CHAPTER FIVE

CONCLUSION

5.1 *The Importance of Measuring IT Performance*

The study, thus far, has attempted to explore, albeit indirect measures, the returns from IT investment in terms of enhancing productivity performance in the manufacturing and service sector. Despite the constraint in formulating a direct measure, there is clear evidence that organisations being examined are performing their best effort in improving their respective productivity performance via IT implementation.

The paper has also touched on the linkage between productivity and IT and has found encouraging evidence that the usage of IT is one of the contributing factors towards enhancing efficiency and simultaneously improve productivity level of an organisation as in Stiroh (2001a). In addition, Lucas (1999) shows that IT investment could have a value by using the IT Investment Equation. Besides that, the return from IT investment should also be measured in terms of its intangible benefits; such as enhance customer service and better teamwork, and also its ability to enable complementary organisational investments such as business processes and work practices (Brynjolfsson and Hitt, 1999).

The issue of productivity paradox of IT implementation, as mentioned in Chapter 3, should not be the barrier for organisations not to indulge in measuring productivity performance. There is a strong possibility that IT can play its role too in raising productivity at macro level in the future and become the catalyst in productivity enhancement, just like mechanisation has in increasing the productivity growth of manufacturing and agricultural sectors at 3 to 4 percent per annum(Abdul Rahman et al, 2001). Evidently, in the year 2000, the Malaysian economy registered productivity growth of 6.1%(1999: 3.9%) from RM22,026 in 1999 to RM23,369. This productivity surge is due to higher capacity utilisation by industries from improvement in demand as well as a shift towards higher technology production processes (NPC, 2000).

Hence, organisations at large should focus on the importance of productivity measurement and management as the saying goes, "What you can measure, you can manage". For a start, a proper and standardised measure of productivity ratios and their linkages across all industries, using the Company Manual for Productivity Assessment (COMPASS) and Productivity Assessment System (PASS), developed by the NPC, would benefit the entire economic sectors in terms of gauging their productivity performance inter- and intra-industries. These manuals would enable organisations to monitor their productivity performance in terms of annual comparison, and also sub-sector and cross sector comparisons at large.

By utilising the above analytical methods to monitor productivity performance, organisations would have a clearer view of how to pursuit profit improvement and provide

profit management plans. This quantitative analysis would serve as a basis to answer essential issues relating to what profit plans should best be adopted by organisations in the future and what steps should be implemented (Shimizu, 2001).

Nevertheless, there still exist several problems in measuring the contribution of IT to productivity at macro and micro levels, in terms of poor availability of data on IT investment per se, a common definition of what constitutes IT investment, and the authority to gather the statistics of IT investment in the country (Mah Lok and Goh, 2001). In addition, the measurement of the intangible costs and benefits of IT investment, albeit the difficulties in quantifying them, should be taken into consideration. Furthermore, the concern here is to improve the data collection and measurement techniques.

In this aspect, more firm-level studies should be conducted to assess the uniqueness of each organisation in measuring the contribution of IT investment to their productivity performance. Brynjolfsson and Hitt (2000) further highlight the importance of firm-level data in the emerging IT-based economy, whereby they opine that the outcome has been a better understanding of key inputs, including complementary organisational assets, as well as the key outputs including the growing roles of new products, new services, quality, variety, timeliness, and convenience.

In recapitulation, as the country is moving towards a knowledge-based economy which place a greater emphasis on the use of IT, there is an urging need to evaluate and monitor the contribution of IT to productivity performance per se, in terms of formulating a direct measure and dimension. As this form of technology is dynamic and the only constant factor here is change, no one would really know for sure if the huge expenditure on IT is justifiable in terms of costs and benefits.

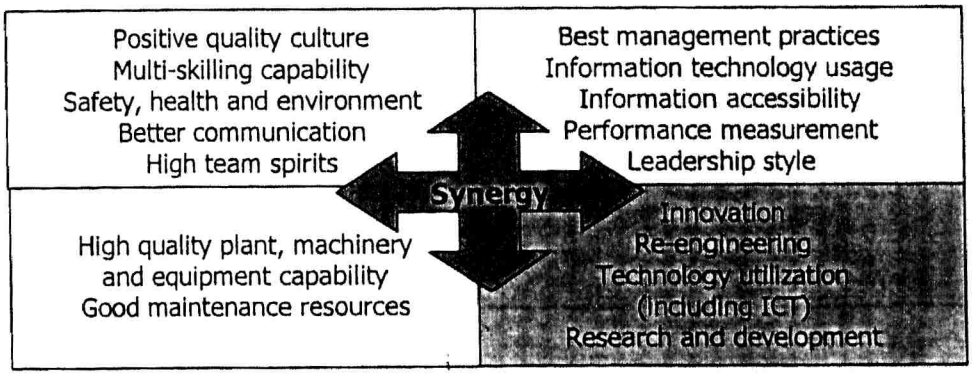
5.2 *The Role of IT in Total Factor Productivity*

