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An Input-Output Analysis for Manpower Requirements: Prospect of Malaysia's Construction Sector

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ABSTRACT

Manpower planning determined in the process of estimating or projecting the number of labour required for a particular period in the selected sectors or projects in the chosen country. This article presents an exhaustive review of manpower requirements in the construction sector for the year 2020 in Malaysia, in the line with issues arising in Malaysia's construction sector. Using the Input-Output table, the forecast of manpower planning based on the data of four selected construction subsectors in Malaysia, mainly residential building, non-residential building, civil engineering and specialised construction activities. The employment categories based on skilled, medium-skilled and low-skilled labour categorised in The Eleventh Malaysia Plan (2016 – 2020). The most obvious finding to emerge from this study is skilled and low-skilled labour is high in need for all construction subsector for the year 2020. Malaysia has a high expectation of workforce energy in the construction sector and expects the majority of the construction works handled by the local labour.

INTRODUCTION

The Manpower planning is an essential concept that growing up fast in human resources theory. This study appraises and widely been practised in many fields such as engineering, medicine, and science, however much common in economics (Loosemore,

Dainty, & Lingard 2003). Perhaps, Abegaz (1994) and Forbes (1979) defined that manpower planning is an effort in matching the labour supply and opportunity available in the labour market. As a corollary, this practice implemented in the construction sector in Malaysia. Entails, the need for nationality coordinated manpower planning is crucial to deal with problems of growing unemployment, knowledge obsolescence and changing skill requirements (Heijke, 1993). Uphold, the debate continues on the lack of local force participation and abundance of foreign labour that employed in the construction sector in Malaysia (Dom, Kasim, & Shamsudin, 2012). To express the breath, a considerable amount of literature published on the issues arising in the construction sector in Malaysia but the range in the workforce requirement in this sector are not satisfied and limited to explore. The key research is to forecast manpower requirement in the construction sector for the year 2020, that could enhance the participation of local labour, in line with the growth of construction sector in Malaysia. After all, manpower planning considered as the effort of preparing a sufficient quantity of workers with needed qualification to perform tasks at a right time and place (Ismail, Saukami, & Sulaiman., 2015).

Recent development in the construction sector has led to a renewed interest in Malaysia's growth. It is irrefutable that the construction sector has become one of the biggest contributions towards the positive development in Malaysia. For the Tenth Malaysia Plan (2011 – 2015), the report stated that construction sector in Malaysia has contributed RM194 billion to the Gross Domestic Product (GDP) and recorded the highest average annual growth rate which was 11.15% compared to other sectors, services (6.3%), manufacturing (4.8%), and agriculture (2.4%) respectively. The long-term application continues for the Eleventh Malaysia Plan (2016 – 2020), as the report proposed that the construction sector could contribute to the GDP in the estimate of RM327 billion. However, the average annual growth rate is expected to drop by around 0.85% for the planned years (2016 – 2020) than the previously planned years (2011 – 2015).

Nevertheless, the construction industry regarded as one of the main contributors towards a country's economy (Ngai et al., 2002). Recently, Al Ehmad and Rahman (2017) have shown interest in studying the challenges faced in the construction sector in Saudi Arabia, claimed that construction is the growth robust as Saudi Arabia is one of the fastest growing countries among the Middle East countries with the help of construction sector. An early study by Lai (2017) overstands the statement with the manpower productivity and construction spectrum in a developed country as Hong Kong. With rapid changes happening in the construction industry, findings become obsolete and unable to reflect the current development in the industry (CIDM Malaysia, 2007). Yet, even in South Africa, Chapano et al. (2017) argued that construction sector could contribute to the high performance and productivity influenced that could enhance its nation's development. However, Naoum (2016), Kapelko (2015) and Borcherding et al. (1986) stated that construction is a significant tool in the performance of economic growth of a nation. However, Enshassi, Mohamed, Mustafa, and Mayer (2007), Dutta (2014), Ngwenya and Aigbavboa (2017) revealed that in developing the construction sector in a nation is thoroughly proportional to the labour productivity and their dimensions of high-skilled, medium-skilled and low-skilled labours attributing in this sector.

