A Decomposition Analysis for Labour Demand: Evidence from Malaysian Manufacturing Sector

POO BEE TIN
School of Economics, Faculty of Economics and Management
University Kebangsaan Malaysia
43600 Bandar Baru Bangi, Selangor
MALAYSIA
pbt@ukm.my

Abstract: - Malaysia experienced four major phases of industrialization, with import substitution or export orientation dominating each phases alternatively. Manufacturing sector is important in Malaysia's industrial development, inducing rapid growth, technology expansion and upgrading labor skill. High growth rates and high technology expansion in these sector resulted in a substantial increase in demand for labor. Indeed, currently the economy is continuously experiencing further structural adjustments in output and employment as the degree of integration with world markets increases and changes in technology deepen. By using three Malaysian input-output tables; 1978, 1991 and 2000 input-output tables - the present study employs the popular model namely the Structural Decomposition Analysis (SDA). The result also shows that changes in the final demand structure were the major source of labor growth, dominating by domestic demand during 1978-1991 and by export demand during 1991- 2000.

Key-Words: manufacturing, decomposition, labor, input-output, growth and Malaysia

1 Introduction

Economic growth is seen an important process of developing an economic, which will certainly involve some form of structural change, normally associated to transforming the economy from one which is heavily reliance on agriculture to a more modern, urbanized, and diverse manufacturing and service activities.

Malaysian manufacturing sector has experienced a rapid structural change in its production process and it is expected that the process will continue as the economy moves towards high value-added economy. The structural changes in the economy have also transformed the country from an exporter of primary commodities to an exporter of high value-added manufactured products. At the same time, integration of the economy into global and advancement technology economy prompted structural changes not only in output composition but also in employment and occupational composition of the workforce. Indeed, currently the economy is continuously experiencing further structural adjustments in output and employment as the degree of integration with world markets increases and changes in technology deepen. As mention by [1], regardless of the type of economic and social organization espoused by a nation or even a geographical region, as well as the historical period that we are looking to characterize, the labour factor represents the central element in the economy of any organization. The level of profitability and the efficiency of the national economy, in its entirety, as well as the living standards of particular individuals depend on the manner in which this particular resource is handled.

Naturally, as a small open economy, Malaysia's domestic demand, exports, imports, economic growth and technological change would certainly affect directly and indirectly changes in labor structure especially in the manufacturing sector. According to [2], the emergence of new scientific disciplines, requiring interdisciplinary skills and knowledge has increased additionally the requirements for the skills and competences of the workforce.

Technological progress in an economy certainly also changes the requirements for the economy's labor force in terms of knowledge level and skill combination and causes replacement of some occupation by others. It is important to undertake new research in labor issues in manufacturing sector because the sector is anticipated to become a major

absorber of labor. Failure to take these into consideration in the promotion of the national development may severely affect the economy because the national development plan aims to ensure sustainable economic growth. It would be interesting to study whether there was any significant shift in labor structure and if there was, what are the sources of labor change during the industrialization process? As a result, it is important to understand and identify the sources of labor growth that would give strongest impetus to this transition. Hence, the present study would like to investigate the sources of labor changes in the manufacturing sector as it moves towards high-technology and capital-intensive production by using the structural decomposition analysis.

In addition, structural decomposition analysis, which is employed in this research, has the capability of not only decomposing changes in the labor of the economy into economic growth, technical change and changes in the structure of final demand effects but also identifying explicitly the occupation substitution and the labor productivity of technical change. Input-output structural decomposition analysis (SDA) is a relatively received increasing attention in recent years. SDA methodology has been practiced in the literature now for more than two decades. This practical tool has made it possible to quantify fundamental sources of change in a wide range of variables, including economic growth, energy use, labor requirements, trade and material intensity of use [3].

2 Literature Review

Structural economic change, defined as temporal changes in interactions among economic sectors [4], can be studied via the use of various measures [5]. A popular and effective way of analysing structural changes over time is the use of an input-output framework because of its uniquely rich representation of economic structure [6] [7] [5]. Among the methodologies that have been developed so far, structural decomposition analysis (SDA) provides an analytical tool for distinguishing among major sources of change in an economy and it has received much emphasis [8] [3] [9].

Structural decomposition analysis can be defined as "a method or way of distinguishing major sources of change in an economy. It is basically involves a set of comparative static exercises in which sets of coefficients are changed, in turn, and activity levels compared to a reference point " [7]. This has been more compactly paraphrased as "the analysis of economic change by means of a set of comparative static changes in key parameters in an input-output table" [8]. Its origins date back to the work of [10] on the structure of the United State economy. A few years later, in the sixties, [11] and [9] extended in several ways this basic methodology [3].

