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The Effects of Health, Labor and Capital towards Labor Productivity in Manufacturing Industries

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Abstract: The manufacturing industry is the focus of this study, in which the proportion of its contribution to economic growth is experiencing a decreasing trend recently. Does it involve factors such as the input of capital, health, or workers that give significant impacts on labor productivity in the Malaysian manufacturing industry? This paper discovered the relationship between capital, health, and workers that consist of foreign and local labor with the labour productivity in the Malaysian manufacturing industry from 1986 to 2020. The Cobb-Douglas production function was used to derive the model specification in this study. The results showed that all variables are significant, in which the capital and health have a positive relationship, whilst the factor of labor including local and foreign labor has a negative relationship with labour productivity. These findings may provide some insights into the improvement of manufacturing industries' performance in Malaysia. It would be useful in determining which input factors significantly affected the productivity of manufacturing labor.

Keywords: *Capital, workers, health, labor productivity, manufacturing industries.*

1. Introduction and Background

Malaysia is an expanding country in which the transformation of its domestic economy is ongoing, from an agrarian to a manufacturing country ever since the 1970s. To date, the manufacturing sector has become a major contributor to the national economic growth. Its contributions towards the country's exports, gross domestic product (GDP), and job recruitment at different levels of expertise cannot be denied (Azer, Hamzah, Aishah, & Abdullah, 2018). In 2021, manufacturing sectors in Malaysia accounted for 23.9% of gross domestic product (GDP) followed by agriculture (7.1%), and mining (6.7%) (Department of Statistics Malaysia, 2022). Moreover, the manufacturing industry plays a crucial part in advancing employment which essentially provided job opportunities for unskilled and semi-skilled workers it also can comprehensively decrease unemployment and minimise poverty (Khan et al., 2014). The manufacturing industry of Malaysia plays an essential part in boosting the economy to develop value, wealth, and job opportunities that finally encourage GDP growth and advancement of the socio-economic sector in this country. In addition, it promotes the utilisation of home-grown products that can increase recruitment in the downstream industry. The manufacturing sector also contributed to job recruitment. For instance, there were 2.5 million employees (16.60% of the total employed workforce) in the manufacturing sector in 2021. Table 1 shows the increasing trend in employment provided by the manufacturing sector. These increments signified the fundamental contribution of the manufacturing industry towards the growth of socio-economic in Malaysia through the enhancement of incomes and job recruitments that can reduce joblessness. Moreover, table 1 also shows that the involvement of non-native employees in Malaysia's manufacturing industry has increased since 1985 and was still high in the year 2021 (Department of Statistics Malaysia, 2022).

Table 1: Employment in Manufacturing Sector and Foreign Workers in Manufacturing Sector, 1986-2021 ('000)

YEAR	EMPLOYMENT	FOREIGN WORKERS
1986	874	16.2
1996	1912.10	264.8
2006	2,082.80	224
2016	2,390.70	506.2
2020	2,498	391.5
2021	2,501.4	378.8

Source: Department of Statistics Malaysia, 2022.

Moreover, with the employment opportunities contributed by this industry, the health of the labor force has become a crucial element towards productivity and the capability of the workers to adapt to technological progress. Meanwhile, life expectancy is commonly associated with the health of the workforce, their productivity and their ability to adapt to technological progress (Madsen, 2012). Life expectancy is frequently adopted as an indicator to assess the population's health status (OECD 2023). In Malaysia, life expectancy at birth has constantly increased towards 75.9 years in 2020 compared to 72.2 years in the year 2000 (World Development Indicator, 2022). One of the common indicators to augment productivity is health (Siddique et al., 2020). A worker that is in a good condition can be competent as he or she possesses physical and mental capabilities which then contributed to high productivity. Investing in health will ensure that the employees are healthy, thus helping them to combat chronic diseases. The countries that experienced poor health conditions will find it hard to achieve sustained development (Soriano and Garrido 2016). There is a significant relationship between productivity and health (Bloom et al., 2001) in which the workers' productivity is a fundamental aspect of economic growth.