Analysed, from the developed to undeveloped countries, this current study can contribute to the knowledge intention by utilising the local workforce to fulfil the manpower requirements in the construction sector to the developing country, Malaysia. Furthermore as tabulated in Malaysia Standard Industrial Classification (MSIC) 2008, four of the construction subsectors selected to address

the research gap, namely residential building, non-residential building, civil engineering, and specialised construction activities. Adding on, by referring to the Malaysian Standard Classification of Occupation (MASCO) 2008, four major groups been chosen for this study, specifically (i) managerial, professional and executive, (ii) technical,, associate professionals and supervisory (iii) clerical workers (iv) services, sales, craft and related trade workers, plant and machine operators, assemblers and elementary workers.

LITERATURE REVIEWS

There are several studies in the literature reporting on manpower requirement that has shown interest in Malaysia's varies of sectors or industries. Ismail et al. (2015) have conducted research on long-run labour demand and manpower requirement in Malaysia's construction sector, focusing on skilled and medium-skilled labours. This study conclusively showed on the labour output elasticity and projected the manpower requirement for the periods of 2015 and 2020; hence found that manpower requirements are higher for the technical workers (medium-skilled) as compared to the professional workers (skilled). Authors also noted that total manpower requirements are larger for the special craftsmanship, which the special construction activities by using ARDL, PMG and SUR procedures. The higher need for this subsector of construction is due to their larger initial stock and higher output growth (Ismail *et al*, 2015). The authors trace out that rapid economic development in Malaysia has encouraged owning property by foreigners which provided opportunities for the construction sector continues growing.

The relationship between the manpower requirement and the sectoral growth has been widely investigated. Ramarao, Agrawal, Rao, Nanda, and Joshi (2014) posited which developing countries need to expand their labour skills especially in the agriculture sector and construction sector. They have studied the manpower requirement in the agriculture sector in India and portrayed the required of low skilled and high skill labour to enhance the agriculture sector which is the pillar of India's economic growth. Perhaps, Javed, Zhan, and Pan (2018) have conducted a comprehensive study on Hong Kong's construction sector by using System Dynamics Approach. Adding to this approach has revealed the potential high-skilled labour that could hands on the sector's productivity with a proper manpower planning. A considerable study by Nasirzadeh and Nojedehi (2013), identified the high-skilled in the economic sector, the economic growth and productivity will supply the higher macroeconomic performance of the nation, proven in Asia countries.

Moving on with manufacturing sector in Malaysia, Sulaiman (2015), Ahmad, Tin, and Yussof (2012) and Tin, Ismail, Yussof, and Zulridah (2011) provides the in-depth analysis of the manpower requirements in the manufacturing sector in Malaysia. By using Manpower Requirement Approach (MRA), the mentioned authors posited that manufacturing sector one of the major sector in Malaysia's economic growth and required a change in skill composition to sustain productivity and output growth. Moreover, Abidin, Ismail, and Sulaiman (2011) have demonstrated the impact of globalisation on labour demand in the selected services sector in Malaysia. Authors have raised several concerns about labour force should be equipped with education and training to access information technology facilities that often change in line with globalisation. The finding is consistent with the study by Ismail et al. (2014). Authors examined the elasticity of labour demand in services sector by focusing on two high-level occupations. The results show the dominated by education and Information and Communication Technology (ICT) sectors towards the output growth of the services sector.

Unfortunately, studies relating to manpower requirements on Malaysia's sectors have been relatively scanty and there is little research about it. It appears from the aforementioned investigations that numerous researchers have been conducted, however, most of the open literature was focused mainly on the studies in the issues arises in the construction sectors and recommend the policy related to the issues. The problem of skill shortage in the construction sector was an attempt by Briscoe (1990), as analysed that in the longer term if this problem does not solve, the labour cost in the construction sector will face a restricted growth. However, Briscoe and Wilson (1991) have conducted a further comprehensive research by establishing a new econometrics technique (RAS method), demonstrated an option within the forecasting model. The results somehow turn out to be sensitive to the assumptions that adopted as well as the parameters used in the econometrics modelling. The same attempt flowed by Ball and Wood (1995) by showing the effect of the employment variables in the construction sectors. Nevertheless, argued that input-output technique is capable of projecting long terms (periods of 10 years) quantitative skilled manpower needs (Campbell, 1997). Undeniable that this input-output method remains popular among economists, workforce planners and policymakers as it's an acceptable forecasting tool. It can adequately deal with the interaction between different labour market segments and substitutions processes between occupational groups (Richter, 1986).