As mentioned previously, TFP measures the synergy and efficiency of the utilisation of both capital and human resources. It serves as an important measure of the productive performance of an economy as TFP considers the contribution of more than one input to output. Furthermore, TFP is important to the growth process in the long run, as there are constraints imposed by population growth, together with diminishing returns that set in as capital intensity is increased (Renuka, 1999).

TFP is also regarded as a composite measure of the degree of technological advancement as well as the changes in efficiency with which the technology is applied to production. The framework (Diagram 1) provides a solid platform for organisations to focus and place greater value on the importance of technical progress.

Technical progress (Diagram 4) relates to the effective and efficient utilisation of technology, innovation, work attitude, and management and organisational effectiveness. This is where the role of IT takes place in the macro level of the TFP. Relatively, higher value-added products and services would be produced at competitive costs with high technological capabilities, a motivated workforce and effective management, thus, assuring a growth in TFP (NPC, 2000).

Diagram 4: Sources of Technical Progress

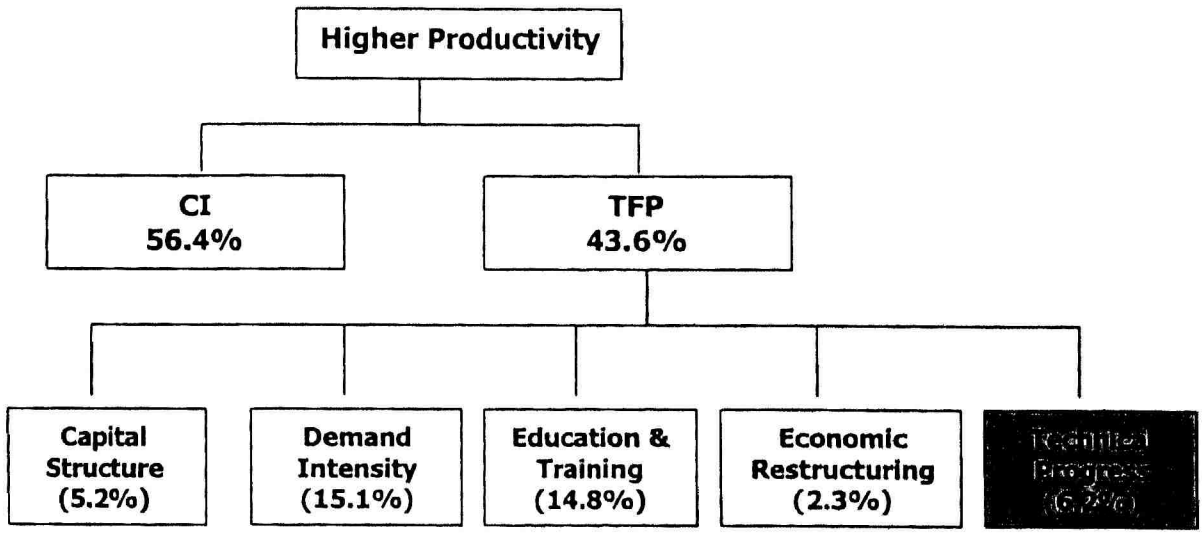


Source: National Productivity Corporation(1999b)

Looking at the statistics of TFP growth, in the period 1990-2000, Malaysia registers a growth of 1.7%, of which TFP growth contribution to GDP growth of 7.3% is 24% (NPC, 2000). The high contribution of capital to GDP growth reflects the high investment by the privates sector in the productive capital .

Analysing the growth in productivity at large (Diagram 5), which is derived from Capital Intensity (CI) and TFP, TFP contribution is 43.6%, while that OF CI is 56.4% between 1990-2000.

Diagram 5: Contribution of CI and TFP to Higher Productivity, 1990-2000



Source: National Productivity Corporation (2000)

As per diagram 5, the components of TFP that lead to higher productivity are capital structure (5.2%), demand intensity (15.1%), education and training (14.8%), economic restructuring (2.3%), and technical progress (6.2%). An in-depth analysis of technical progress shows that for the period 1990-2000, it contributes about 14.4% to the growth of TFP.