For instance, productive organizations generated more income and recruitment, whilst experienced employees are more productive, earn more, and have a better living standard than unskilled workers (Arabi and Abdalla, 2013). In terms of the economy, health is regarded as the engine of advancement and a capital of creative assets (Barro, 1996). The investment in health and education will give a country a profitable return (Mushkin, 1962). Bloom and Canning (2000) and Grossman (2017) stated that healthy workers are more productive as they can acquire knowledge more efficiently. Even though the contributions of the manufacturing sector in Malaysia towards advancing exports, generating economic growth, and providing job recruitment have been acknowledged, the ongoing direction of liberalization, globalization, and accelerated institutional, organizational, along with technological alteration have created overwhelming barriers and challenges for the development of this sector (Nikolić, Jovanović, Nikolić, Mihajlović, & Schulte, 2019; Rahman, Yaacob, & Radzi, 2016; Saleh & Ndubisi, 2006). Furthermore, some researchers believed that the manufacturing industry in Malaysia is experiencing major challenges and issues that could reduce its productivity such as the ability to explore new markets and improve productivity, efficiency, and quality (Hooi & Leong, 2017; SMIDEC, 2002; National SME Development Council, 2010).

Other ongoing issues faced by manufacturing players in Malaysia are the increased costs of raw materials; high start-up costs; insufficient supply of workforce and high labor costs; lack of incentives and grants from the government; limited capabilities to go up against foreign makers; accelerated global competition; and lack of information and knowledge. In addition, the manufacturing industry is also devastated by disintegration, overhead costs, hazards, time overrun, and extravagance (da Silva, Marins, Tamura, & Dias, 2017; Nallusamy, Kumar, Yadav, Prasad, & Suman, 2018). Besides, the accelerated advancement of industrialization also sped ups waste production, pollution and environmental deterioration in Malaysia and other expanding countries (Carvalho et al., 2018; Ghazilla et al., 2015). This scenario can be seen in the decreasing trend of GDP growth in the manufacturing sector and its contribution to GDP in Malaysia. In the year 2000, the manufacturing sector's growth was at 19.1% which contributed 32.3% of Malaysia's Gross Domestic Product (GDP) compared to the year 2021 in which the growth was 9.5% and contributed approximately 23.9% to the national GDP. As depicted in Table 2, the GDP of manufacturing in Malaysia has declined from 2000 to 2021 (Department of Statistics Malaysia, 2022).

Table 2: GDP Growth and Share of GDP in the Manufacturing Sector, 2000-2021 (%)

	Annual Growth (%)		Share of GDP (%)	
Years	**2000**	**2021**	**2000**	**2021**
Manufacturing	**19.1%**	**9.5**	**32.3%**	**23.9%**

Source: Department of Statistics Malaysia, 2022.

Moreover, the manufacturing industry is suffering from several issues that needed to be addressed and resolved (Singh, Singh, & Sharma, 2018). Researchers have suggested several critical strategies that can be adopted towards achieving sustainable production in the context of social, economic, and environment (Mukhedkar, 2020). The improvement in productivity, quality, and novelty is crucial in creating a sustainable manufacturing industry in Malaysia, which is not only successful in implementing complex manufacturing projects domestically but able to participate in major projects at the international level as well. Hence, it is

crucial to take a holistic approach by reviewing the challenges to promote the productivity and efficiency of the Malaysian manufacturing industry. Recognising this matter, the main objective of this research is to study the relationship between the factor of labour, capital, and health on labour productivity in the manufacturing industry of Malaysia.

To determine whether these factors of labour, capital, or health give more significant impacts towards labour productivity in the Malaysian manufacturing industry. In addition, we departed this study from the previous research by proposing a relationship effect of health on labour productivity in the manufacturing industry. There was only a few research conducted previously to determine the relationship of health factors that influenced productivity in the industry. This study also aims to fill in the gaps in the existing literature in theoretical and practical manners. The novelty of this study is it estimates the effects of the capital intensity, employees that consist of local and foreign workers, as well as the health of manufacturing labour's productivity. The findings of this study should complement the previous literature with a discussion on the aspect of the relationship and the causality between workers and health. It can be concluded that information on the impacts of health on labour productivity especially in manufacturing industries in the variables of interest of this study is almost non-existent, especially in the Malaysian context.