In contrast, Wong, Chan, and Chiang (2004) argued that projections of productivity, interest rates and overall output to predict manpower needs are difficult for modelling. Authors added that those results would cause bias because of obscurity in the forecasting economic activity, technological and commercial change. Johanson (2000) and Bradenburg et al. (2006) also supported the argument by stating manpower planning is not a static to the process but responds to the changing circumstances, either internal or external changes. However, Decenzo and Robbins (1999) and Kofoworola and Gheewala (2008) defeat the above statements by concluding that human planning has benefits that are many and varied across industries all over the world as it allows organisations to restructure, reduce or expand their workforce by forecasting. This is supported by the Deborah et al. (2005) which reveals workforce analysis begins with the focus into issues whereby highlights the future workforce requirements needed up front and determine the current and future supply within the industries.

Randy, Loretta, and Bryan (2006) raised several concerns about the workforce issues in Malaysia's industries. Authors added a workforce is a number of workers available to complete the activity, job or project in the scopes of work. Meanwhile, Chiang, Chan, and Sharma (2004) indicated it in particular when focusing on the construction sectors where places heavy reliance upon the skills of its labour. Accordingly, Malaysia is a high reliance on workforce energy in the construction sectors and expects the majority of the construction tasks should be carried out by the local workforce. Moreover, the study by Wong et al. (2017) revealed that Hong Kong's construction sector detect the presence of future skilled labour in enhancing the productivity and growth of the sector in the developed country. However, far too little attention has been paid to these sorts of studies indicating the requirement of the workforce in specific sectors.

DATA AND METHODOLOGY

Sources of Data

Data for the number of labours in the construction sector for the year 2010 in Malaysia collected from Labour Force Industrial Survey classified with the employment category in The Eleventh Malaysia Plan (2016 – 2020), see

Appendix 3. Besides, another data used in this study is Malaysia's Input-Output Table for 2010 and 2005, resourced by the Department of Statistics Malaysia (DOSM). The following table been aggregated and reduces to 8 x 8 dimensions, covering the four subsectors in the construction sectors. Those subsectors are a residential building, non-residential building, civil engineering and specialised construction activities. Meanwhile, single sectors represented by the agriculture sector, mining and quarrying sector, manufacturing sector and services sector.

Input-Output Methodology

Input-output (Leontief, 1986) models share the practice of translating production targets into implied manpower needs using relatively rigid input-output coefficients (Abegaz, 1994). Based on the Input-Output approach, the balance equation is written:

$$X = AX + F \quad (1)$$

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.

From equation (1),

$$X = ZF \quad (2)$$

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 ($i = 1,\ldots, n$).

Therefore the labour coefficient for each industry is calculated as follows:

$\ell_i = L_i / X_i$

Where: L_i = level of labour in industry *i*
X_i = total output of industry *i*
ℓ_i = row vector of labour coefficient ($i = 1, 2, 3, \ldots, n$)

Then, $\ell_i = (\ell_1, \ell_2, \ell_3 \ldots \ell_n)$. By summing the products of labour coefficients and total outputs of all industries throughout the economy, thus the expression for total industrial employment can be derived as follows:

$$L_T = \sum_{i=1}^{n} \ell i \, Xi \quad (3)$$

Where L_T represent total industrial employment in the economy.

Thus, the labour requirement equation of an Input-Output production system of *n* sector is,

$$L = \ell(I - A)^{-1} F \quad (4)$$

Input-Output model is the assumption of a single type of labour per sector where labour is homogenous. Labour row vector coefficient ℓ_i have to be extended to an *m* (occupations) x *n* (sectors) matrix or manpower coefficient matrix (*H*).

Perhaps, the replacement of labour vector coefficient ( ) with manpower coefficient matrix (*H*) yields the equation shown below:

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

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

Where L is a total manpower requirement in column vector by occupations $m \times 1$, measured in workers;
H is a manpower coefficient matrix by occupation and by sector $m \times n$ with the coefficients calculated in terms of workers required per unit output;
F is a final demand vector $n \times 1$ measured in value terms;
A is a technical coefficient matrix $n \times n$, which measures the input requirements per unit output in value terms;
I is an identity matrix $n \times$

The inter Industry Manpower Requirement Model

From equation (1):

$X - AX = F$

$(X = F$

$X = (^{-1} F,$

As $(^{-1}$ is Leontief inverse matrix.

