be rewritten as follows:

$$y = Ak^{\alpha(\beta)}\varepsilon \qquad (3)$$

The symbol A in the above equation refers to technology or total factor productivity. Therefore, A can also be written as:

$$A = A_0 e^{\theta + \lambda(\chi i)} \qquad (4)$$

Where θ is the time effect and x_i is the factor that affects productivity. By substituting equation (4) into equation (3) the following equation is obtained:

$$y = A_0 e^{\theta + \lambda(\chi i)} k^{\alpha} e^{\varepsilon} \qquad (5)$$

Equation (5) can then be rewritten in logarithmic form as:

$$\ln y = \ln A_0 + \alpha \ln k + \theta + \lambda(xi) + \varepsilon \qquad (6)$$

Equation (6) can also be developed as follows:

$$\ln y = \alpha_0 + \alpha_1 \ln k + \theta + \lambda_1 x_1 + \lambda_2 x_2 + .. + \lambda_m x_m + \varepsilon \qquad (7)$$

Based on equation (7) above, $x_1 + x_2 +..+ x_m$ are the various factors that can affect productivity, including the human capital variables such as level of education and skill levels of labour. Based on the above equation, the basic model developed for studying the influence of human capital on labour productivity is as follows:

$$\text{Ln } Y/L = \beta_0 + \ln\beta_1 K/L + \ln\beta_2 PROF + \ln\beta_3 TECH + \ln\beta_4 OTH + \varepsilon \qquad (8)$$

$$i = 1,\ldots n; \qquad t = 1,\ldots t$$

where:

Y/L : labour productivity
K/L : capital labour ratio
PROF : labour of managerialand professional category
TECH : labour oftechnicalandsupervision category
OTH : labour of other employment category
ε : an error term

Based on the equation (8), this study employs two analysis as well to examine the impact of labour productivity of sub-sector under NKEAs and labour productivity of the NKEAs sector. The first analysis is taken place by odinary least square (OLS) methods and the second is panel regression analysis. The model is used to investigate the relationship between labour productivity of the sub-sectors under NKEAs and independent variables.

Sources of Data

This study utilizes data from Industrial Manufacturing Survey (IMS) published by Department of Statistics Economy (DOS). Since the study employs panel regression analysis, this work has to combine data of time series and cross section. The time series covers 26 observations from the period of 1985 to 2010, and the cross section contains three sub-sectors of the NKEAs, namely sub-sector of palm oil, petroleum and electrical and electronics. By utilizing both data, this study classifies an analysis into the impact of labour by skill on the labour productivity of the sub-sector under NKEAs of the manufacturing sector. The classifications of sub-sectors under NKEAsof the manufacturing sector are at three digit-level of the Malaysian Standard Industrial Classification (MSIC).

For the labour productivity measures, the gross output and labour by industry is used. Capital data computed from the value of net fixed assets as at the end of a calendar year (gross fixed asset - depreciation rate + gross fixed capital formation/capital expenditure). The capital consists of building and other construction, machinery equipment, transport equipment, and ICT tools such as computers. The independent variables in this study are capital-labour ratio (K/L) and labour by skill. This study used total labour by each category of employment in each sub-sector of of the NKEA's. The variable of skill labour is divided into three categories. These are labour by category of managerial and professional (PROF), category of technical and supervisory (ST), and category of other employment groups (OTH). The skilled labour is presented by managerial and professional, semi-skilled labour by technical and supervisory category, while other employment category represents unskilled labour.

RESULTS AND DISCUSSION

Descriptive Statistics and Variables

Table 2 shows descriptive statistics of the explanatory variables and dependent variable. The table shows the mean value, standard deviation, minimum and maximum value for all variables examined in this study. Based on the table, the mean value for labour productivity is found larger in the petroleum sub-sector followed by palm oil and electrical and electronics. Petroleum as heavy industries indicated a capital-labour ratio relatively larger compared to palm oil and electrical and electronics industry. From the table, the mean value of capital intensity of electrical and electronics sub-sector is at only 54.30. It reflects that this industry is labour intensive, whereby the mean value of capital intensity is relatively smaller than other two sub-sectors. However, both sub-sectors of electrical and electronics and palm oil have shown a mean value for high skilled labour (PROF) which is relatively small. Only the petroleum shows a highly skilled labour of a mean value at about 0.21, while electrical and electronics, and palm oil at less than 0.1. This highlights the proportion of managerial and professional labour is relatively small in each sub-sectors of NKEA's. The similar trend can also found for semi-skilled labour (TECH). This type of labour is relatively larger for petroleum sub-sector which is at 0.28, while another two sub-sectors accounted for 0.13 and 0.14, respectively. However, unskilled labour category (OTH) is relatively smaller for petroleum at 0.51 compared to electrical and electronics, and palm oil which accounts for more than 0.80, respectively. The proportion of other employment labour is the largest among the NKEA's sub-sectors.

