An Analysis of Manpower Requirements of the Manufacturing Sector in Malaysia

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Abstract

Malaysia's manufacturing sector actually has experienced deteriorating in employment in terms of percentage and number. An employment growth and number of person employed in this sector is decreased compared to other economic sectors. The decreased was relied on the two prominent factors. Firstly, the manufacturing sector has no more advantages of labour abundance which what was experienced in decade of 1970s and 1980s. This reflects in the particular industries that are relying on the foreign labour as to resolve problem of shortage in local labour. Secondly, technological change attributes to investment in capital, which is technology of machinery and equipment has replaced labour usage as well. Both factors have mentioned above highlight employment deteriorating in the manufacturing sector. More essential, the need of the future manpower of the manufacturing sector has changed in terms of number of person required and specifically skills of manpower needed. This issue motivates this paper to project the manpower requirement of Malaysia's manufacturing sector in such a way to minimize the mismatch problem between labour supply and labour demand from industries. More meaningful is to sustain productivity and output growth of the manufacturing sector. The finding from this study is able to give direction on the manpower requirements of the manufacturing sector in the short coming years.

Keywords: Manpower requirements, employment, skills, manufacturing Sector

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1. Giriş

Bugün hayatın her alanında özellikle ekonominin her sektöründe yoğun bir rekabet

Introduction

The continuous process of rising living standard experienced in Malaysia since the 1970s are largely attributed to the accumulation of physical and human capital as well as technological progress. The country has shifted from agricultural based to manufacturing and today, the main contribution to its economy is services sector. In sustaining these progressive growth, it is vitally important for Malaysia to focus on its effective manpower planning, that is putting right number of people, right kind of people at the right place, right time, doing the right things for which they are suited for the achievement of goals in the industries. This is one of the key functions in effective utilization of the country's existing human resources as it boost higher productivity as a result of minimum wastage of time, money, resources and energies.

The globalization and rapid change in technology has transformed demand for labour entirely. In the face of international competitive market, it should be formulated economic strategies in order to maintain the competitiveness of the country. Increased competitiveness depends not only on physical inputs such as capital and labor, but it also depends on the productivity of the labor. In efforts to get to the advanced industrial countries by 2020, labor quality and marketability of all the skills that are required.

The manufacturing sector has contributed significantly to growth of the Malaysian economy, though its current contribution however relatively smaller compared to services sector. Until October 2012, the value added of the manufacturing sector increased by 5.2%, an increase of RM 25.6 billion in the first ten months in 2012. The number of manpower in this sector has increased by 1.7%, an increase of 16,867 persons to 1,024,352 persons (Malaysia, 2013). For the same period, the average sales value per employee has increased by 3.5%, where the increase is a positive sign of economic growth. Despite the slower growth as mentioned above, the manufacturing sector is still needed a larger workforce, especially for unskilled category approximately 34%, while skilled category comprise of 26%. The overall of contribution of the total employment in the manufacturing sector is about 17.8% (Malaysia, 2013). Given the significant contribution of the manufacturing sector to economic growth, it is desirable that the manufacturing sector is supplied with sufficient manpower requirements, so that it can continuously drive the economy. But in ensuring that the needs sufficient manpower needed in

every sector, Malaysia is still facing various issues in the labour market, particularly unemployment and labour mismatch. In addition, increasing demand for manpower requirements is a major challenge to the Malaysia education system.

The elasticity of labour demand is a substantial tool in manpower requirement forecasts. Indeed, the initial labour demand model includes three fundamental factors, namely output, price of labour (wage rate) and price of capital (interest rate). Demand for labour relies on changes in wage rate and productivity. When there are changes in wage rate, the producer attempt to adjust demand for labour due to cost of production increased. This situation needs observation both in short term and long term period. Unemployment is a problem that often goes by every country. The unemployment problem may arise due to changes in production techniques used by employers from the labor-intensive to capital-intensive and technology and mismatch problem. In an uncertain labor market that has created a tight labor market, to get a job is very competitive among graduates. In turn, it has increased the unemployment rate in 2012, the number of unemployed workers in Malaysia is about 396,300 people (LFS, 2013). Therefore, the suitable manpower planning must be implemented to ensure that the labour supply at this sector has always been sufficient in the future.

An employability skill is an importance skill that is required by the employer in the manufacturing industry, especially for a new employee (Rasul et al, 2009). Technical students in Malaysia has more than sufficient technical skills, but some employers feel less satisfied, especially in terms of motivational skills, communication, interpersonal skills, critical thinking, problem solving and entrepreneurial skills that are part of the employability skills that are not controlled in circles this technical graduates (Ramlee, 2002).

Data and information on the labor market and manpower projection needs of the economy and employment by sector is very important in planning and policy formulation and economic development strategies, particularly human capital development planning. However, the issue of lack of information on labor market demand has also been a main issue for the policy maker discussion. Where it is one of the major challenges faced by institutions of higher education, particularly for the provision of skills training in education planning and training (Siti Nor Habibah et al, 2012). These challenges include determining the courses offered and the number of students required being consistent with labour market needs.

Against this background, the objective of this paper is to forecast the demand for manpower in manufacturing sector using Malaysia's input-output 2010. By observing the analysis of labour demand in short term, this study is able to contribute in policy recommendations of the manpower planning. In addition, the actual number of employment published by Labour Force Survey is compared with the projected manpower for the year 2020 as to validate the manpower forecast of the manufacturing sector.