2. Literature Review

Numerous studies have been done previously to determine the effects of factors that contributed to productivity in the manufacturing sector. Among the determinants that will be focused on in this study are the contribution of capital investment in manufacturing, health, and workers which consist of native and non-native workforce. The immigration of foreign workers will either give positive or negative impacts on the labor productivity of the receiving countries. Some studies have been conducted on the positive impacts of the foreign workforce on labour productivity in the manufacturing sector. For instance, a study carried out by Thangavelu (2016) that discovered non-native employees could affect productivity in the manufacturing sector, but the impacts were insignificant compared to the native workers. There was a decrease in the capital-to-labour ratios presented along with the increasing number of foreign workers available. Whilst another study conducted by Noor et al. (2011) found that foreign labours have significantly impacted labour productivity, but did not substitute or complement the local workforce and their productivity.

However, a study done by Kangasniemi et al. (2012) found that the migrants were more productive than locals in the UK, but on the other hand, Spain native's workforce is more productive than their new migrants, due to the different policies of immigration. Meanwhile, a study carried out by Jordaan (2018) has concluded that foreign workers have created positive productivity effects on the manufacturing sector. Some researchers studied the relationship between local and non-native employees to determine whether the connection are substituting or complimenting one another. A study by Friedberg & Hunt (2018) found that the earnings and job opportunities for the local population did not cause an increment in the immigration labours. In addition, a study by O'Connor & Graham (2019) revealed that immigration did not statistically affect a native's well-being across all scenarios. Moreover, a study by Sulaiman, Ismail & Saukani (2017) found that the number of non-native workers and the number of technological agreements did not affect the Total Factor Productivity (TFP). Furthermore, the study by Brunello, Lodigian, & Rocco (2020) discovered the current increase in low-skilled.

Immigrants in Italy has prevented the conversion of economic arrangement to be more productive and increased wages. Whilst a study by Ismail & Yuliyusman (2014) validated that there was an adverse impact of immigrants on productivity. The interrelated other factors that affected the labour productivity of the manufacturing sector were also studied. Some of the factors are in the form of capital investment and only a few studies have discussed the health factor, especially in the manufacturing industry. Another factor of production productivity in the manufacturing industry is capital. It is frequently associated with the ratio of total assets or fixed assets to labour inputs which further defined a company's efficacy in utilising its resources to generate materials or services (Chang & Singh, 1999; Sen & Farzin, 2000). The instrument and equipment were commonly described as the capital in production. Equipment and technology play crucial roles in the enhancement of construction activities towards automation, which significantly affected manufacturing productivity and project performance. The impacts of technology, automation and

modernization towards improving productivity were investigated to determine and assess.

The effects of management tools in improving productivity (Baker, Kumar, & Singh, 2019; Singh, Singh, & Sharma, 2018). Moreover, a study done by (Dhillon, 2006) revealed that investment in fixed assets and capital expenditure did significantly affect labour productivity. Furthermore, the connection between human health and labour productivity has been investigated. Siddique et al. (2018) discovered the existence of a significant relationship between life expectancy and economic growth, considering that a negative relationship existed between newborn fatality and economic growth in 76 middle-income countries from 1991 to 2016. The findings showed that economic growth can be enhanced through education. The study also concluded that in the upper- and middle-income countries, education, newborn fatality, and life expectancy have greater impacts compared to the lower- and middle-income countries. Biyase & Malesa (2019) also found that life expectancy has a positive effect on economic growth in 10 South African countries from 1985 to 2017. Ullah et al. (2019) studied the effects of health on labour productivity in Pakistan from 1980 to 2010. The results indicated that the advancement in health will increase productivity. Chaabouni et al. (2016) also examined the two-way causality between health expenditures and economic growth.