Table 2 Descriptive Statistics of the Variables

Electrical and electronics				
Variable	mean	min	max	standard deviation
Y/L	49860.42	20633.00	84519.00	22114.93
K/L	54.30	19.46	83.89	25.00
PROF	0.06	0.03	0.11	0.02
TECH	0.13	0.10	0.16	0.02
OTH	0.81	0.74	0.86	0.04
Petroleum				

Variable	mean	min	max	standard deviation
Y/L	1270516.00	344594.00	4692996.00	1266353.00
K/L	6256.98	765.52	100574.0	20121.04
PROF	0.21	0.15	0.33	0.05
TECH	0.28	0.15	0.45	0.08
OTH	0.51	0.21	0.69	0.12

Palm oil

Variable	mean	min	max	standard deviation
Y/L	77259.39	94.45	132928.00	31780.85
K/L	112.02	72.99	173.42	28.55
PROF	0.05	0.04	0.05	0.003
TECH	0.14	0.11	0.17	0.01
OTH	0.81	0.78	0.84	0.01

Table 3 and 4 present the findings of the study, respectively by each sub-sectors of the NKEAs and overall sub-sectors of the NKEAs. The results for both equations are fitted with the model if the variance inflation factor (VIF) value is less than 10, which indicates that all the explanatory variables are free from the problem of multi collinearity. The test of multi collinearity is to verify that each regress or is not highly correlated. In addition, the White test also exhibits that each explanatory variable and dependent variable in the model has no disturbance term. This is to confirm that all the variables are normally distributed and free from heteroscedasticity. Both equations show the test of Durbin-Watson values are without autocorrelation problem (see Table 3 and Table 4). In addition, this study continues with the Breusch-Godfrey procedures in order to confirm the influence of autocorrelation does not exist.

Table 3 shows the findings of the three sub-sectors of NKEAs which are expected to benefit directly from the ETP program – for example, the electrical and electronics, petroleum and palm oil sub-sectors. For each sub-sector, the R-squared value for electrical and electronic sub-sector is reported at 0.951, which means that 95.1 per cent of the variables estimated in this study are explained by the explanatory variables. The adjusted R-squared is reported at0.941, which accounts for 94.1 per cent. The R-squared value for sub-sector of petroleum accounted for 0.753, and the adjusted R-squared indicated at 0.705. For palm oil, the R-squared value is at 0.889, and the adjusted R-squared value at 0.868 (see Table 3). The results indicate that all sub-sectors of the NKEAs have more than 70 per cent of the variation in the dependent variable can be explained by the determined independent variables.

Based on the findings from Table 3, the result shows capital-labour ratio for three sub-sectors is statistically significant with a positive sign.All sub-sectors of NKEAs are statistically significant at 1 per cent level of significance. This indicates that an increase of 1 per cent in the capital-labour ratio is expected to result in an increase in productivity by 6.10, 2.58 and 6.25 per cent for electrical and electronics, petroleum and palm oil sub-sectors, respectively. This shows that capital labour ratio has a significance influence on the productivity level of the three sub-sectors of NKEAs.

Furthermore, as expected the managerial and professionals employment category shows a positive sign with labour productivity. The findings show that this variable has statistically significant with a positive relationship of labour productivity for sub-sector of electrical and electronics, and, petroleum. This type of employment contributes to an increase in labour productivity level for these two sub-sectors. An increase of 1 per cent in the number of labour by skill of managerial and professional labour contributes to the increase in productivity by 0.003 and 13.73 per cent for electrical and electronics, and petroleum sub-sectors, respectively. It should be noted that high-skilled labour has significant influence on the productivity level for these sub-sectors. However, the result is not significant for the palm oil sub-sector.

For category of technical and supervisory labour, only sub-sectors of petroleum show that this variable is statistically significant at 5 per cent level of significance, but it has a negative relationship with the productivity level. Thus, it is expected that an increase of 1 per cent in labour of this category will result in a decline of 6.11 per cent in the productivity of labour in petroleum industry. Furthermore, this variable is obtained not statistically significant for the sub-sector of electrical and electronics, and, palm oil. This result implies that petroleum industry is capital intensive, whereby an increase in the number of managerial and professional labour will increase the productivity of the sub-sector.