This paper is structured as follows. Section 2 debates on the past studies' findings on the manpower requirements. Section 3 presents manpower planning and employment classification used in this study. Section 4 outlines the methodology used to project the manpower planning and sources of data. Section 5 discusses the findings of this study, and finally, section 5 proposes some aspects that related to manpower planning should be given emphasize by the employer and government, specifically on training.

Literature Review

The analysis of manpower planning is helpful in projecting future manpower needed due to mismatch problems. In addition, retirement, resignation, retrenchment, discharge, demotion, separation and etc. also create an additional job in labour market. Manpower planning is a logical result to the continuous mismatch in skills between supply of and demand for labour, resulting in persistent increase in unemployment (Hopkins, 2002). Another problem is job-worker mismatch exhibits the inefficiency in resource allocation in the economy. Moreover, the investment in human capital by the labour is not utilized at the maximum level production activity, consequently resulting in the different wages between workers (Badillo & Vila, 2013).

Moreover, manpower planning is an important in the process of achieving economic goals and facilitating growth, workforce needs in various stages of approval and various types of jobs created. The importance of human resource development in Malaysia can be divided into three elements; labor productivity, labor skills to adapt and restructure society (Rahmah & Idris, 2004). The study suggests that the demand for skilled manpower in economic sectors can be reinforced by considering labor skills adjustment. For instance, labor supply should be adapted to the structure of demand employment as this is necessary to avoid the problem of skills mismatch and unemployment problems. In the others words, manpower planning is a process to predict manpower needs in accordance with the requirements of output by sector in the economy.

In the previous study, they forecast the manpower needs in agriculture-based industries from 1997 to 2001 using Manpower Requirement Approach (MRA) (Rahmah & Idris, 2000). The study found that during period, high demands for labor can be seen in wood products and rubber products industries. However, skilled labour such as engineers and technicians are less needed in agriculture-based industries as compared to non-agriculture-based industries. Using similar approach, another study conducted by Zakariah & Siti (1997) showed that the number of people employed in the manufacturing sector for the year 2000 has a large decline and it is likely occurred on technical and professional skilled labour. Although, a variety of programs have designed to drive the skilled manpower imbalance, but there still always be manpower imbalance in the labour market.

The reduction of employment in the manufacturing sector is also demonstrated in a study by Judith (2004) in China. The number of employment estimates was around 98 million in 1995 and it is dropped to 80 million in 2001 and recovering to 83 million in 2002. The study in the United States found that the composition of exports has affected the manufacturing sector manpower by reducing labor demand during the recession in 1991 (LeClair, 2002). In a study of the Mexican manufacturing sector, trend in employment has been declining especially for the export-oriented industries covering the period from 1970 to 1993 (Alarcon & Zepeda, 1998).

Meanwhile, using the same approach, Poo et al (2012) forecast manpower needs in Malaysian manufacturing sector for a different job categories under the Third Industrial Master Plan (IMP3). The study observes that the amount of labor required to produce the same unit of output has declined and growth in output is more rapidly than the growth in employment. This implies an increase in labor productivity in the manufacturing sector and other sectors and a reduction in demand for labour, particularly in high-skilled category. The higher demand for manpower is obtained in industries of machinery, raw materials product and, wood and wood products. Similar study also revealed the sub sector of domestic equipment, sub sector of radio and television and the manufacturing of plastic products is among the three sub sectors that needs higher of manpower requirement (Siti Nor Habibah et al, 2012).

A number of researchers have studied demand for labour and manpower forecats by taking into account an elasticity. A recent study by Akay et al (2013) have utilized panel data at firm level

of six industries from 1991 to 1997, which consists of food, furniture, wood, metal, machinery and textiles. The results showed that elasticity of wage both for skilled and unskilled labour are negative ranging from -0.88 to -0.92 for skilled and from -0.65 to -0.89 for unskilled labour. The long-term demand for skilled and unskilled labour using panel data in Colombia recorded that the output elasticity was 0.89 and 0.76 and the wages elasticity for both categories of labour are -0.42 and -0.65, respectively (Roberts & Skoufias, 1997). Another study estimate only the substitution among white-collar labour, blue collar labour and capital in eighteen industries of the manufacturing sector in Canada from 1962 to 1982 (Betts, 1997). The study obtained that the capital and labour demand by category are complementary skills.

A different dimension of study by Zaleha, Rahmah & Mohd Anuar (2007) attempts to identify the factors that affect demand for high-level manpower requirement consists of professional, skilled workers and managerial workers of the manufacturing sector in Malaysia. The study focused on timber industry, transportation equipment, electrical and electronics, metal and food industries. The results showed that the output level becomes an important factor for the professional and highly-skilled managerial workers in all industries, while wage rate and the price of capital are not significant. This study concludes that the professional and skilled workforce is an important contributor to the increase in output of the manufacturing sector in Malaysia.

Several studies have examined the elasticity of substitution between capital and labor of the manufacturing sector. A higher elasticitiy of substitution between labour and capital may result in a higher level of labour productivity in the steady-state (Klump & de La Grandville, 2000). Further, the substitution of capital-labour elasticity may also implies demand for labour and manpower requirements. In 1969, a study by Thillainathan on the capital-labor elasticity of West Malaysia was recorded positive elasticity, ranging from 0.45 to 1.18. The similar result obtained in a study by Virmani & Hashim (2009) estimates the elasticity of substitution between capital and labour approximately about 0.64. The results show the substitution between both inputs is low in the case of the manufacturing industries in India.