Nowadays, SDA become a common descriptive tool in studying changes over time. Actually, it is traditionally used to study the observed changes in the level and mix of output and employment. The central idea is that the change in some variable is decomposed, usually in an additive way, into the changes in its determinants. It thus becomes possible to quantify the underlying sources of the changes [13]. These changes, often defined as "structural transformation" of the economy, are decomposed into changes in technology, changes in final demand and changes in import dependence.

Structural decomposition analysis is defined 'as a method of distinguishing major shifts within an economy by means of comparative static changes in keys sets of 'parameters' [14]. The basic concepts of decomposition analysis is to explain structural change by a multitude of factors, such as technological change, demand change, trade pattern change, labor change, income distribution and so forth . According to [13], structural decomposition techniques are used to break down the changes in one variable into the changes in its determinants. Typically, these determinants are assumed to be independent.

3 Methodology

Input-Output (I-O) analysis is the name given to an analytical framework developed by Professor Wassily Leontief in the late 1930s, work for which he received the Nobel Prize in Economic Science in 1973 [15]. Leontief's input-output analysis constitutes a powerful tool to describe and analyse an economy and it can be useful both at a national and regional level. In general terms, I-O analysis offers a static view of structural relationships among the different sectors of an economy (typically national or regional) for a certain period of time. Besides, input-output analysis also is a particular planning and projection technique with a wide of applications. It offers a snapshot picture at a point in time of the interdependencies between activities in an economy. Recent years, the I-O framework has been extended to deal more explicitly with such topics as interregional flows of products and accounting for energy consumption, environmental pollution, employment associated with industrial production, economic impact analysis, identification

of development potentials, market analysis, tax analysis, resource development/depletion analysis, dynamic simulation, revenue projection import/export analysis, occupation projections and development projections [15].

A simple input-output model is useful framework for decomposing the different factors conducive to growth and structural change in the production system. Input-output decomposition analysis has become a popular methodology for several reasons. Firstly, the structural decomposition analysis technique describes the structural development of a production system. It separates certain components and thus helps to explain better what has happened in the economy but it does not explain why structural changes have occurred. The driving forces behind structural changes and the dynamic process if development are not analysed since the technique relies on comparative static analysis. However, the technique does yield good material on which to base dynamic studies.

Secondly, input-output coefficients are the links which transmit changes between industries. The links themselves are related to technical changes and are thus an important central area for the dynamic analysis of structural change. SDA gives information about changes in these coefficients and their impact on the development of the economy. This information is useful in identifying the most important changes for further analysis and for suggesting the reasons for change.

Thirdly, the open static input-output model assumes constant input coefficients. The decomposition technique examines changes in input coefficient and does not assume constant coefficients for the year outside examination. It supposes that the average production technique is used in each industry for producing all the commodities included in the output of industry. The final reason for the increasingly widespread use of SDA is that it is a pragmatic alternative to econometric estimation. Analysis of similar topics using econometrics requires a time series covering 15 years or more, and not only for output and primary factors of production but all intermediate inputs as well. In contrast, SDA requires only two I-O tables: one for the initial year and the other for the terminal year of the analysis.

By using the input-output analyse it is possible to observe the interdependence of an economy's various sectors of production by viewing the product of each sector both as a commodity demanded for final consumption and as a factor in the production of itself and other goods. In the input-output approach, the balance equation can be written as:

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

Where,

F is the vector of final demand
X is the vector of sectoral output
And A is the technical coefficient matrix

Solving the balance equation for X, we obtain

$$X = (I - A)^{-1} F$$

Let $R = (I - A)^{-1}$

Where $R = (r_{ij})$ is Leontief inverse matrix

We may write equation (1) as $X = RF$ (2)

The labor requirement equation of an I-O production system of n sector is

$$L = l(I - A)^{-1} F \quad (3)$$

where L is a total labor requirement row vector by n sectors (1 x n), measured in workers; l is the labor row vector coefficient by n sector (1 x n) with the coefficients measured in terms of workers required per unit output; F is a final demand vector (n x 1) measured in value terms; A is a technical coefficient matrix (n x n), which measures the input requirements per unit output in value terms; and I is an identity matrix (n x n). From equation 3, the present study defines

