# CHAPTER TWO

## LINKING PRODUCTIVITY AND INFORMATION TECHNOLOGY

### *Productivity and Information Technology*

The extensive use of IT application is evident, regardless of economic sector, in particula in manufacturing and service sectors. This phenomenon stems from the need to provide a higher quality of goods and services in terms of timeliness, reduced costs, an increased efficiency.

Nevertheless, the definition of IT is somewhat varied and encompass a huge array c terms and concepts. A simple definition of IT within the context of this research paper is **"IT includes computer and communications hardware, as well as the software an associated services required to exploit that hardware"** (National Research Counc 1994). A more in -depth of defining IT would be: **"the acquisition processing, storag and dissemination of vocal, pictorial, textual, and, numeric information by microelectronics-based combination of computing and telecommunicatio** (Wilcocks and Lester, 1999).

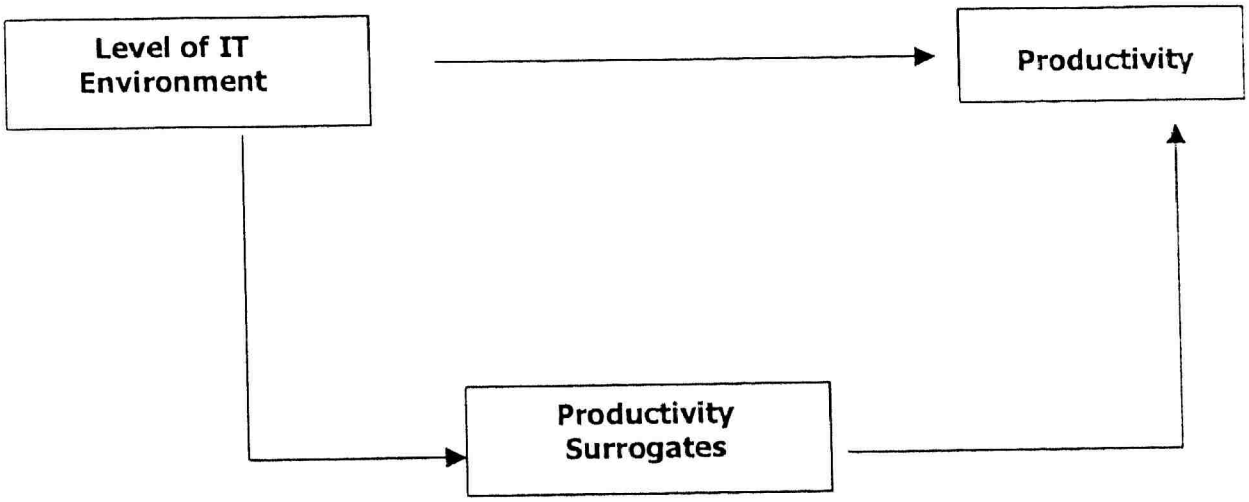
Basically, IT is perceived as an enabling tool that has been accepted as part and par of an organisation. The evolution of IT role from a merely data-processing mechani into a more complex tasks and functions, hence promises a new height of improv productivity and quality (P&Q) level of an organisation.

Notwithstanding, the relationship between IT and improved productivity is a recurring debate that has yet to be resolved. In any organisation, there are several other factors that have an impact on productivity besides IT. Among them are leadership, customer focus, benchmarking, quality of process and product, relationship with workers, customers and suppliers (NPC and UKM, 1995).

However, this research paper would make an attempt to emphasise the contribution of IT on productivity. Thus, it is necessary to determine whether a the implementation of IT would have any positive impact on the productivity performance of an organisation.

On the same note, there is an argument that IT affects productivity indirectly via increasing the organisation's effectiveness and efficiency. The rationale of this argument is on the basis of productivity improvement initiatives. As organisation successfully manages its productivity improvement aspects in terms of material resource planning, utilisation of machinery and equipment, product/service development, technical efficiency, and productivity management, logically its productivity should have increased.

**Diagram 2: The Relationship between IT and Productivity**




The diagram above succinctly reflects this argument and hopefully through this study, the positive relationship between IT and productivity is revealed and thus gives a better image of organisation that emphasise the importance of productivity.

IT may increase productivity and consumer surplus, that is, it may increase customer values but not necessary that it will increase the revenue of an organization or the profitability. Furthermore, the primary reason for IT investment is customer service followed next by cost savings, then timeliness and quality. However, values of these benefits of IT are hardly reflected in aggregate price deflators or output statistic (Wilcocks and Lester, 1999).