For a panel of 51 countries from 1995 to 2013, by utilising the dynamic simultaneous equation models whilst Zortuk & Ceken (2015) have identified that spending on health care is one of the fundamental expenses in the European Union from 1995 to 2011. In relation to that, it is possible to mention the input factors of productivity such as investment of capital, labour, and health are associated with the production. This signified that productivity portrays the quality level of production factors' characteristics. In this context, production can be observed consequently of the process, in terms of services or products, whilst input factors comprised any humans and physical resources adopted in the process. All in all, the impacts of labour and other inputs factors towards labour productivity can be positive, negative or have no connection, but the relationship is mainly having negative impacts, specifically for the factor of labour. Thus, it can be assumed that the impact factor of labour towards labour productivity in the manufacturing industry is more towards the negative relationship. The purpose of this study is to enlighten the project management teams in the manufacturing industry on the perspectives of labour, health, and capital investment and determine which factors contributed to low labour productivity. This will help the project teams in the manufacturing industry to identify early signs of issues due to low productivity and adopt corrective measures in time to bring the project back on track.

3. Methodology and Analysis Approach

This study adopted the Solow growth model by carrying out the primary Cobb-Douglas production function in the Solow framework model (Noor et al., 2011). The basic equation of the function is as follows:

$$Y_t = AK_t^{\alpha} L_t^{\beta} Mat_t^{\theta} \quad (1)$$

Derived from the Cobb-Douglas production function, the value-added variable in the equation was divided by the total number of labours to convert it into a labour productivity equation (Noor et al., 2011). In this equation, labour consists of two categories which are local labour and foreign labour. Then, health was added to the equation and the entire variables were then transformed into a logarithm. The estimated equation is as follows:

$$\ln y_t = A + \beta_1 \ln capital_t \ \beta_2 \ln workers_t + \beta_3 \ln \text{□}ealt\text{□}_t + \in_t \quad (2)$$

Referring to the equation above, where t =1, …, T, refers to the time.
Meanwhile,
1n y = logarithm of labour productivity (value added /total number of workers),
ln capital = logarithm of capital in terms of fixed assets,
ln workers = logarithm of the total number of labour which consist of local labour and foreign labour,
ln health = logarithm of life expectancy at birth.

Table 3: Measurement of Data Explanatory Variables and Proxies

Variable	Proxy	Unit	Past Studies
Labour Productivity	Gross Domestic Product or value added / Total Number of Labour	Gross Domestic Product (GDP) in hundred thousand Ringgit Malaysia ('000 RM), Total Number of Labour in hundred thousand ('000, Person working) consist of Local Labour and Foreign Labour	(Trpeski & Cvetanoska, 2018)
Capital	Value of Fixed Assets	Fixed Assets in hundred thousand Ringgit Malaysia ('000 RM)	Noor et al., (2011), Jordaan (2018)
Workers	Total Number of Local Labour and Total Number of Foreign Labours	Total number of Local Labour in hundred thousand ('000, Person working)	Noor et al., (2011)
Health	Life Expectancy	The average period that a person may expect to live	Siddique et al. (2018)

Equation (2) was tested by employing Ordinary Least Square (OLS) method. Before commencing further analysis, the existence of a time series problem in the data must be validated. The Unit Root Test which consists of the Philips Perron (PP) unit root test was used to test the data. Data for this study were obtained from the survey conducted by the Department of Statistics of Malaysia. All data were collected annually and then converted into logarithms. The analysis period is from 1986 to 2020 and the Ordinary Least Squares (OLS) method for data estimation was used to analyse the data.

4. Results and Discussion

In this study, descriptive statistics were used to measure the basic conduct of the data. Table 4 indicated that on average, the labour productivity in Malaysia is ($\bar{x}$ = 3.8540, s = 0.7104), with the capital ($\bar{x}$ = 11.7364, s = 0.8773) has the highest value among the sets of independent variables, followed by workers ($\bar{x}$ = 7.5165, s = 0.3065), and health ($\bar{x}$ = 4.2943, s = 0.0232) . Jarque-Bera analysis signified that all variables were normally distributed. Thus, Ordinary Least Square (OLS) is appropriate to be used in this study.