$R = (I - A)^{-1}$, and then equation 4 can be expressed as;

$$L = lRF \quad (4)$$

From equation 4, thus decomposition of labor changes for n sectors as recommended by [14] can be express as:

$$L = lR(F)^{\wedge} \quad (5)$$

( ) ^ denotes the diagonal matrix of the F vector in the parentheses and let

$$\theta = \frac{GDP_t}{GDP_0}$$

is the expansion rate of the gross domestic product (GDP) between terminal year and initial year. Then the sources of labor change of an economy between the two years (years 0 or initial and year 1 or terminal) can be decomposed into;

$$\Delta L = L_t - L_0$$
$$= l_t R_t F_t - l_0 R_0 F_0$$
$$= l_t R_t F_t - l_0 R_0 F_t + l_0 R_0 F_t - l_0 R_0 \phi F_0 + l_0 R_0 \phi F_0 - l_0 R_0 F_0$$
$$= (l_t R_t - l_0 R_0) F_t + l_0 R_0 (F_t - \phi F_0) + l_0 R_0 (\phi - 1) F_0$$
$$= (l_t R_t - l_0 R_0) F_t - (l_t R_t - l_0 R_0) F_0 + (l_t R_t - l_0 R_0) F_0 + l_0 R_0 (F_t - \phi F_0) + l_0 R_0 (\phi - 1) F_0$$

Or

$$\Delta L = (l_t R_t - l_0 R_0) F_0 + l_0 R_0 (F_t - \phi F_0) + l_0 R_0 (\phi - 1) F_0 + (l_t R_t - H_0 R_0)(F_t - F_0) \quad (6)$$

The first term of equation 6 is the effect of technical change on the labor requirement of the economy, which includes both the direct effect of technical change on the labor requirement, through changing direct labor input coefficients, and the indirect effect of technical change on the labor requirement, through changing intermediate input coefficients. The second term is the effect of changes in the structure of final demand. The third term is the effect of economic growth. The final term is the effect of interaction between technical change and changes in the final demand.

2.1 Technical Change

We shall assume that the technical change within each sector can be broken into two separate parts, i.e. changes in intermediate input using technology and changes in manpower using technology, and denoting l^* as a hypothetical direct labor coefficient matrix (m x n) with the labor intensity of each sector the same as that of l_t, but the occupation mix of each sector labor the same as that of l_0, which is mathematically defined as ;

$$l^* = l_0 (\nu l_t)^{\wedge} (\nu l_0)^{\wedge -1} \quad (7)$$

ν is a unit row vector (1 x m) and ( ) ^ denotes the diagonal matrix of the vector in the parentheses, Then, the effect of technical change (first term) can be further decomposed into;

$$(l_t R_t - l_0 R_0) F_0$$
$$= (l_t R_t - l_0 R_t + l_0 R_t - l_0 R_0) F_0$$
$$= (l_t - l_0) R_t F_0 + l_0 (R_t - R_0) F_0$$
$$= (l_t - l_0) R_t F_0 - (l_t - l_0) R_0 F_0 + (l_t - l_0) R_0 F_0 + l_0 (R_t - R_0) F_0$$
$$= (l_t - l_0)(R_t - R_0) F_0 + (l_t - l^* + l^* - l_0) R_0 F_0 + l_0 (R_t - R_0) F_0$$
$$= (l_t - l^*) R_0 F_0 + (l^* - l_0) R_0 F_0 + l_0 (R_t - R_0) F_0 + (l_t - l_0)(R_t - R_0) F_0 \quad (8)$$

Based on equation 8, the effect or technical change can be further decomposed to effect of inter – occupation substitution effect (first term of equation 8); changes in labor productivity (second term of equation 8); effect of changes in intermediate input (third term of equation 8) and Effect of interaction between changes in manpower coefficient and changes in intermediate input coefficients (final term of equation 8)

2.2 Final Demand

Final demand comprise of domestic consumption, government expenditure, investment, stock change, exports and imports. The effect of changes in the structure of final demand also can be further decomposed. Let us suppose that the final demand is decomposed into domestic final demand (including domestic consumption, government consumption (federal, state, local), changes in inventory, gross fixed capital formation), exports and imports, and let

$$\gamma^d = \frac{\mu F_t^d}{\mu F_0^d} \qquad \gamma^e = \frac{\mu F_t^e}{\mu F_0^e} \qquad \gamma^m = \frac{\mu F_t^m}{\mu F_0^m}$$

where

F^d = Domestic final demand (n x 1)

F^e = Exports (n x 1)

F^m = Imports (n x 1)

μ = Unit row vector (1 x n) and

$f = (F^d \;\; F^e \;\; F^m)$ (n x 3)

$$\bar{\gamma} = \begin{pmatrix} \gamma^d \\ \gamma^e \\ \gamma^m \end{pmatrix} \qquad \bar{\phi} = \begin{pmatrix} \phi \\ \phi \\ \phi \end{pmatrix}$$

(3 x 1) (3 x 1)