Table 3 Results of the Study

Variables	Electrical and electronics	Petroleum	Palm oil
Constant	-109.134 (-2.692)***	1390.718 (0.499)	-823.270 (-1.259)
KL	6.106 (6.533)***	2.583 (2.830)***	6.255 (3.213)***
PROF	0.003 (2.686)***	13.736 (3.342)***	16313.750 (1.646)^{ns}
ST	-0.001 (-0.388)^{ns}	-6.111 (-2.006)**	-1659.086 (-0.731)^{ns}
OTH	0.0001 (-0.130)^{ns}	-2.710 (-3.985)***	0.016 (2.982)***
R-squared	0.951	0.753	0.889
Adjusted R-squared	0.941	0.705	0.868
F-statistics	102.251	16.007	42.306
p-value	0.000	0.000	0.000
Number of observations	26	26	26

DW statistics	1.183	1.852	1.144
VIF test	7.94	2.01	2.55
White test (Obs*R-squared)	5.46	8.86	5.76

Note: i. figure in parentheses is t value of β coefficient.
ii. *** significant at 1 percent level of significance.
** significant at 5 percent level of significance.
* significant at 10 percent level of significance.
ns not significant.

The finding for other categories of employment show a significant result of 1 per cent level of significance for petroleum and palm oil sub-sectors, but it has a negative sign for the petroleum. The finding shows this category of employment has a positive effect on labour productivity for the palm oil sub-sector, but it has a negative outcome in the petroleum sub-sector. The nature of palm oil industry relies on the unskilled labour which revealed that the result obtained from this study is quite relevant. For the petroleum sub-sector, an increase of labour for this type category of employment will have a negative effect on labour productivity for this industry. This finding also supports the significant result of capital-labour ratio, which indicates that petroleum industry is capital intensive and relies more on the highly skilled workers, especially the managerial and professional group.

In contrast, the palm oil sub-sector is found to be different from the estimation results for petroleum and electrical and electronics sub-sectors of NKEAs. This is probably due to the characteristics of the palm oil sub-sector, which is an agro-based industry and has a labour-intensive nature. Therefore, the result shows that only the employment category has a significant relationship with the level of productivity for this sub-sector, while the management and professional, and, technical and supervision labour variables are insignificant.

Table 4 Results of the NKEAs

Variables	Coefficient value
C	5.585 (4.952)***
K/L	0.234 (2.032)**
PROF	5.703 (3.835)***
ST	1.143 (6.643)***
OTH	-1.370 (-3.579)***

R-Squared	0.740
F-Statistic	47.721
ϱ-value	0.000
DW-statistics	2.097
VIF value	3.847
White test(Obs*R-squared)	10.097
No of observations	72
Fixed effect cross section	
Electrical and electronics	-0.071
Petroleum	0.038
Palm oil	0.033

Notes: number in ( ) is standardized errors respectively. ***, ** and * denoted level of significant at the 1%, 5%, and 10%, respectively.

Table 4 shows the results of NKEAs based on the estimation of the panel regression analysis. The random effect model has been selected based on the results of panel regression test (see Appendix 1). All variables have been tested for the stationary test of level. The unit root test of the Philips Peron shows that all variables are stationary at 1 percent level of significant at the first-order difference. Based on the table, the variance inflation factor (VIF) value for the model is less than 5.This indicates that all the explanatory variables are free from the multi-collinearity problem. The model is free from the multi-collinearity problem to verify that each regress or is not highly correlated. The model also free from the autocorrelation problem, which is Durbin Watson value of the model is at 2.097 and AR(1) p value is 0.00. The result of the model is presented in the equation below as follows:

$$K/L = 5.585 + 0.234K/L + 5.703PROF + 1.143ST - 1.370OTH$$

From the result, the R squared value registered at 0.740. This shows that all explanatory variables explain about 74.0 per cent the performance of productivity level of the NKEAs sector during the study. The result shows that the variable of managerial and professional labour and technical and supervisory labour has positively and statistically significant at 1 per cent level of significance, while capital intensity has positively and statistically significant at 5 per cent level of significance. The findings show that an increase of 1 per cent in capital intensity, managerial and professional labour and technical and supervisory labour, the level of productivity of the NKEAs will increase by 0.234, 5.03 and 1.143 per cent respectively. On the other hand, the variable of other employment (OTH) is significant; but it has a negative impact on the productivity of the NKEAs sector.