In contrast, the result obtained by Upender (2009) is contradictory with the result acquired by Virmani & Hashim (2009), which found the elasticity of substitution between capital and labor of the manufacturing industries in India is more than unity. A current study by Bishwanath et al (2013) attempt to reconfirm the elasticity of substitution between capital and labor in Indian

manufacturing industries by considering twenty-two industries at two-digit-level indicate that the elasticity of substitution commonly less than one. It shows the elasticity range from 0.54 to 0.97 of the study period from 1980 to 2007.

Considering all of this evidence, it seems that manpower requirements of the manufacturing sector tend to be reduced. Together, these studies indicate that output or labour productivity of the manufacturing sector increased consistently with an increasing forecasts in the workforce particularly, demand for high skilled labour. All of the studies reviewed here support the human capital theory that labour quality, whereby skilled labour ultimately contribute to a larger output or higher productivity of a firm. However, previous published studies are limited to analyse manpower requirements on the forecasting by observing labour demand elasticity or capital-labour elasticity.

3. Manpower Planning and Employment Classification

Over the past decade, there has been a choice of techniques and approaches been used in quantifying manpower labour requirements. The technique of forecasting attempts to achieve the optimal number of employees with the right skills and ability for the right type of job, so that is able to minimize the mismatch problems as well. However, the most popular approach begins with a conditional projection of manpower needs given sectoral output forecasts. According to Richard and Amjad (1994), manpower planning has two objectives. The first is to make an assessment of the skilled human resource needs of the economy during a specific time period. The second is to provide an analytical framework for undertaking human resource planning which will help identify the skills requirements for educational planning and the making of appropriate investments in education, training and manpower development.

As skill is a multi-dimensional concept, direct measurement is difficult. In empirical work, proxies for skills are often used. Two methods are frequently used to separate aggregate labour into different components. First, one uses job or occupation classifications to create proxies for skilled and unskilled labour, and the other employs educational characteristics to measure skills (ISCO & ICED, 2008). In order to make the data of Industrial Manufacturing Survey correspond with Labour Force Survey Report published by the Department of Statistics, Malaysia (DOS), the present paper classifies the labour occupations according to Malaysian Standard Classification of Occupations (MASCO) 2008 (see Table 1). The MASCO is

basically aligned to International Standard Classification of Occupation published by the International Labour Organisation.

Table 1 Category of occupation

1	Managers
2	Professionals
3	Technicians and associate professionals
4	Clerical support workers
5	Service and sales workers
6	Skilled agricultural, forestry and fishery workers
7	Craft and related trades workers
8	Plant and machine-operators and assemblers
9	Elementary occupations

Note: Occupation is classified according to the Malaysia Standard Classification of Occupations (MASCO) 2008

Data and Methodology

Sources of data

This study utilised two sorts of data. The first set of data is unpublished data on number of persons engaged in the manufacturing industries classified by Malaysia Standard Industrial Classification (MSIC) at 5 digit-level collected from the DOS. The data was for the year 2010. As mentioned earlier, we classified the labour occupations according to the Dictionary of Occupational Classification, 1980 in order to make the data comparable with the Malaysian Standard Classification of Occupations (MASCO) 2008, in the Labour Force Survey Report. The second set of data used Malaysia Input-Output Table for 2010 by the DOS. The input-output data have been aggregated and reduced to 17 x 17 dimensions, covering thirteen subsectors of the manufacturing sector, and single sectors which represent
agriculture sector, mining and quarrying sector, construction sector and services sector. Labour data is based on the MSIC, 2008 at 5 digit-level were in concordance with the input-output table. The Producer Price Indices (PPI) were computed at two digit-level of the commodity group based on the Standard Industrial Trade Classification (SITC).

Input-Output Methodology

In the input-output approach, the balance equation can be written as $X = AX + F$ (1)

where: F is the vector of final demand

X is the vector of sectoral output

A is the technical coefficient matrix

Solving the balance equation for X, we obtain $X = (I - A)^{-1}F$ Let $Z = (I - A)^{-1}$, where $Z = (z_{ij})$ is Leontief inverse matrix. We may write equation (1) as $X = ZF$ (2)

Input-Output Industrial Labour Model

Industrial labour can be thought of as being distributed in certain proportions throughout all industries. Using equation (2), we can estimate the impact of any change in final demand on the level of total industrial labour in the economy. By deriving a row vector of n labour coefficients, l_i (each element of which depicts the number of workers required to produce a unit of industry i's output , where $(i = 1, \dots, n)$, the labour coefficient for each industry is therefore, calculated as follows: $l_i = L_i/X_i$

Where: L_i = level of labour in industry i

X_i = total output of industry i

l_i = row vector of labour coefficient $(i = 1,2,3, \dots, n)$

Then, $l_i = [l_1, l_2, l_3, \dots, l_n]$. The level of labour in each industry is uniquely related to the amount of total output produced by that industry. Thus, to find the amount of labour employed in industry i, we merely multiply the corresponding labour coefficient, l_i by the total output X_i of that sector. By summing the products of labour coefficients and total outputs of all industries throughout the economy, we can derive the following expression for total industrial employment:

$$L_T = \sum_{i=1}^{n} l_i X_i \quad (3)$$

Where L_T represents total industrial employment in the economy. From equation (3), in any given year, the following identity has to hold as well: $L = lX$ (4)

By combining equations (2) and (4), the following expression is arrived as: $L = lZF$