Then, the effect of changes in the structure of final demand can be further decomposed into;

$$l_0 R_0 (F_t - \phi F_0)$$

$$= l_0 R_0 [F_t^d + F_t^e + F_t^m - \phi (F_0^d + F_0^e + F_0^m)]$$

$$= l_0 R_0 (F_t^d + F_t^e + F_t^m - \gamma^d F_0^d - \gamma^e F_0^e - \gamma^m F_0^m$$

$$+ \gamma^d F_0^d + \gamma^e F_0^e + \gamma^m F_0^m - \phi F_0^d - \phi F_0^e - \phi F_0^m)$$

$$= l_0 R_0 [(F_t^d - \gamma^d F_0^d) + (F_t^e - \gamma^e F_0^e) + (F_t^m - \gamma^m F_0^m) + f_0 (\bar{\gamma} - \bar{\phi})$$

$$= l_0 R_0 (F_t^d - \gamma^d F_0^d) + l_0 R_0 (F_t^e - \gamma^e F_0^e) + l_0 R_0 (F_t^m - \gamma^m F_0^m) + l_0 R_0 f_0 (\bar{\gamma} - \bar{\phi}) \quad (9)$$

The right hand side of equation 9 represents effect of changes in domestic demand structure; effect of changes in export structure; effect of changes in import structure and effect of changes in final demand component structure.

2.3 Interaction between Technical Change and Changes in the Final Demand.

The effect of interaction between technical change and changes in the final demand also can be further decomposed into;

$$(l_t R_t - l_0 R_0)(F_t - F_0)$$
$$= (l_t R_t - l_0 R_0)(F_t - \phi F_0 + \phi F_0 - F_0)$$
$$= (l_t R_t - l_0 R_0)(\phi - 1) F_0 +$$
$$(l_t R_t - l_0 R_0)(F_t - \phi F_0) \quad (10)$$

The first term of equation 10 represent growth multiplied technical change effect and the second term represent effect of interaction between technical change and changes in final demand structure.

This study applied two types of data. The first set of data used three sets of Malaysia's I-O tables for 1978, 1991 and 2000 published by the Department of Statistics Malaysia. The presented structure of national income account classification has administrated the possible maximum size of the Malaysian Input Output Tables. Basic sets of symmetric tables published by Department of Statistic (DOS) were offered at the 60 x 60 level of industries (commodities) aggregation for I-O table 1978, 92 x 92 level of industries (commodities) for I-O table 1991 and 94 x 94 level of industries for I-O table 2000. We have reduced the tables to 32 by 32 sub-sectors, covering all 31 manufacturing sub-sectors/commodities and single sector which represent "other sectors" that includes the services, agriculture, mining, construction, and the rest of public sectors. While the second group of data used different categories of workers (unpublished data) for manufacturing industries for 1978, 1991 and 2000 at 5 digits Malaysian Industrial Classification 1972 (MIC) and Malaysian Standard industrial Classification 2000 (MSIC) [17] [18].

The data are taken from the Industrial Production and Constructions Statistic Division, Department of Statistics Malaysia (DOS). In order to make all the I-O table comparable, the nominal values of 1991 and 2000 have been deflate into their 1978 constant price. This conversion is necessary to present the real changes in the variables. The present study used producer prices indices (PPI) for local production by commodity group and import price indices (IPI) to deflate some of the variables to reflect the real change in the variables. Analysis for the sources of labor change are estimated for the period 1978 to 2000 which covers two sub-periods; 1978-1991 (representing the second half of First Outlined Perspective Plan, OPP1) and 1991-2000 (representing the Second Outlined Perspective Plan, OPP2)

4 Results and Discussion

The estimated results of decomposition the sources of labor change in manufacturing sector reveals that the net changes of final demand structure, and economic growth had employment increasing effect (positive sign) while the net changes of technical changes, and interaction of technical change and changes in final demand had employment reducing effect (negative sign) on employment for both sub-periods and overall period.

4.1First Sub-period 1978-1991

For the period of 1978-1991 , manufacturing sector gross value of output grew from RM25,635,024 thousand to RM108,477,987 thousand between 1978 and 1991(in 1978 prices), obviously an increase of 323.16 percent . Thus, manufacturing total employment would also have increased by