In many cases, re-engineering businesses using IT may reduce both the organization revenue and profitability. Such study suggests that IT investments are necessary to maintain competitive parity but are not able to gain competitive advantage (Abdullah and Goh, 2001).

Nevertheless, recent productivity developments in the US indicate the contribution of IT, in which there are three mechanisms through which advances in IT may increase recorded productivity growth. Among them are the direct production of goods themselves can boost productivity growth to the extent that producers of these goods are making rapid advancements in efficiency. Another factor is the of IT by other sectors of the economy can boost productivity due to the purchase of IT equipment that raises the capital-labour ratio, thus increasing labour productivity (Gus and Marquez, 2001).

Stiroh (2001a) further analyses the link between IT and productivity growth in the IT-producing and IT-intensive industries, using 1987-1999 data on real gross output and full time employment workers from the US Bureau of Economic Analysis (BEA). He finds that the IT-producing industries show a gain of 3.7 percentage points, while the IT-intensive industries reflect a gain of 1.4 percentage points. These results below suggest an important link between IT use and productivity gains.

| Industries | Number of Industries | Average Annual Productivity Growth (%) 1987-95 | 1995-99 | Change |
|---|---|---|---|---|
| IT-producing | 2 | 8.24 | 11.90 | 3.66 |
| IT-intensive | 26 | 1.24 | 2.61 | 1.37 |

*Source: Stiroh (2001a)*

Needless to say that the usage of IT is one of the contributing factors towards enhancing efficiency and simultaneously improve productivity level of an organisation. The importance of IT in today's competitive environment is prevalent in every stage of process. Investment in IT in the form of capital and technology is considered as tools or factor of production.

The distinction between tools and factor of production lies in the fact that factor of production can replace labour, while tools of production depends on its utilisation purpose, method, and skill to increase productivity per se (Gray and Jurison, 1995). Consequently, organisations spend massively on IT infrastructure and the works in the hope of achieving a higher level of productivity without acknowledging the fact that capital input should tally with labour input in terms of skill and knowledge. As a result, despite the introduction and implementation of IT in the work environment, the level of productivity still stagnant and remains unchanged.

In this context, measuring productivity is essential so as to enable organisations gauge their performance at sectoral and industrial level. Through productivity measurement, one can see the relation between products and services produced, and the resources used to create them. As mentioned previously, productivity increases when output is maintained but with less amount of input utilised. The importance of measuring productivity does not confine to firm level only but also concerns every level of economy.

Furthermore, by addressing productivity as a strategic issue, monitoring of productivity becomes essential and measurement becomes the vehicle to explicitly relate productivity to organisation's other strategic objectives. Relatively, productivity measurement provides a mechanism for feedback so that the organisation can learn and improve, and employees can enjoy a sense of accomplishment.

The role of productivity measurement can be seen in three ways:

i. to create an awareness of productivity within an organisation by providing a focus on existing activities;
ii. to establish a profile of existing performance; from which to plan for an improvement in productivity; and
iii. to provide an on-going control of the productivity improvement process.

Among the benefits that organisation can derive from implementing productivity measurement are:

i. the ability to assess the efficiency of conversion of organisation's resources where every single input used to produce output is monitored and linkages between input and output are established;

ii. the ability to plan decision-making in terms of capital investment, outsourcing, and acquisitions, so as to set a realistic target based on the present measured levels;

iii. the ability to benchmark productivity levels with other organisations or with industry averages in terms of efficiency and growth rates; and

iv. the ability to have a strategic direction for improving productivity so as to achieve organisational goals.

## 2.2 *Measuring Returns from IT Investment*

As productivity practice and measurement are beneficial for organisation to gauge its performance, another issue arise as to whether the huge investment in IT manage to yield the expected returns. In this aspect, organisation should realise that not all investments in IT should be expected to show a measurable return, as investments can have value to an organisation even without demonstrable financial returns (Lucas, 1999).

Using the IT Investment Equation:

*P(Success/Return) = P(Return on Investment Type) x P(Conversion Success)*

Lucas (1999) constructs a probability table of how much return would a particular investment yield as per below.

| Type of Investment | Estimate of Probability of a Return Based on the Type of Project | Estimate of Probability of Successful Conversion Effort | Overall Probability of a Return |
|---|---|---|---|
| Budgeting system | 0.5 | 1.0 | 0.5 |
| EDI/JIT system | 0.95 | 0.75 | 0.71 |
| Infrastructure network | 0.5 | 0.7 | 0.35 |
| Web pages | 0 | 1.0 | 0 |