Continuous Exponential Growth Rate of Labour

The continuous growth rate of final demand for the year 2005 and 2010 was used to obtain the growth rate of final demand for the forecasted year of 2020.

For growth rates from the year 2005 to 2010 (5years):

$$F_{jm\ 2010} = F_{jm\ 2010}\, e^{rt}$$

$$e^{rt} = \left(\frac{F_{jm\ 2010}}{F_{jm\ 2005}}\right)$$

$$\mathrm{r\ t\ ln\ e} = \ln\left(\frac{F_{jm\ 2010}}{F_{jm\ 2005}}\right)$$

$$r = \frac{1}{5}\ln\left(\frac{F_{jm\ 2010}}{F_{jm\ 2005}}\right) \quad (6)$$

Following projected growth rates of final demand from the year 2010 until 2020 (10 years), equation (6) is substituted into equation (7) to obtain the projected final demand for the year 2020.

$$F_{jm\ 2010} = F_{jm\ 2010}\, e^{rt} \quad (7)$$

Where,

F_{jm} = Final demand in sector *j* by the subsector *m* for the year, *t*

e = Exponent

r = Annual growth rate

The model introduced by Psacharopoulos (1973) as shown:

$$L_T = H\,(^{-1}\,(F_T) \quad (8)$$

Where;

L_T = Projections of manpower for the sector (number of employees)

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

$(I - A)^{-1}$ = Leontief inverse matrix for the base year

(F_T) = Forecast of a diagonal matrix of final demand

T = Targeted year (2020)

Noted that H matrix is the element that reflecting the change of labour productivity on the number of labour requirements.

RESULTS AND DISCUSSIONS

Construction sectors in Malaysia consist of four subsectors, which are a residential building, non-residential building, civil engineering and specialised construction activities. Among the plausible explanations for this study, Table 1 shows the projection of the total employment and total final demand in the construction sectors for the year 2020. By using the Input-Output table and Manpower Requirement Approach (MRA), the total employment projected is 1,239,771 labour for the year, 2020 as increased by 150,011 labour compared to the year of 2010. This striking result shows 14.5% increase been expected in the coming year of 2020. Undoubtedly, the findings provide evidence that construction sector is aimed at Vision 2020 of Malaysia and increasingly important due to the higher demand for modern and efficient infrastructures in Malaysia (EPU, 2015).

The findings in Table 1 reveal that subsector non-residential building of the construction sectors are high in need as much as 456,430 labours compared to the specialised construction activities subsector, which is 316,161 workers. Adding on, residential building and civil engineering show 316,161 and 117,210, projected manpower required in the construction sectors as respectively. It is apparent that residential building subsector could contribute the highest to the total final demand of the year 2020, estimated about RM 16,877 million, followed by civil engineering at RM15,500 million. Whereas residential only shows a small increase in the projection,

which is RM16,877 million, meanwhile final demand of specialised construction activities has expected to increase by RM1,743 million by the year 2020 compared to the year 2010. The findings revealed that all the subsectors in the construction sector in Malaysia have expected an increase in the manpower requirement for the year 2020, in accordance with the final demand.

Table 1 Projection of total employment and total final demand in the construction sectors for the year 2020*

	2010		2020*	
Construction Sectors	Total Employment (per person)	Total Final demand (RM)	Total Employment (per person)	Total Final demand (RM)
Residential Building	306,295	15,325,484	316,161	16,877,920
Non-Residential Building	393,370	11,678,763	456,430	12,283,831
Civil Engineering	111,856	13,336,554	117,210	15,500,192
Specialised Construction Activities	271,180	2,476,232	349,970	4,219,266
Total Employment	1,082,700		1,239,771	

Source: Labour Force Industrial Survey (2010) & Microsoft Excel (2017)
Note: * Projected figure (Input-Output Table)

In concordance with Table 2, indicates projected manpower requirements in the construction sectors for the year 2020, with respective employment category. The mentioned table demonstrates that four classifications of occupations [(i) managerial, professional and executive, (ii) technical, associate professionals and supervisory, (iii) clerical support workers, service and sales workers, agricultural skilled workers, forestry and fisheries, agricultural skilled workers, forestry and fisheries, skilled workers and related workers and plant operators, machines and installers (iv) Basic works]. The occupation has been forecasted with the manpower requirements, accordingly with the four construction subsectors (residential building, non-residential building, civil engineering and specialised construction activities).