Sources of change	Light		Heavy		Manufacturing	
Technical change	**-2739**	***(-1.42)***	**-5852**	***(-1.45)***	**-8591**	***(-1.44)***
Inter-occupation substitution*	29	***(0.02)***	-29	***(-0.01)***	0	***(0.00)***
Changes in labor productivity	**-3726**	***(-1.93)***	**-7888**	***(-1.95)***	**-11614**	***(-1.95)***
Changes in intermediate input	1526	***(0.79)***	3284	***(0.81)***	4810	***(0.81)***
Interaction of changes in labor input and changes in intermediate input	-568	***(-0.29)***	-1219	***(-0.30)***	-1787	***(-0.30)***
Changes in final demand structure	**169147**	***(87.83)***	**351835**	***(87.15)***	**520982**	***(87.37)***
Changes in domestic demand structure	105103	***(54.58)***	215712	***(53.43)***	320815	***(53.80)***
Changes in export structure	32498	***(16.88)***	68621	***(17.00)***	101119	***(16.96)***
Changes in import structure	15397	***(8.00)***	34513	***(8.55)***	49910	***(8.37)***
Changes in final demand component structure	16149	***(8.39)***	32989	***(8.17)***	49138	***(8.24)***
Interaction of technical change and changes in final demand	**-24536**	***(-12.74)***	**-48409**	***(-11.99)***	**-72945**	***(-12.23)***
Growth multiplied technical change effect	-8633	***(-4.48)***	-16281	***(-4.03)***	-24914	***(-4.18)***
Interaction of technical change and changes in final demand structure	-15903	***(-8.26)***	-32128	***(-7.96)***	-48031	***(-8.06)***
Economic growth	**50703**	***(26.33)***	**106123**	***(26.29)***	**156826**	***(26.30)***
Total	192575	***(100.00)***	403697	***(100.00)***	596272	***(100.00)***

Table 1: Decomposition of Labor Changes in the Manufacturing Sector in the First Sub-period, 1978-1991

323.16 percent from 374.937 thousand workers in 1978 to 1586.583 thousand workers in 1991 if there had been no structural change. In other words, *ceteris paribus*, the economic growth would have increased manufacturing total employment by 1211.646 thousand workers. On the other hand, manufacturing total employment was only 971.209 thousand workers in 1991 (376.833 thousand workers in the light industry and 594.376 thousand workers in the heavy industry). There were about 615.374 thousand workers short compared with proportional growth to the gross value of output. Table 1 provides the results of sources of labor growth in the manufacturing sector in the first sub-period 1978-1991. The reason that manufacturing sector total employment did not grow as fast as its gross value of output were that (i) technical changes, and (ii) interaction of technical change and changes in final demand effects had reduced the total employment.

During first sub-period, this study found that interaction of technical change and changes in final demand was the main factor that had reduced manufacturing sector total employment by 72.945 thousand workers (12.23 percent). Out of these 72.945 thousand workers, 24.914 thousand workers resulted from new technologies, rather than the old technologies. As mention by [16], when the output grew, the effect of technical change was magnified. Therefore, we identify this effect as the growth multiplied technical change effect. The interaction between technical change and changes in the structure of final demand had a reducing effect of 48.031 thousand workers on manufacturing sector total employment.

Further analysis showed that technical change was the second factor that had reduced total employment by 8.591 thousand workers (1.44 percent) and this reduction was absolutely significant because of the increase in labor productivity in the manufacturing sector especially in the heavy industry. Thus, the gains from technical change can be attributed to the use of more advanced imported technology brought about by the promotion and significant flow of Foreign Direct Investment (FDI) into Malaysian manufacturing sector since 1986. In addition, this also accords with our earlier observations, which showed that electrical machinery, textile products, plastic products, China, glass and clay product and non- electrical machinery were the sub-sectors that experienced large increases of direct labor productivity between 1978 and 1991. This finding is also in agreement with [19] findings which showed technical change as the source of Total Factor Productivity (TFP) growth, in the manufacturing sector during 1981-1984, 1986-1990 and 1990-1996.

All things being equal, the estimated results reveal that an increase in the labor productivity would have reduced manufacturing sector total employment by 11.614 thousand workers. It is interesting to note that most of the labor decreasing effect due to the labor productivity improvement was from heavy industry (7.888 thousand workers) compared to light industry (3.726 thousand workers). These findings of the current study are consistent with those of [20] who found that heavy industry like chemical, non-metallic mineral products, transport equipment and rubber products enjoyed higher TFP growth, whereas TFP growth in the light industry likes food and textiles products was quite low for the period 1982-1994. However, employment-decreasing effect due to improvement in the labor productivity was offset somewhat by the employment-increasing effect of changes in the intermediate input coefficients. The employment-increasing effect of changes in the intermediate input coefficients had increased total employment by 4.810 thousand workers. This result can be explained by the fact that labor is one of the important inputs in the production function as the output increased. Consequently, the amount of labor will also increase. As can be seen from Table 1, inter occupation substitution in the manufacturing sector

was equal to zero. A possible explanation for this might be that movement or mobility of labor was only within the manufacturing sector and this may be due to promotion or changing occupation.