Table 4: Descriptive Statistics

Analysis	Labor Productivity	Capital	Workers	Health
Mean	3.8540	11.7364	7.5165	4.2943
Standard Deviation	0.7104	0.8773	0.3065	0.0232
Minimum	2.6390	9.9703	6.7452	4.2530
Maximum	4.8202	12.8265	7.8678	4.3299
Jarque-Bera	2.4968	4.6649	12.0274	2.5451
Probability	0.2869	0.0970	0.0024	0.2801

Then, the Philips Perron (PP) Unit Root test was performed on the four variables to identify whether the variables are stationary or non-stationary. The results revealed that all variables for PP with drift in the unit root test were stationary at the first difference, I (1). Moreover, with drift and trend in the PP unit root test, all variables were stationary at first difference.

Table 5: Result of Philips Perron Unit Root Test

Variables	Philips Perron (PP) Unit Root test			
	Intercept		Trend & Intercept	
	Level	1st Difference	Level	1st Difference
Ln labor productivity	-1.2204 (0.6545)	-5.4655*** (0.0001)	-1.6513 (0.7513)	-5.6348*** (0.0003)
capital	-2.2746 (0.1854)	-3.2131** (0.0278)	-1.2331 (0.8877)	-3.9842** (0.0189)
Ln workers	-3.3617 (0.0194)	-4.2191*** (0.0022)	-2.1344 (0.5096)	-4.8652** (0.0021)
Ln health	-1.4145 (0.5640)	-2.8591* (0.0608)	-1.8623 (0.6523)	-3.0698 (0.1295)

After that, Ordinary Least Square (OLS) was applied to regress the equation in (2). The result was shown in Table 6 below. It can be concluded that all variables have a significant relationship. The result showed that capital has a positive relationship with labour productivity in the manufacturing industry. It indicated that the increase in capital by 1% will increase labour productivity by 0.51%. This is consistent with Durdyev & Mbachu (2018) who stated that by overcoming the shortage of tools and equipment, the biggest gain in labour productivity can be achieved. Additionally, workers consist of two categories which are local labour and foreign labour has a significant and negative relationship with labour productivity in the manufacturing industry. It showed that an increase of 1% in the workers will decrease labour productivity by 0.59%. This is consistent with Ismail (2015) who found out that unskilled and semi-skilled foreign workers have a negative contribution towards labour productivity. Moreover, health has the highest significant relationship with labour productivity. The result showed that health has a positive relationship with the significance of labour productivity in the manufacturing industry. It indicated that the increase in health by 1% will increase labour productivity by 18.45%. This is consistent with the findings from Ullah et al. (2019) who studied the impacts of health on labour productivity in Pakistan from 1980 to 2010. The outcomes of the study showed that health improvement could increase productivity. Table 6 summarised the results of the ordinary least square regression analysis:

$\ln y_t$ = -76.9315 + 0.5140 $\ln capital_t$ - 0.5966 $\ln workers_t$ + 18.4512 $\ln$ ealt $_t + \in_t$ (3),

Table 6: Result of the Ordinary Least Square Regression

Variables	Coefficient	p-value
C	-76.9315	0.0000
Ln capital	0.5140***	0.0005
Ln workers	-0.5966***	0.0243
Ln health	18.4512***	0.0000
R-squared	0.9751	
Adjusted R-squared	0.9728	
F-statistic	419.3952	
Durbin-Watson statistics	0.5205	

Thus, it can be concluded that the manufacturing sector in Malaysia is experiencing lower labour intensive as the result showed that any increases in labour usage will not affect labour productivity. In addition, this sector is moving towards the capital accelerated landscape as any increases in capital utilisation will boost labour productivity. Furthermore, health was also known as a crucial factor contributing to the increase in labour productivity. R^2 Indicated that the productivity output of the manufacturing is represented by 97.5% of the discussed variables in the model. The diagnostic test then was carried out such as the normality test and also the heteroscedasticity test for the model. The purpose of these tests is to indicate the model is valid to use. The normality test is done by using the Jarque-Bera test. The result of Jarque-Bera on the Estimated Regression Coefficient shows that the error term normally distributed due to the coefficient is not statistically significant at the 5% level. The result is shown in Table 7.