From the perspective of employment category as exhibited in Table 2, basic works, which classified as low-skilled labour, are highly required in all four subsectors of construction with total employment 1,098,559 workers. A higher number of labour expected in the year 2020, with 411,129 workers in the non-residential subsector. Basic works include workers in maintenance and construct building workers. Since non-residential subsectors comprise an industrial building, commercial buildings and other buildings, thus labour consists of basic works highly required for the year 2020. The numerical simulation indicates that skilled workers expected to require more as 92,916 workers projected for the year 2020 in all four subsectors of construction in Malaysia, an increase of 7.9% compared to the year 2010. Skilled workers are consists of (i) Managerial, professional and executive and (ii) Technical, associate professionals and supervisory. Civil engineering includes construction building that consists of railways, roads or highways, water and sewage. Based on the manpower projection for the year 2020, 10,642 of skilled labours and 101,315 low-skilled workers are required for the civil engineering subsector. Perhaps, the residential building distinguished as comprising all types of house buildings and other residential buildings. As demonstrated in Table 2, the expected need for residential building subsector of low-skilled workers is large in numbers which 411,129 workers. Perhaps projected manpower requirement is also high for the residential building subsector in terms of 30,082 of skilled labours. This

shows that, the construction sector in Malaysia prone to manpower requirement in terms of skilled and low-skilled workers. The relevance projection of the manpower requirements in terms of employment category shows the clear picture and most obvious results in emerging noteworthy contribution in terms of construction subsectors in Malaysia.

Table 2 Projected manpower requirements in the constructions sectors for the Year 2020*

Construction Sectors	Employment Categories (per person)				Total Employment
	(i)	(ii)	(iii)	(iv)	
Residential Building	10,402	10,128	11,769	283,861	316,161
Non-Residential Building	14,984	15,098	15,219	411,129	456,430
Civil Engineering	5,549	5,093	5,253	101,315	117,210
Specialised Construction Activities	15,367	16,294	16,056	302,253	349,970
Total Employment	46,302	46,614	48,296	1,098,559	1,239,771

Source: *Projected figures (Input-Output Table) & Microsoft Excel (2017)

Note: (i) Managerial, professional and executive,
(ii) Technical, associate professionals and supervisory,
(iii) Clerical support workers, service and sales workers, agricultural skilled workers, forestry and fisheries, agricultural skilled workers, forestry and fisheries, skilled workers and related workers and plant operators, machines and installers
(iv) Basic works

Estimating from Table 3 shows that low-skilled workers in specialised construction activities subsector could contribute 88.61% share of employment to the construction sectors for the year 2020. However, non-residential building subsectors show the highest share of 90.10% in low-skilled workers compared to skilled and semi-skilled manpower, 6.61% and 3.33% respectively. Civil engineering in construction sectors shows an ascending pattern in the skilled and semi-skilled labour requirements, which are 9.08% and 4.5%, correspondingly. Table 3 exhibits clearly that total employment projected for the year 2020 in the construction sector in Malaysia shows a high increase in the share of employment for the skilled and low-skilled at 7.54% and 88.61% respectively. These findings suggest in general, as stressed earlier skilled and low-skilled labours are highly required in the projection for the year 2020 in the construction sector in Malaysia.

Table 3 Share of employment projected in the construction sectors for the year 2020*