The most interesting finding was that the employment-reducing effect of increased labor productivity was further offset by the effect of changes in final demand structure. All things being equal, changes in the structure of final demand were the main factor that had increased total employment in the manufacturing sector either in light or heavy industry. The empirical results of this study indicate that changes in the final demand had a total increasing effect of 520.982 thousand workers or 87.37 percent on manufacturing sector total employment (169.147 thousand workers from light industry and 351.835 thousand workers from heavy industry). Of this, 320.815 thousand workers (53.80 percent) would have been the result of changes in the structure of domestic final demand (which includes domestic consumption, government consumption, changes in inventory and gross fixed capital formation), 101.119 thousand workers (16.96 percent) would have resulted from changes in the structure of exports, increasing of 49.910 thousand workers (8.37 percent) as a result of changes in the structure of import and an increasing of 49.138 thousand workers (8.24 percent) would be the result of changes in final demand component structure. The current study found that within the changes in final demand structure, changes in the structure of domestic demand and export were the both dominant factors that underlying the changes of labor in the manufacturing sector either in light or heavy industry.

In the present study, economic growth was the second important factor that had an increasing effect of 156.826 thousand workers on manufacturing sector total employment of which, 50.703 thousand workers in light industry and 106.123 thousand workers in heavy industry. As can be seen from the Table 1, sources of labor growth in the manufacturing sector either in light or heavy industry were favored by both changes in the final demand structure, and economic growth.

4.2 Second Sub-period 1991-2000

Like the first sub-period, it is clear that the changes in final demand structure and economic growth were the determinants of employment increasing effect in the manufacturing sector as shown in Table 2. Changes in the structure of final demand have a total increasing effect of 779.242 thousand workers (131.07 percent) on manufacturing sector total employment (181.303 thousand workers in the light industry and 597.939 thousand workers in the heavy industry).While economic growth would have increased employment by 39.199 thousand workers. However, scenarios of employment increasing effect due to changes in final demand structure, and economic growth were slightly different from the first sub-period.

(i) Firstly, within the changes in final demand structure, changes in export structure were the dominant factor in increasing employment. It seems possible that these results were due to export expansion in the second OPP2, 1991-2000.

(ii)Secondly, the employment increasing effect due to economic growth was relatively small in the second sub-period compared to the first sub-period. The reason for this was not clear but it may have something to do with Malaysian economic being adversely affected by the East Asian financial crisis since July 1997 The majority of those retrenched were mainly employed in the manufacturing sector.

(iii) It is also interesting to mention here that employment changes in the second sub-period was favoured by both changes in final demand structure, and interaction of technical change and changes in final demand which is different from the first sub-period.

For the duration of 1991-2000, manufacturing sector gross value of output had expanded from RM108,477,987 thousand in 1991 to RM316,463,861 thousand in 2000 (in 1978 prices), obviously an increase of 191.73 percent. *Ceteris paribus*, manufacturing total employment would also have increased by 191.73 percent from 971.209 thousand workers in 1991 to 2833.308 thousand workers in 2000. However, manufacturing total employment was only 1565.746 thousand workers in 2000. There were about 1267.562 thousand workers short compared with proportional growth to the gross value of output. It is clear from Table 2 that one of the most important reasons that manufacturing total employment did not grow as fast as its gross value of output were that (i) technical changes, and (ii) interaction of technical change and changes in final demand sector had reduced the total employment.

The empirical results showed that technical change and interaction of technical change and changes in final demand have decreased 74.358 thousand and 149.546 thousand workers respectively. The main factors behind the employment-decreasing effect actually were due to the improvement in labor productivity, and interaction of technical change and changes in final

demand. Comparing with the effect of technical change, and changes in final demand structure between two sub-periods reveals that both effects were much larger in the second sub-period.

Table 2: Decomposition of Labor Changes in the Manufacturing Sector in the Second Sub-Period, 1991-2000

Sources of change	Light		Heavy		Manufacturing	
Technical change	**-17052**	***(-12.05)***	**-57306**	***(-12.65)***	**-74358**	***(-12.51)***
Inter-occupation substitution*	-141	***(-0.10)***	141	***(0.03)***	0	***(0.00)***
Changes in labor productivity	-17202	***(-12.16)***	-56250	***(-12.42)***	-73452	***(-12.35)***
Changes in intermediate input	-156	***(-0.11)***	-454	***(-0.10)***	-610	***(-0.10)***
Interaction of changes in labor input and changes in intermediate input	447	***(-0.32)***	-743	***(-0.16)***	-296	***(-0.05)***
Changes in final demand structure	**181303**	***(128.13)***	**597939**	***(131.98)***	**779242**	***(131.07)***
Changes in domestic demand structure	45757	***(32.34)***	152609	***(33.69)***	198366	***(33.36)***
Changes in export structure	232899	***(164.60)***	766781	***(169.25)***	999680	***(168.14)***
Changes in import structure	-83200	***(-58.80)***	-274382	***(-60.56)***	-357582	***(-60.14)***
Changes in final demand component structure	-14153	***(-10.00)***	-47069	***(-10.39)***	-61222	***(-10.30)***
Interaction of technical change and changes in final demand	**-31680**	***(-22.39)***	**-117866**	***(-26.02)***	**-149546**	***(-25.15)***
Growth multiplied technical change effect	-2793	***(-1.97)***	-12937	***(-2.86)***	-15730	***(-2.65)***
Interaction of technical change and changes in final demand structure	-28887	***(-20.42)***	-104929	***(-23.16)***	-133816	***(-22.51)***
Economic growth	**8926**	***(6.31)***	30273	***(6.68)***	**39199**	***(6.59)***
Total	141497	***(100)***	453040	***(100)***	594537	***(100)***