Thus the labour requirement equation of an I-O production system of n sector is,

$$L = l(I - A)^{-1}F \quad (5)$$

Theoretically and empirically, the most serious supposition in the I-O labour model is the assumption of a single type of labour per sector (labour is homogenous). By ironing out all differences between types of employed labour, this assumption directly violates the basic idea of I-O economics, that is, structural differentiation (Holub and Tappeiner 1989). The most important of these structural differentiations is certainly based on the different categories of labour. The model of manpower structural decomposition analysis begins with the labour requirement equation of an input-output production system with n sectors and m occupations or manpower. Labour row vector coefficient l_i have to be extended to an $m \times n$ matrix or

manpower coefficient matrix (H). Thus, the replacement of labour vector coefficient (l) with manpower coefficient matrix (H) yields the equation shown below:

$$L = H(I - A)^{-1}F \qquad (6)$$

Where; $H = \begin{matrix} h_{11}h_{12}\cdots h_{1n} \\ h_{21}h_{22}\ddots h_{2n} \\ h_{n1}h_{n2}\cdots h_{nn} \end{matrix}$

Where; L is a total manpower requirement column vector by occupations $m\times1$, measured in workers;

H is a manpower coefficient matrix by occupation and by sector $m\times n$ with the coefficients measured in terms of workers required per unit output;

F is a final demand vector $n\times1$ measured in value terms;

A is a technical coefficient matrix $n\times n$, which measures the input requirements per unit output in value terms; and

I is an identity matrix $n\times n$

Compounded Annual Growth Rate of Labour

Compounded annual growth rate of final demand was used to obtain the final demand for 2020. The function took the simple form of $G_{jm}^{t} = G_{jm}^{0}(1+\pi)^{n}$

$$\pi = \left(\frac{G_{jm}^{t}}{G_{jm}^{0}}\right)^{1/n} - 1 \qquad (9)$$

Where; G_{jm}^{t} = output in sector j by subsector for terminal year

G_{jm}^{0} = output in sector j by subsector for base year

n = number of years

Results and Discussion

The input-output model enables us to evaluate the performance of the economy in terms of the amount of primary factors required, particularly labour, to deliver a given amount of final demand (Zakariah & Chan, 1997). The yearly growth in final demand is calculated over the period 2005 to 2010. Therefore, this paper attempts to estimate the manpower by taking into account direct and indirect technical change and changes in final demand structure that influence future manpower requirements. The final result in manpower forecasting will be the number of workers employed by various categories of occupation in the future. Based on Table 2, total manpower projection using the MRA approach can be seen from the estimated results

that summarise manpower requirement for the year 2020 and is projected to increase by 39.47% over the period 2010 to 2020. From Table 2, it shows that the total manpower requirement projection in the economy for the year 2020 was recorded as 16,596.525 million peoples, while in the 2010 and 2015, it was about 11,899.700 and 14,067.700 million workers (see Table 4), respectively.

The estimated results as reported in Table 2, indicate that total manpower requirement projection of the manufacturing sector for 2020 was about 2,871.551 million workers, indicating 17.30% of employment share out of total employment. Based on this figure, it shows an increase of percentage change in employment by 37.25% over the period 2010-2020, representing an increment of 763,051 million workers. The detailed results of thirteen subsectors of the manufacturing sector show a larger share of employment indicates by subsector of manufacture of machinery and equipment (25.30%) followed by the manufacture of food products, beverages and tobacco products (11.70%), the manufacture of rubber, plastics and other non-metallic mineral products (15.40%), and manufacture of basic metals and fabricated metal products (10.90%). These four industries reflect a larger employment projected for the year 2020 indicating by 0.727, 0.442, 0.336 and 0.313 million workers. Based on the number of employment projected, these industries highlight a potential growth in output, whereby generate more employment in the next four year period.

Apart from that, other subsectors have also potential in the output expansion that attribute to an increase in the final demand can be seen in the manufacture of manufacture of wood and products of wood, the manufacture of chemicals, chemical products and basic pharmaceutical products, and the manufacture of motor vehicles, trailers, semi-trailers and other transport equipment. For these industries, Malaysia should take an advantage to produce a larger output to meet the final demand because those industries have a larger market (both domestic demand and exports), especially for the manufacture of food products and beverages industries.

From Table 2, out of total employment, the employment share for the economic sectors recorded for 11.48% for agriculture sector, followed by 0.49% for mining and quarrying, 17.02% for construction sector and the largest indicate by the service sector (53.72%). These figures highlight the number of worker increased by 0.289 million people in the agriculture sector, 0.024 million for mining and quarrying, 1.741 million for construction sector, and 1.879

million for service sector. The construction sector shows the largest increment of more than 100% of the percentage change in the employment over the period 2010-2020.

As shown in Table 3, the manpower projection of the manufacturing sector shows that all subsectors of the manufacturing sector experienced employment expansion for all types of occupations. This is highlighted by the ratio of labour by skills occupational type recorded total labour of the manufacturing sector at amount of 2.872 million workers, out of that amount it indicates 11.14% of skilled labour, 12.23% of medium skilled and 76.63% of low skilled labour. Though these figures of skilled and medium skilled labour are smaller in terms of percentage, however the number of manpower projected has increased to 0.320 million and 0.351 million workers, respectively. It shows a larger increment of more than 50% both in skills occupational types.