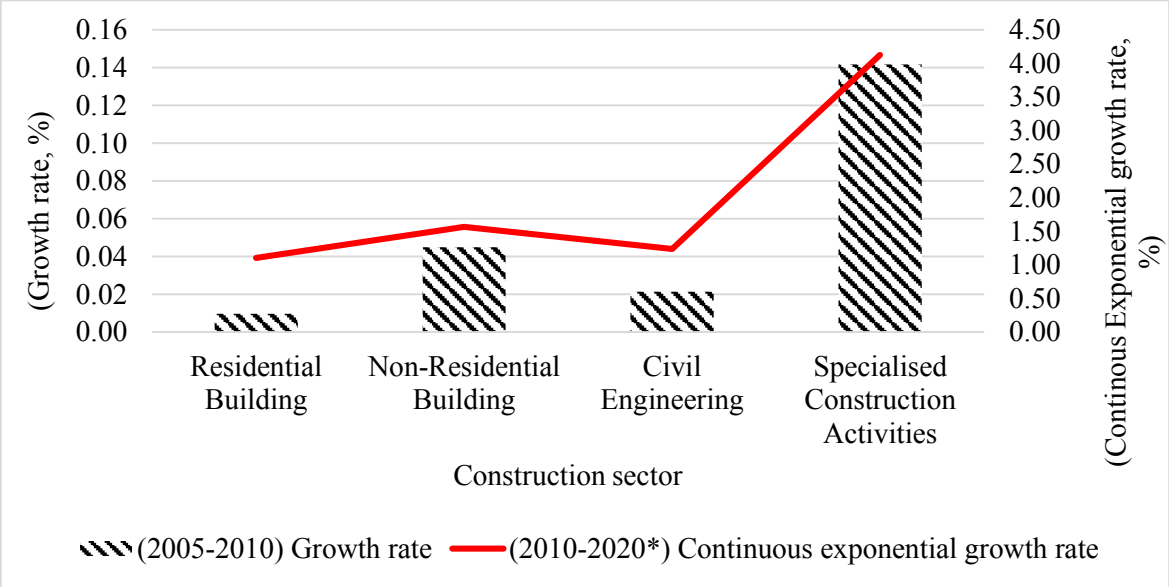
Construction Sectors	Employment Categories (%)			
	(i)	(ii)	(iii)	(iv)
Residential Building	3.30	3.20	3.72	89.80
Non-Residential Building	3.30	3.31	3.33	90.10
Civil Engineering	4.73	4.35	4.50	86.44
Specialised Construction Activities	4.40	4.70	4.60	86.37
Total Employment	3.74	3.80	3.90	88.61

Source: *Projected figures (Input-Output Table) & Microsoft Excel, 2017

Note: (i) Managerial, professional and executive,
(ii) Technical, associate professionals and supervisory,
(iii) Clerical support workers, service and sales workers, agricultural skilled workers, forestry and fisheries, agricultural skilled workers, forestry and fisheries, skilled workers and related workers and plant operators, machines and installers
(iv) Basic works

The continuous exponential growth rate based on the final demand for the construction subsectors has been calculated for the forecasted year of 2020, included the growth rate of the year 2010 which been clearly plotted in Figure 1. The findings reveal that specialised construction activities subsector has the largest growth rate, which 4.13% for the year 2020 compared to other subsectors in both 2010 and 2020. Meanwhile, the growth rate of specialised construction activities was still the highest in the year 2010 at 0.14% compared to a residential building (0.01%), non-residential building (0.04) and civil engineering (0.02).