In terms of data access and availability, while the NPC database for the manufacturing sectors to measure TFP is largely available, the database is still lacking of data from the service sectors, which incidentally constitute a major portion of IT share, to measure the TFP contribution at large. Griliches (1994) echoes the importance of TFP where he says that the major source of productivity growth were seen as coming from improvements in the quality of labour and capital, and from sources of efficiency and technical change.

Hornstein and Krussel (2001) quote several microstudies that argue that TFP growth at the firm level is positively correlated with the growth of computer capital in the firm. These studies also suggest that the benefits from investment in computer capital are delayed, which can be interpreted as being due to needing to learn to use IT or to the accumulation of IT-related organisational capital.

Moreover, Bresnahan, Brynjolfsson, and Hitt (Hornstein and Krussel, 2001) find that their measures of IT capital, human capital, and work organisation are all positively correlated. Some of their findings are that firms that have a better educated workforce and a more decentralised work organisation tend to use more IT capital, and firms that use more IT capital tend to spend more on training their workforce.

In this context, looking at the contribution of IT to technical progress, Mah Lok and Goh (2001) cite the finding of Dewan and Kraemer, who decompose the production function into an inter-country production function to study the contribution of IT investment.

$Q_{it} = f(C_{it}, K_{it}, L_{it}, i, t)$

Where,

i = 1,2,3,... for country

C_{it} = IT capital (including IT labour) stock of country i and year t

Expanding using the exponential Cobb-Douglas production function, they derive th translog productivity functions as:

$$\ln Q_i = \acute{\alpha} + \beta_C \ln C_i + \beta_K \ln K_i + \beta_L \ln L_i + \gamma_i + \xi_i$$

where,

ξ_i = random error term representing the influence of all unmeasured factors

γ_i = country specific effect invariant over time

β_C , β_K , β_L = output elasticities to be estimated

$\acute{\alpha}$ = the intercepts can vary with country in addition to time

The study provides a number of interesting insights on the impact of IT on productivity. The developed countries have already built up a mature stock of ordinary capital to support their economic activities, and as a result the marginal productivity of non-IT capital is low. The increasing levels of IT investment have been accompanied by investments in infrastructure and human capital as well as the "formalisation" of new business models, which serves to enhance and amplify the effects of IT investments.

Stiroh (2001b) presents two theories, the neoclassical theory versus the new growth theory in explaining the sources of productivity growth. In the neoclassical view, broadly defined capital accumulation drives growth in the short run, but capital eventually succumbs to diminishing returns, so long run productivity growth is entirely due to exogenous technical progress. On the other hand, the new growth theory moves beyond this unsatisfying conclusion, arguing that productivity growth can continue indefinitely without the elixir of exogenous, and entirely unexplained, technical progress.

He further examines the Solow's methodology for measuring the rate of technical progress under the neoclassical assumptions of competitive factor markets and input exhaustion when technology is Hicks-neutral and output is modelled as $Y_t = A_t \cdot f(K_t, L_t)$. The rate of Hicks-neutral technical progress equals the Solow residual or TFP growth.

He believes that if the neoclassical assumptions fail to hold, the Solow residual will not measure only technical change. Other factors that affect the Solow residual include distortions from imperfect competition, externalities and production spillovers, omitted inputs, cyclical fluctuations, nonconstant returns to scale, and reallocation effects (Stiroh, 2001b).

In the case of Malaysia, as the country is moving towards a knowledge-based economy, it is imperative that organisations exploit factors that contribute to higher technical progress such as technology, innovation, management, and organisational effectiveness. The K-economy era would undoubtedly require more IT-literate workers with more utilisation and applications of IT and ICT in businesses. This is further emphasised in the recent Third Outline Perspective Plan (OPP3), the increased use of computers and ICT as well as the enhanced capabilities of the Internet, in addition to investment spillover effects, will contribute significantly to improvements in TFP (Malaysia, 2001).

5.3 *Shortcomings of the Study*

The study attempt to analyse at micro level the contribution of IT investments to productivity performance of organisations is undoubtedly insufficient to provide a realistic picture of the entire economy. The problem of data availability and accessibility is no uncommon as most organisations are rather unwilling to share their data in terms of thei productivity performance.

Moreover, in the case of the service industry, Malaysia has yet to establish a prope database, similar to that of the manufacturing, to capture essential data and informatior However, the effort of the NPC in establishing a productivity performance database fc Malaysian ports and hotels is nevertheless significant and imperative to enhance th understanding of the service industry at large.