Comparing the number of total employment in 2010, 2015 and estimated figure of manpower requirements for 2020 as shown in Table 4, it shows that total employment has increased from 11,899.5 million people to 14,067.7 million people (18.22%) and to 16,596.5 million people (17.98%), respectively. Out of these amounts, the employment of the manufacturing sector has raised from 2,108.5 to 2,322.7 million workers (10.16%) and 2,871.6 (23.63%) million workers, respectively. Other economic sectors also showing expansion in the employment projected for the year 2020, specifically for construction sector, which is has remarkably increased in total number of manpower estimated to 2.824 million workers. It demonstrates an increment of 1.514 million workers (115.58%) from the year 2015. Other sector such as agriculture and service sector have also increased by 8.59% and 3.96% for the year 2020, respectively. On the other hand, employment projected for the mining and quarrying sector however decreased from 0.0104 million workers in 2015 to 0.0814 million workers in 2020. It shows declining in the employment share of 22.03% for the year 2020.

In respect to this, though employment share by occupation seems has not changed, the number of labour in skilled occupational type however increased. It is accounted for 2.519 million workers, which contributing 15.18% while medium skilled occupational type of labour is approximated at 1.884 million workers (11.35%). The rest of type 3 and type 4 represents low skilled occupation amounted of 12.194 million workers (73.47%) is a larger part of employment contribute to the whole economic sectors.

In respect to skill, this study classified labour into four occupational types. Type 1 consists of occupation of managerial, professional and executive. Type 2 is occupation of technical, associate professionals and supervisory, followed by type 3 is a clerical workers, and type 4 is occupation of service, sales, craft and related trade workers, plant and machine operators, assemblers and elementary workers. Type 1 and 2 occupation can be classified into skilled and medium skilled labour, while type 3 and 4 representing low skilled labour. The manufacturing industry accounted for about 2.872 million (17.30%) of total workers in the economy.

The detailed analysis of manpower requirements by occupational type is shown in Table 5. The results by subsectors show the largest share of employment projected indicates by the manufacture of machinery and equipment accounted for 0.727 million workers which contributing by 10.98% from skilled labour, 13.66% from medium skilled and the rest of 75.34% demonstrated by low skilled labour. The second largest share is the manufacture of rubber, plastics and other non-metallic mineral products which registering 0.442 million workers. Out of that amount, 9.61% recorded for labour in skilled occupation, 13.54% for labour in medium skilled occupation and 76.85% labour in low skilled occupation. Subsector of the manufacture of food products, beverages and tobacco also show potential in employment projected with an increase in all types of labour by skills occupational types which indicates in total employment of 0.336 million workers.

Based on the manpower projected for the year 2020, Malaysia has a big potential to increase domestic demand and export to other countries and economic region due to larger capacity of final demand among subsectors of the manufacturing sector. Though the manpower projected showing expansion in this study, however the share of skilled labour by occupational type is the main concern in this study. The share of employment by skills of occupations should also expand, especially those who are in the type 1 and type 2 skills occupation, which this is reflects by skilled and medium skilled group of labour. Other than that, the number of manpower projected should be in line with the output produced, whereby the study can foresee the productivity of labour among subsectors of the manufacturing sector and economic sectors of the Malaysian economy, especially skilled labour ultimately contribute to a larger output or higher productivity of a firm.

Table 2 Number of employment projected and share of employment 2020

No	Sector/sub sector	Total employment 2010	FD 2010 (RM million)	Share of employment 2010 (%)	Total employment 2020 (%)	FD 2020 (RM million)	Share of employment 2020 (%)	Change in employment 2010-2020 (%)
1	Agriculture, forestry and fishing	**1,614,900**	**36,076**	**13.57**	**1,904,560**	**221,305**	**11.48**	**289,660 (17.94)**
2	Mining and quarrying	**57,200**	**42,932**	**0.48**	**81,400**	**30,247**	**0.49**	**24,200 (42.31)**
3	Construction sector	**1,082,700**	**70,817**	**9.10**	**2,823,905**	**257,381**	**17.02**	**1,741,205 (160.82)**
4	Manufacture of food products, beverages & tobacco products	241,758	108,647	11.47	335,971	590,962	11.70	94,214 (38.97)
5	Manufacture of textiles and wearing apparel	98,301	9,485	4.66	117,734	12,372	4.10	19,433 (19.77)
6	Manufacture of leather and related products	9,729	631	0.46	16,052	555,097	0.56	6,323 (65.00)
7	Manufacture of wood and products of wood	133,606	9,329	6.34	178,036	8,406	6.20	44,430 (33.25)
8	Manufacture of paper, paper products, printing, reproduction of recorded media and furniture	222,557	15,896	10.56	252,696	18,749	8.80	30,139 (13.54)
9	Manufacture of coke and refined petroleum products	9,218	61,910	0.44	15,118	508,758	0.53	5,900 (64.01)
10	Manufacture of chemicals, chemical products and basic pharmaceutical products	104,634	37,052	4.96	146,736	36,094	5.11	42,102 (40.24)
11	Manufacture of rubber, plastics and other non-metallic mineral products	312,740	32,288	14.83	442,348	85,140	15.40	129,608 (41.44)
12	Manufacture of basic metals and fabricated metal products	209,839	25,262	9.95	312,999	33,390	10.90	103,160 (49.16)
13	Manufacture of machinery and equipment	503,951	16,728	23.90	726,502	20,786	25.30	222,552 (44.16)
14	Manufacture of computer, electronic, optical products and electrical equipment	84,639	230,925	4.01	100,504	180,930	3.50	15,866 (18.75)
15	Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	130,546	34,352	6.19	166,550	36,496	5.80	36,004 (27.58)
16	Manufacture of other manufacturing, repair, installation of machinery and equipment	46,984	6,955	13.57	60,303	33,324	0.17	13,319 (28.35)
17	Services sector	**7,036,400**	**472,657**	**59.13**	**8,915,109**	**1,365,881**	**53.72**	**1,878,709 (26.70)**
	Total employment /total final demand of the manufacturing sector	**2,108,500**	**589,460**	**17.72**	**2,871,551**	**1,565,961**	**17.30**	**763,051 (37.25)**
	Total employment/ final demand	**11,899,700**	**1,211,942**		**16,596,525**	**3,440,774**		**4,696,825 (39.47)**