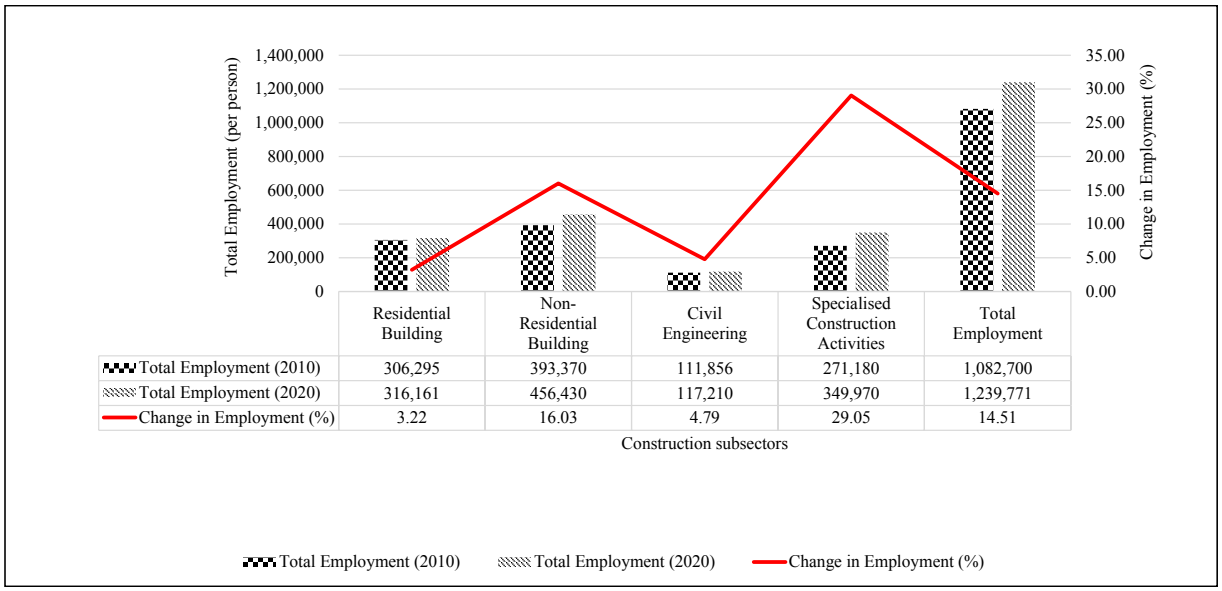
This paper seeks to address the manpower requirement in the construction sector in Malaysia for the year 2020. So far, in accumulating the forecast, this study spawned the importance of skilled and low-skilled workers in the construction sectors in Malaysia. Regardless the issue of a large number of foreign labour involved in this construction sector in Malaysia, which deniably participating in the 3D (Difficult, Dirty and Dangerous) categories of jobs. In the year 2010, Ministry of Home Affairs of Malaysia has reported that 235,010 foreign labour were working in the construction sector, legally. It was 12.9% from the share of total employment of foreign labours which was 1,817,871 foreign workers including all economic sectors in Malaysia. However, for the year 2015, this number has doubled to 745,131 foreign workers have been recorded in the construction sector. It showed the largest share of employment out of all economic sectors in Malaysia which were 34.9% in terms of 2,135,035 legal foreign labour in Malaysia.



Source: *Projected figures (Input-Output Table) & Microsoft Excel (2017)

Figure 1 The continuous exponential growth rate for the year 2020*

The highest need for skilled and low-skilled labour is emphasised and highlighted in this study after the clear and revealing results shown in the forecasts of the construction sector in Malaysia for the year 2020. The share of projected manpower requirements in the construction sectors for the year 2020 are plotted in Figure 2, clearly shows that specialised construction activities illustrated higher need in manpower with the change of employment, 29.05% from the year 2010 and 2020. Meanwhile, non-residential building subsector shows the change of employment of 16.03% compared to a residential building (3.22%) and civil engineering (4.79%).



Source: Input-Output Table, 2010 & Microsoft Excel, 2017

Figure 2 Shares of total employment in the construction sectors for the year 2010 and 2020*

CONCLUSION AND POLICY RECOMMENDATIONS

This study set out to determine the manpower requirement in Malaysia's construction sector for the year 2020. By using Input-Output Approach, four subsectors of construction sector mainly residential building, non-residential building, civil engineering and specialised construction activities are evaluated with three types of skills which are skilled employment categories consists of managerial, professional and executive, technical, associate professionals and supervisory. Meanwhile, semi-skilled employment categories are in terms of clerical support workers, service and sales workers, agricultural skilled workers, forestry and fisheries, agricultural skilled workers, forestry and fisheries, skilled workers and related workers and plant operators, machines and installers and lastly basic works are classified as low-skilled. The purpose of this current study is to resolve the circumstances, in which the need of local manpower participations is very important in Malaysia's construction sector, through the manpower planning implementation. The findings and forecasts have its significance from the point of view as illustrated in the Input-Output table.

One of the significance forecasts to emerge in this study is that specialised construction activities and non-residential building subsectors in the construction industry show the highest requirement in the skilled and low-skilled labour force for the year 2020. Overall, specialised construction activities subsector has shown the massive need for workers regardless of skilled and low skilled. As per forecast for the year 2020, the share of employment that been projected shows low-skilled manpower are higher in requirements, the prospect of labour demand in the mentioned of four subsectors of the construction industry that been drawn in this study.