The better technological change during second sub-period indicates the improvement and success of more advanced technology, sufficient and efficient training of workers helped them to adapt and used better equipment over time. It also seems possible that these results were due to government emphasis in Human Resource Development (HRD) in the manufacturing sector by the introducing of Human Resource Development Fund. The scheme provided incentive grants to enterprises undertaking training of the workforce in basic, enterprise-based and new emerging skills as well as retraining for higher skills.

5 Conclusion

The result of this study indicates that causes of structural changes on labor increasing effect are driven by shifts in final demand structure. The current study found that during both sub-periods, the sources of labor growth in the manufacturing sector either in light or heavy industry is favored by changes in the final demand structure. As presented in Table 1 and Table 2, within the changes in the final demand structure, the analysis by sub-periods, 1978-1991 and 1991-2000 show that there is a switch in the role of changes in domestic demand structure, and changes in export structure.

The underlying factors that contribute towards employment increasing effect on the manufacturing sector for the period 1978-1991 are mostly changes in domestic demand structure (53.80 percent), and changes in export structure (16.96 percent). Employment changes were driven by domestic demand structure during 1978-1991 could be attributed to the emphasis on import substitution policies through government sponsored heavy industries. During the second stage of import-substituting industrialization, priorities on industrial development are given to manufacturers of capital and intermediate goods for export oriented industries. The strengthening of macroeconomic fundamentals and the financial sector together with prudent fiscal policy management have contributed to the expansion in aggregate domestic demand after the global recessionary years of 1985-1986.

However, during the second sub-period 1991-2000, changes in the export structure appear to have been the major employment increasing effect. These imply that labor growth was exports structure driven during second sub-period. Labor changes were driven by export demand during second sub-period 1991-2000, resulting from greater promotion of export orientation strategy (1985 onwards). Expansion of labor-intensive exports stimulated strong growth in employment in sub-sectors such as electrical and non-electrical machinery. During the period 1990-1997, employment growth in export oriented sub-sector slow down due to the tight labor market and rising production. However after the East Asian financial crisis 1997-1998, manufacturing exports especially the labor-intensive exports began to grow again impressively, thus stimulated strong growth in employment in the export oriented sub-sectors.

In the first sub-period, the results of this investigation also showed that changes in the structure of import had employment-increasing effects. Conversely, changes in the structure of import had reducing effects on employment during the second sub-period. These two factors were found to exert a positive and almost an equal effect on manufacturing employment. In other words, an emphasis on domestic demand expansion is

constructive to employment creation. In a situation of poor export performance, the domestic market should be promoted rigorously to achieve sustainable employment in the manufacturing sector. In order to complement this effect, the government can introduce a more caring policy to the society by implementing some reduction and incentives on income tax, so that it can boost domestic spending successfully.

If compared to previous studies on sources of output growth by [21] for the year 1959-1968, [22] for the year 1978-1987 and [23] for the year 1978-2000, the findings of this study suggest that given the current economic structure, the sources of output growth is parallel with sources of employment growth which relied on changes in final demand structure. Even though the current study has used different dependent variable (labor and manpower) and methodology but generally the determinants of sources of the changes are the same, namely the changes in the components of final demand structure (changes domestic demand structure, changes in export structure, changes in import structure, and changes in final demand component structure).

Technical change is one of the important factor of output growth as well as sources of labor growth even though overall net effect of technical change to labor is employment decreasing effect for both sub-periods and overall period. These may be due to labor saving technological progress. Technological progress since the late nineteenth century consisted largely of rapid advances in labor saving technologies such as computers, the internet and many other kinds of modern machinery and equipment for the production process.

The evidence from this study also suggests that the effect of technological change was small (reducing effect) than the effect of other factors on employment. However, even as technological change reduces the amount of labor needed per unit of output, it can be compensated by an expansion in total output that demands more labor. Technological progress is one of the important components of economic growth beside capital accumulation and population and labor force growth.

Furthermore, technological progress in an economy certainly changes the requirements for the economy's labor force in terms of knowledge level and skill combination. Therefore, technological change may have adverse impact on workers in certain occupations by making their particular skill obsolete.