Note: (1) Managerial, professional and executive
(2) Technical, associate professionals and supervisory
(3) Clerical workers
(4) Service, sales, craft and related trade workers, plant and machine operators, assemblers and elementary workers

Table 3 Projected manpower requirements of the manufacturing sector, 2020

No	Sector/sub sector	Employment category				Total employment 2020	Growth in FD 2010-2020*
		(1)	(2)	(3)	(4)		
1	Agriculture, forestry and fishing	112,369	99,279	145,699	1,547,265	**1,904,560**	6.13
2	Mining and quarrying	8,140	9,768	6,919	56,573	**81,400**	0.70
3	Construction sector	169,434	282,391	112,956	2,259,124	**2,823,905**	3.63
4	Manufacture of food products, beverages and tobacco	25,844	33,884	29,290	246,953	335,971	5.44
5	Manufacture of textiles and wearing apparel	10,912	12,061	8,615	86,147	117,734	1.30
6	Manufacture of leather and related products	946	1,013	986	13,107	16,052	0.88
7	Manufacture of wood and products of wood	10,625	11,486	8,902	143,578	178,036	0.90
8	Manufacture of paper, paper products, printing, reproduction of recorded media and furniture	26,131	25,557	22,970	175,455	252,696	1.18
9	Manufacture of coke and refined petroleum products	5,743	2,949	804	5,623	15,118	8.22
10	Manufacture of chemicals, chemical products and basic pharmaceutical products	22,972	17,229	14,358	92,177	146,736	0.97
11	Manufacture of rubber, plastics and other non-metallic mineral products	43,073	60,719	28,716	315,871	442,348	2.64
12	Manufacture of basic metals and fabricated metal products	51,114	37,330	23,547	201,009	312,999	1.32
13	Manufacture of machinery and equipment	79,797	99,231	31,874	515,601	726,502	1.24
14	Manufacture of computer, electronic, optical products and electrical equipment	14,358	16,942	11,773	57,431	100,504	0.78
15	Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	18,952	20,675	12,061	114,862	166,550	1.06
16	Manufacture of other manufacturing, repair, installation of machinery and equipment	9,410	12,175	9,743	28,974	60,303	4.79
17	Services sector	1,908,952	1,140,960	1,141,135	4,724,062	**8,915,109**	2.89
	Total employment of the manufacturing sector	**319,877 (11.14)**	**351,252 (12.23)**	**203,637 (7.09)**	**1,996,785 (69.54)**	**2,871,551 (100,00)**	
	Total employment	**2,518,773 (15.18)**	**1,883,650 (11.35)**	**1,610,346 (9.70)**	**10,583,809 (63.77)**	**16,596,525 (100.00)**	

Note: (1) Managerial, professional and executive
(2) Technical, associate professionals and supervisory
(3) Clerical workers
(4) Service, sales, craft and related trade workers, plant and machine operators, assemblers and elementary workers
* compounded growth

Table 4 Number of employment by economic sectors and share of employment by occupation

Sector	2010	2015 (%)	2020* (%)
Total employment *(million people)*	11,899.5	14,067.7 (18.22)	16,596.5 (17.98)
Agriculture, forestry and fishing	1,614.9	1,753.9 (8.61)	1,904.6 (8.59)
Mining and quarrying	57.2	104.4 (82.52)	81.40 (-22.03)
Manufacturing	2,108.5	2,322.7 (10.16)	2,871.6 (23.63)
Construction	1,082.7	1,309.9 (20.98)	2,823.9 (115.58)
Services	7,033.9	8,575.1 (21.91)	8915.1 (3.96)

	Employment share by occupation** (%)			
	(1)	(2)	(3)	(4)
2010	13.40	9.54	9.56	64.38
2011	15.49	10.58	9.12	65.83
2012	15.04	10.20	8.79	67.05
2013	14.62	9.66	8.94	66.46
2014	14.73	9.45	8.82	65.68
2015	15.50	9.31	9.56	64.38
2020*	15.18	11.35	9.70	63.77

Source: Labour Force Survey, various years
Note: * estimated figure

** Skill of labour is classified by occupational according to the Malaysia Standard Classification of Occupations (MASCO) 1998. Category of occupation are as follows: Group 1: legislators, senior officials, managers and professionals; Group 2: technicians and associate professionals; Group 3 clerical workers as group; and, Group 4: service workers and shop and market sales workers; skilled agricultural and fishery workers; craft and related trade workers; plant and machine-operators and assemblers; and elementary occupations.