The narrow perceptions of Malaysian citizen of the jobs available in the construction sectors cause the foreign labour to undertake the untaken jobs. Perhaps, there are other careers that are equally important in terms of its role, however, the activities in the construction sector cannot be implemented, namely the workers in the construction sites which been highlighted earlier based on the forecasted result, specifically low-skilled workers. The narrow perceptions of the locals on the jobs available in the construction sectors has opened an access of foreign labour

to undertake the job. These findings provide the following insights for future research. This study has potential to be broadened with the inclusion of the education level, number of unemployed citizens and supply of labour. As this study shrank in demand for labour and final demand of the construction sector, the further analysis in line with education and technology emphasises the clear picture of the environment of the labour market in Malaysia.

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APPENDIX 1

Total employment in economic sectors and by construction sectors for the year 2010 and 2020*

No	Sector/ Subsector	Employment Category (per person) [2010]				Total employment 2010	Total employment 2020*	Final Demand 2010 (RM)	Final Demand 2020* (RM)
		(i)	(ii)	(iii)	(iv)				
1	Agriculture, fishery and forestry	218,388	214,278	246,604	935,720	1,614,900	2,008,444	36,075,686	37,304,986
2	Mining and quarrying	5,512	6,617	6,823	38,248	57,200	48,721	42,931,530	30,246,580
3	Manufacturing	322,414	419,103	100,112	1,266,871	2,108,500	3,107,614	589,460,236	642,041,863
4	Residential building	9,570	9,853	10,564	276,308	306,295	316,161	15,325,484	16,877,920
5	Non-residential building	13,584	14,471	14,285	351,030	393,370	456,430	11,678,763	12,283,831
6	Civil engineering	4,155	4,724	4,605	98,371	111,856	117,210	13,336,554	15,500,192
7	Specialized construction activities	14,130	15,665	15,264	226,121	271,180	349,970	2,476,232	4,219,266
8	Services	1,494,782	1,254,585	1,953,201	2,334,132	7,036,700	8,029,233	272,657,003	301,763,623
	Total Employment					11,900,090	14,433,783		

Note: (i) Managerial, professional and executive, (ii) Technical, associate professionals and supervisory, (iii) Clerical support workers, service and sales workers, agricultural skilled workers, forestry and fisheries, agricultural skilled workers, forestry and fisheries, skilled workers and related workers and plant operators, machines and installers (iv) Basic works

Source: Construction Labour Force Industry Survey, *Projected figures (Input-Output Table) & Microsoft Excel (2017)

APPENDIX 2

Input-Output Table

	INTERMEDIATE CONSUMPTION		**FINAL DEMAND**						
Consuming sectors	1…..j….n	Total Intermediate Demand	Private Consumption	Government Consumption	Gross Fixed Capital Formation	Changes in Inventories	Total net export	Total Final Demand	Total output
Producing Sectors									
1	X_{11}	S_1	C_1	G_1	I_1	V_1	X_1	F_1	Y_1
.	.								
.	.								
i	X_{i1}…X_{ij}….X_{in}	S_i	C_i	G_i	I_i	V_i	X_i	F_i	Y_i
.	.								
.	.								
n	X_{n1}	S_n	C_n	G_n	I_n	V_n	X_n	F_n	Y_n
Total intermediate input	**X_{sum}**	**S_{sum}**	**C_{sum}**	**G_{sum}**	**I_{sum}**	**V_{sum}**	**X_{sum}**	**F_{sum}**	**Y_{sum}**
Total input	E_1… E_j… E_n	E = S							
Value added	D_1… D_j….D_n		D_C	D_G	D_I	D_V	D_X	D	
Total Output	Y_1… Y_j…..Y_n		C	G	I	V	X	F	Y

Source: Leontief, W. (1986), Input-Output Economics, Oxford University Press, New York.

APPENDIX 3

Employment category classified in The Eleventh Malaysia Plan (2016 – 2020)

i) Managerial, professional and executive	**Skilled workers**
ii) Technical, associate professionals and supervisory	
iii) Clerical support workers, service and sales workers, agricultural skilled workers, forestry and fisheries, agricultural skilled workers, forestry and fisheries, skilled workers and related workers and plant operators, machines and installers	**Semi-skilled workers**
iv) Basic works	**Low-skilled workers**

Source: The Eleventh Malaysia Plan, 2016 – 2020, Economic Planning Unit (2016)