Table 7: Result of Jarque Bera on the Model

Jarque-Bera	**1.4635**
Probability	0.4813

The Heteroskedasticity test then was carried out. This study applied Breusch Pagan Godfrey to test Heteroskedasticity whether it exists or not in this model. The result of Heteroskedasticity on the Estimated Regression Coefficient shows that there is no Heteroskedasticity in the model due to the coefficient is not statistically significant at the 5% level. The result is shown in Table 8:

Table 8: Result of Heteroskedasticity on the Model

F-statistics	**1.9774**	**Prob. F (3,32)**	**0.1372**
Obs * R-squared	5.6301	Prob. Chi-Square (3)	0.1311
Scaled explained SS	6.1420	Prob. Chi-Square (3)	0.1049

Hence, in this model, the error term of the model is normality distributed and there is also no heteroskedasticity in the model. The causal relationship between workers and health in (3) was obtained by running the Granger causality test to determine the causal relationship between workers and health. The relationship is shown in Table 9 below:

Table 9: Result of Granger Causality Test

Null hypothesis	**Observation**	**F-statistic**
Workers do not Granger cause Health	27	2.6510 (0.0923)
Health does not Granger cause Workers	27	17.6905 0002)

From Table 9, the findings revealed that there was causality between health and workers, but none was found between workers and health. The null hypothesis which stated that health does not Granger cause employees was rejected, while the null hypothesis which stated that employees do not Granger cause health was accepted based on the results obtained. This indicated that health did have a significant effect towards workers. Thus, it can be concluded that health is fundamental for workers in the manufacturing sector to preserve their productivity. This outcome matched the study conducted by Ullah et al. (2019) who investigated the effects of health on labour productivity in Pakistan from 1980 to 2010. The findings showed that the advancement in health could raise productivity.

5. Conclusion and Recommendations

Fundamentally, this research aims to determine the factors that affected the labour productivity of the manufacturing industry in Malaysia. The factor variables in this study comprise the capital, health, and workers, which include the foreign and local workforces. Annual data samples from 1986 to 2020 were used in this study. The theory adopted to analyse the relationship between the factor's variables and labour productivity in Malaysia is the Cob-Douglass theory and the Philip Perron Test were applied as a unit root test of this study. The estimation results indicated that capital and health have contributed positive effects on labour productivity. Contrarily, workers consisting of local and foreign labours showed a negative relationship towards labour productivity in Malaysia's manufacturing industry. Based on the findings, the factor of labour on local and foreign workers has a negative relationship with the labour productivity in the manufacturing sector, whilst other factor inputs have a positive relationship. The negative relationship of factor labour might be due to the lack of investment in terms of human capital that led to the low rate of labour productivity. Moreover, Ibrahim et al. (2010) suggested that to tackle the issues of administrative shortage, inexperienced workers, and technical problems, the manufacturing industry of Malaysia should increase training for professionals and employees to enhance their capabilities, competencies, and operational performances at the local and international levels.

Hence, it is also suggested that the government should strengthen the capability of local and foreign workers by increasing industrial training. It can be achieved through collaboration with experts from the industry and training institutes (Varaprasad, 2022). Employers could also motivate their local and foreign workers by

providing interesting incentives, such as offering bonuses and allowances as rewards for any achievements in the workplace to enhance their productivity (Nikiforakis, Oechssler & Shah, 2019; Mohd Fateh et al., 2022). It is also recommended that employers should provide workers with incentives and allowances for workers' healthcare so that they can be healthier, thus increasing their productivity as well (Ullah et al., 2019). The employers could also provide a conducive and safe working environment to attract more local workers to work in this sector (Verghese, Viswanathan, & Ramalingam, 2018). Therefore, with all these initiatives, the workers would be more motivated, productive, and attracted to work in the manufacturing sector. Mohd Fateh et al. (2022) added that the living quarters provided by the employers should meet the requirement for local legislation and international best practise, such as minimum allocation of space for every worker, provision of sanitary, laundry, and cooking apparatus as well as a sufficient supply of clean water. In addition, future research should include other factors that could affect labour productivity in the manufacturing sector to enhance understanding of the other factors in the context of labour productivity.

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