Table 5 Share of employment projected of the manufacturing sector and economic sectors , 2020

No	Sector/sub sector	Employment category			
		(1)	(2)	(3)	(4)
1	Agriculture, forestry and fishing	5.90	5.21	7.65	81.24
2	Mining and quarrying	10.00	12.00	8.50	69.50
3	Construction sector	6.00	10.00	4.00	80.00
4	Manufacture of food products, beverages and tobacco	7.69	10.09	8.72	73.50
5	Manufacture of textiles and wearing apparel	9.27	10.24	7.32	73.17
6	Manufacture of leather and related products	5.89	6.31	6.14	81.65
7	Manufacture of wood and products of wood	6.09	6.58	5.10	82.24
8	Manufacture of paper, paper products, printing, reproduction of recorded media and furniture	10.45	10.22	9.18	70.15
9	Manufacture of coke and refined petroleum products	37.99	19.51	5.32	37.19
10	Manufacture of chemicals, chemical products and basic pharmaceutical products	15.66	11.74	9.78	62.82
11	Manufacture of rubber, plastics and other non-metallic mineral products	9.61	13.54	6.40	70.45
12	Manufacture of basic metals and fabricated metal products	16.33	11.93	7.52	64.22
13	Manufacture of machinery and equipment	10.98	13.66	4.39	70.97
14	Manufacture of computer, electronic, optical products and electrical equipment	14.29	16.86	11.71	57.14
15	Manufacture of motor vehicles, trailers,	11.38	12.41	7.24	68.97

	semi-trailers and other transport equipment				
16	Manufacture of other manufacturing, repair, installation of machinery and equipment	15.60	20.19	16.16	48.05
17	Services sector	21.41	12.80	12.80	52.99

Note: (1) Managerial, professional and executive
(2) Technical, associate professionals and supervisory
(3) Clerical workers
(4) Service, sales, craft and related trade workers, plant and machine operators, assemblers and elementary workers

Conclusion and Policy Recommendations

This study applied the methods of Manpower Requirements Approach (MRA) insists that manpower requirement forecasts strongly deal with labour demand. It can be concluded that manpower inventory and analysis provides valuable information pertaining to present and future employees needed in any level. The information may not be completely accurate but it is valuable and provides basis for the recruitment, selection and training processes.

The projection of type 1 and type 2 (skilled and medium skilled labour) show that both occupational categories need more labour parallel with the total inventory in 2010. More specifically, both types of labour relatively needs to be increased compared to labour in type 3 and type 4 for projection in 2020. The implication of these findings is that an effort has to be made to increase labour requirement growth rate for high level occupations, as well as to reduce unemployment amongst prospective university graduates. A wage rate that helps improve the welfare of workers should also be increased since it can increase demand for labour for the whole manufacturing sector. Furthermore, the encouraging growth of demand for these two types of labour implies that present efforts of training need to be continued. At the same time, education planning ultimately help policymakers to make decisions towards the formulation of manpower policies more closely, since projections of manpower is also useful for education planning.

A sufficient supply of labour is imperative for a sustained economic growth and this can be done through the education and training system. However, the researchers concede that this study has not covered the supply side of the labour market and consequently unable to project the difference between supply and demand of high level labour in the manufacturing sector. Other study would need to include projection of supply with tertiary education graduates as indicator. A more comprehensive study shall be conducted as an extension to the present study to include supply of high level labour in the manufacturing sector.

This study has limitations due to the projection of manpower is solely based on the output growth or final demand. This study also used the share of employment by skills type that represents Malaysia in order to get the actual ratio of labour by occupational types due to data constraint. This study will extend to the manpower projection by taking into account change in labour productivity or productivity growth that this will be presenting the manpower need in the economic sectors.

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Appendix 1 Total employment in economic sectors and by sub-sectors of the manufacturing sector, 2010

No	Sector/sub sector	Job category				Total employment 2010	FD 2005 (RM million)	FD 2010 (RM million)	Annual growth in FD 2005-2010 (%)
		(1)	(2)	(3)	(4)				
1	Agriculture, forestry and fishing	90,676	73,614	102,272	1,348,338	1,614,900	14566	36,076	18.14
2	Mining and quarrying	5,434	7,150	4,862	39,754	57,200	51148	42,932	-3.50
3	Construction sector	41,439	44,713	44,718	951,830	1,082,700	37147	70,817	12.90
4	Manufacture of food products, beverages and tobacco products	17,588	22,091	19,550	182,528	241,758	46585	108,647	16.94
5	Manufacture of textiles and wearing apparel	4,779	8,242	5,365	79,914	98,301	8305	9,485	2.66
6	Manufacture of leather and related products	644	670	686	7,728	9,729	673	631	-1.28
7	Manufacture of wood and products of wood	4,945	8,289	6,839	113,532	133,606	9829	9,329	-1.04
8	Manufacture of paper, paper products, printing, reproduction of recorded media and furniture	19,096	17,296	19,596	166,570	222,557	14637	15,896	1.65
9	Manufacture of coke and refined petroleum products	2,327	2,173	590	4,128	9,218	21597	61,910	21.06
10	Manufacture of chemicals, chemical products and basic pharmaceutical products	14,281	13,532	8,939	67,883	104,634	37540	37,052	-0.26
11	Manufacture of rubber, plastics and other non-metallic mineral products	22,298	29,615	19,540	241,287	312,740	19884	32,288	9.70
12	Manufacture of basic metals and fabricated metal products	17,904	22,734	16,398	152,803	209,839	21973	25,262	2.79
13	Manufacture of machinery and equipment	50,872	67,727	20,515	364,836	503,951	15006	16,728	2.17
14	Manufacture of computer, electronic, optical products and electrical equipment	7,764	10,928	5,949	59,997	84,639	260886	230,925	-2.44
15	Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	11,610	15,448	7,526	95,962	130,546	33328	34,352	0.61
16	Manufacture of other manufacturing, repair, installation of machinery and equipment	3,752	4,430	3,235	35,568	46,984	3177	6,955	15.67
17	Services sector	942,878	1,002,687	699,418	4,391,417	7,036,400	278044	472,657	10.61
	Total employment	1,258,287	1,351,339	985,999	8,304,075	11,899,700	874,323	589,460	
	Total final demand							1,211,942	