Based on the above reasons, government should increase human resource development through training and upgrade research and development (R&D). An appropriate strategy and choice of human resource development and innovation are also crucial in improving labor productivity. Higher labor productivity brings lower production cost, higher products quality, and better wages for workers and better investment returns for investors. Besides, according to [2], educational institutions also have a special place in the society and provide services related to the transfer of knowledge to their customers–individuals, public and private organizations and the society in general. Their development is influenced by various factors linked to political, technological, economic, environmental, as well as social trends and changes.

References:

[1] Zirra, D., The impact of the economic crises on Romanian labour market, *WSEAS Transactions on Business and Economics*, Vol. 6, No.7, 2009, pp. 362-373.

[2] Gouvara, E., Todorova, Y, and Gourov, N., Skills for future engineers: challenges for universities in Bulgaria, *WSEAS Transactions on Business and Economic*, Vol. 6, No.7, 2009, pp. 386-399.

[3] Rose, A. & Casler, S., Input-output structural decomposition analysis: A critical appraisal. *Economic Systems Research*, Vol.8, No.1, 1996, 8(1), pp. 33-62.

[4] Jackson, R. W., Rogerson, P., Plane, D. & O' Huallachain, B., A causative matrix approach to interpreting structural change, *Economic Systems Research*,Vol.2, 1990, pp. 259-269.

[5] Ciobanu, C., Mattas, K. and Psaltopoulos, D., Structural changes in less developed areas: An input-output framework, *Regional Studies.* Vol. 38, No.6, 2004,pp. 603-614

[6] Chenery, H.B., Interactions between industrialization and exports, *American Economic Review*, Vol. 70, 1980, pp. 281-287.

[7] Rose, A. and Miernyk, W., Input-output analysis: The first fifty years, *Economic Systems Research*, Vol.1, 1989, pp. 229-271.

[8] Rose, A. and Chen, C. Y., Sources of change in energy use in the US economy 1972-82. *Resources and Energy*, Vol. 13,1991, pp. 1-21.

[9] Carter, A., *Structural Change in the American Economy*. Cambridge: Harvard University Press, 1970.

[10] Guo, D., Hewings G.J.D. and Sonis M., Integrating decomposition approaches for the analysis of temporal changes in economic

structure: an application to Chicago's economy from 1980 to 2000. *Economic Systems Research*, Vol. 17, No. 3, 2005, pp. 297-315.
[11] Leontief, W. *Structure of the American Economy*, New York: Oxford University Press, 1941.
[12] Chenery, H.B., Shishido, S., and Watanabe, T., The Pattern of Japanese Growth, 1914-1954, *Econometrica*, Vol. 3, No. 1,1963, pp. 98-139.
[13] Dietzenbacher, E. and Los, B., Structural decomposition analyses with dependent determinants. *Economic Systems Research*, Vol.12, No.4, 2000, pp. 497-512.
[14] Skolka, J., Input-output structural decomposition analysis for Austria, *Journal of Policy Modelling*, Vol. 11, 1989, pp. 45-66.
[15] Miller, R., and Blair, P.D., *Input-Output Analysis: Foundation and Extensions*. Englewood Cliffs, New Jersey: Prentice-Hall Inc, 1985.
[16] Han, X., Structural change and labor requirement of the Japanese Economy. *Economy System Research*, Vol. 7, No. 1, 1995, pp. 47-65.
[17] Malaysia Industrial Classification, Department of Statistic, Kuala Lumpur, 1972.
[18] Malaysia Standard Industrial Classification Department of Statistic, Kuala Lumpur, 2000.
[19] Mahadeven, R., Is there real TFP growth measure for Malaysia's manufacturing industries?, *ASEAN Economic Bulletin*, Vol. 19, No. 2, 2002, pp. 178-190.
[20] Rahmah, I. and Idris, J., Sources of productivity growth in large scale Industries in Malaysia, *Malaysia Journal of Economics and Management*, Vol. 34, 2000, pp. 5-75.
[21] Hoffman, L. and Tan, T. N., Pattern of Growth and Structural Change in West Malaysia's Manufacturing Industry, 1956-68. In David Lim. Malaysian Economics Development. Kuala Lumpur: Oxford University Press, 1975.
[22] Zakariah, A.R. and Ahmad E. E., Source of industrial growth in the Malaysian manufacturing sector: A factor decomposition approach, *The Developing Economies*, Vol. 37, No. 2, 1999, pp. 162-196.
[23] Rohana, K., Zakariah, A. R. and Kamaruzaman, J., An input-output analysis of sources of growth and key sectors. *Modern Applied Science*, Vol. 2, No. 3, 2008, pp. 94-109.