The findings of all models show that the managerialand professional employment category is an important factor in affecting the productivity of the NKEAs sub-sectors and the overall sub-sectors of the NKEAs, except for the palm oil industry. The technical and supervisory category as positive influence on labour productivity for the petroleum sub-sector, although a negative impact is obtained for electrical and electronics and palm oil sub-sectors. The estimation for NKEAs sector, however, has a significant relationship with the dependent variable. This finding is quite consistent with the theory of human capital which states that skilled workers contribute to higher productivity levels. The managerial and professional group, which represents highly skilled labour, shows a significant result with positive influence on the productivity level.

In Malaysia, employees of the technical and supervisory categoryare in the general workers' group who are at the education level ranging from certificate level to diploma. Malaysian Skills Certificate (SKM) is one indicator that can be used to assess the skill level of an employee. Certificate Level 1 is the most basic level of skill while the Malaysian Skills Advanced Diploma is the highest level of skill under the jurisdiction of the Department of Skill Development (JPK). From the JPK report (2009), the department has awarded a total of 91,526 Malaysian Skills Certificates. Of this amount, 42,262 certificates awarded were SKM Level 1, and 35,098 were SKM Level 2 certificates (Pemandu, 2011). Both SKM levels represent 84 percent of the overall skill certificates awarded. Based on these figures, it is clear that the talents produced are mostly with most basic skills, i.e. at the level of SKM Level 1 and Level 2. Skill level is more operations and production oriented, and this may reduce their influence on the productivity of the organisation represented.

CONCLUSIONS

The sub sector of NKEA is an important sector for the performance of the Malaysian economy. Under the Economic Transformation Program (ETP), it clearly shows that sub sector of NKEA plays an important role among the primary sources of national income in line with the aspiration to position Malaysia as a high-income country by 2020. In addition, as the process of globalisation and trade liberalisation requires local firms especially in the manufacturing sector to improve their competitiveness as well as to face competition from foreign firms both in domestic and overseas markets.

From this study, we are able to highlight that one of the measures that can be taken to improve competitiveness is to increase highly-skilled workers, in terms of number and percentage of the NKEA's sub sector, and generally for the manufacturing sector as well. Based on the finding from this study, it shows that human capital in the context of highly-skilled workers is able to contribute positively to the productivity of the NKEA's sub-sector and an overall NKEA's sector. This study suggests that this category of labour has to be increased since the percentage of skilled workers of the manufacturing sector is below 20 per cent over the years. Although it has increased in terms of number, the proportion of skilled worker out of total employees of the manufacturing sector remains unchanged. As the government plans to maximize the potential of NKEA's sector in terms of productivity, an increase of skilled worker has become an important agenda in our economy.

Although workers in the technical and supervisorycategory is not significant and has a negative influence on the level of labour productivity in the NKEA's sub sectors, except for petroleum, this category of worker actually supports the performance of NKEA's sector. Thus, this study suggests some efforts must be undertaken to improve the contribution of this worker. It can be done through training and retraining, for instance, those who are holding a certificate level of level 1 and level 2 need to enhance their certification level to a higher level (Level 3 and 4). These levels of certificates are actually proposed to this type of labour category by Department of Skill Development (JPK). The enhancement in the certificate level is expected to increase the productivity of labour of the NKEA's sector.

The finding also indicated that capital intensity is also important in affecting the productivity of the NKEA's sector and the manufacturing sector as well. It has to be noted that capital intensity is intensely related to highly skilled job category, as they are required to deal with new machines that make use of new technology. The result also highlights the NKEA's sector which is capital oriented, especially for the sub sector that utilize capital more intensively. This can be seen in all sub sectors of NKEA, especially for sub sector of petroleum. Therefore, the need to increase labour in the highly skilled job category in terms of number and enhance them in terms of capability should be seen as crucial to overcome the problem of competitiveness in this age of globalization. This needs an effective plan in order to make sure all players in the economy are more proactive in order to become more productive.

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Appendix 1 Test for the Model Selections

	Pooled least squared	Fixed effect	Random effect
Wald test	Pooled vs Fixed reject H_o (F critical > F table)		
F-Wald test at 1%	13.42	5.20	
Hausman test		Random vs Fixed do not reject H_o (χ^2 critical < χ^2 table)	
χ^2 test at 1%		5.14	13.28
LM test		Pooled vs Random do not reject H_o (χ^2 critical < χ^2 table)	
χ^2 test at 1%		4.34 11.35	

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