Note: (1) Managerial, professional and executive
(2) Technical, associate professionals and supervisory
(3) Clerical workers
(4) Service, sales, craft and related trade workers, plant and machine operators, assemblers, and elementary workers

References

Akay, G., & Yuksel, M. 2013. Demand for skilled and unskilled labour: Evidence from manufacturing firms in Ghana. Actual Problems of Economics, 143(5), 195-204.
Alarcón, Diana & Eduardo Zepeda. 1998. Employment trends in the Mexican manufacturing sector, *The North American Journal of Economics and Finance*, 9(2), 125-145.
Badillo-Amador, L & Vila, L.E. 2013. Education and skill mismatches: wage and job satisfaction consequences, *International Journal of Manpower*, 34(5), 416-428.
Betts, J.R. 1997. The skill bias of technological change in Canadian manufacturing industries, *Review of Economics and Statistics*, 79, 146-50.
Bishmanath, G, Basanta, KP & Akhilesh, K.S. 2013. Elasticity of substitution between capital and labour inputs in manufacturing of the Indian economy. *Journal of Industrial Statistics*, 2(2), 169-194.
Daron Acemoglu & Jörn-Steffen Pischke. 1999. Beyond Becker: Training in imperfect labour markets. The Economic Journal, 109(453), F112-F142. *http://www.jstor.org/stable/2565588*.
Department of Statistics. 2000 & 2008. Malaysia Standard Industrial Classification. Kuala Lumpur: National Publication.
Hopkins, M. 2002. *Labour market planning revisited*, New York: Palgrave Macmillan.
Hughes, G. 1991. Manpower forecasting: A review of methods and practice in some OECD countries, FÁS/Economic and Social Research Institute, Dublin: Ireland.
ISCO & ICED, 2008, International Labour Organization, Geneva, Switzerland
Judith Bannister. 2004. Manufacturing employment and compensation in China. Consultant's report to U.S Department of Labor. Bureau of Labor Statistics (December) *http://www.bls.gov/fls/chinareport.pdf*.
Klump, R. & de La Grandville, O. 2000. Economic growth and the elasticity of substitution: two theorems and some suggestions, *American Economic Review*, 90(1), 281-291.
Labour Force Survey, various years. Department of Statistics Malaysia, Putrajaya: National Publication.
Leclair, M.S. 2002. Export composition and manufacturing employment in the US during the economic downturn of 1991-92. *Economic Systems Research*, 14(2), 147-156.
Malaysia 2013. Malaysia Economic Report 2012/2013, Ministry of Finance Malaysia, Kuala Lumpur: National Publication.
Papps, K.L. 2001. Occupational and skill forecasting: A survey of overseas approaches with applications for New Zealand, New Zealand Department of Labour Occasional Paper Series 2001/1.
Poo, B.T., Rashid, Z.A., & Hassan, M.K.H. 2012. Manpower Requirements of Malaysian Manufacturing Sector under the Third Industrial Master Plan. *Malaysian Journal of Economic Studies*, 49(1), 1-19.
Rahmah Ismail & Idris Jajri. 2000. Impact of Output Level and Input Price on Demand for Labours and Manpower Requirement in the Agriculture Based Manufacturing Sector. Jurnal Ekonomi dan Manajemen, 7(1), 89-97. Universiti Andalas, Indonesia
Rahmah Ismail & Idris Jajri. 2004. Elasticity of Substitution between Skills in Malaysian Manufacturing Sector. International Journal of Management Studies, 2(2):21-41, UUM.
Ramlee, M. 2002. The role of vocational and technical education in the industrialization of Malaysia as perceived by educators and employers. Doctoral dissertation, Purdue University.

Rasul M. S., Ismail, M. Y., Ismail N., Rajuddin, M. R. & Abdul Rauf, R. A. 2009. Peranan institusi pendidikan teknikal dalam pemupukan kemahiran 'employability' pelajar. *Jurnal Teknologi*, 50(E), 113-127.

Richard, P & R. Amjad 1994. New approached to manpower planning and analysis, International Labour Organization, Geneva, Switzerland.

Roberts, M. J., & Skoufias, E. 1997. The long-run demand for skilled and unskilled labour in Colombian manufacturing plants. *Review of Economics and Statistics*, 79(2), 330-334.

Siti Nor Habibah, H., Mahanum, M. Z., Siti Nurhaida, K., Nortazi, S., Faizil, W., & Anita Akmar, K. 2012. Company perception on the employability skills of industrial training students. *Journal of Technical Education and Training*, 4(2), 1-8.

Upender, M. 2009. Elasticity of substitution between labour and capital across twenty six major industries in Indian during 2004-05, *International Journal of Applied Econometrics and Quantitative Studies*, 9(1), 101-110.

Virmani, A. & Hashim, D.A. 2009. Factor employment, sources and sustainability of output growth: Analysis of Indian Manufacturing. Working paper no. 3/2009-DEA.Ministry of Finance, Government of India.

Zakariah, A.R. & Siti Khairon, S. 1997. Manpower requirements and supply in the Malaysian manufacturing sector: the case of an emerging industrial economy. In: Case Studies in Education Research and Policy, Asian Development Bank, p. 95-117.

Zaleha M.N., Rahmah, I. & Mohd Anuar M.A. 2007. High level employment requirement in the manufacturing sector. In R. Ismail , N. A. Idris & R. Mohd (eds*).* Human Resource Development in the Era of K-Economy, (p.163-183), Bangi: The National University of Malaysia.