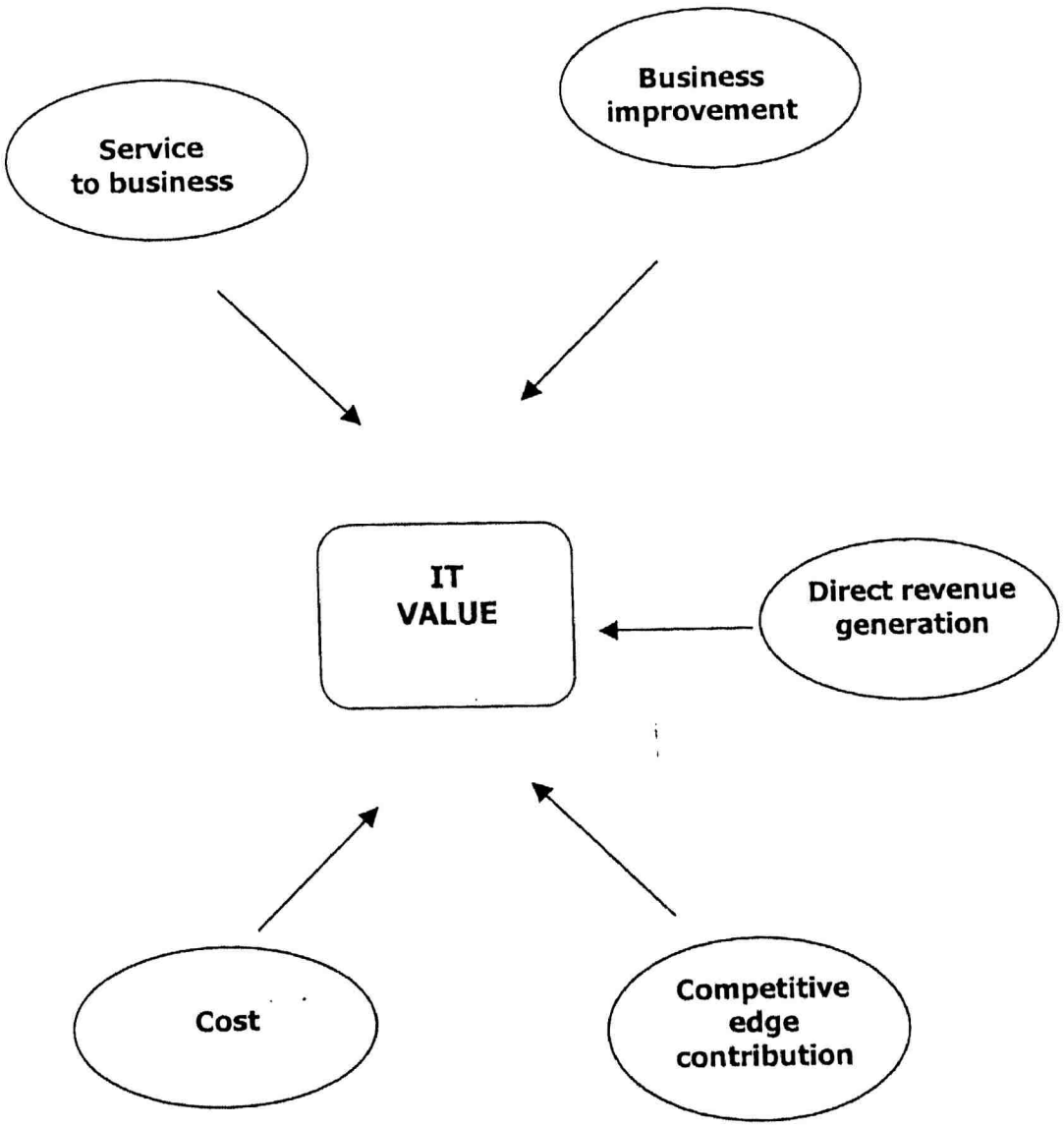
He asserts that anything less than a probability of 1 for a return on the type of investment and a probability of 1 for conversion success dramatically reduces the probability that you will be successful in obtaining a return on an IT investment.

This is to say that despite lack of evidence to prove that benefits exceeding costs when investing in IT, there are certain intangible or indirect benefits to justify the investment, such as improve decision-making process, enhance customer service, and better teamwork. A good example is in the case of Federal Express (FedEx), making use its web site for tracking packages may encourage customers to use FedEx for more shipments because of its convenience. This method of utilising IT encourages firm to take advantage of the dynamic and advances in technology thus creating a positive impression of the organisation.

Brynjolfsson and Hitt (1999) further argue that a significant component of the value of IT is its ability to enable complementary organisational investments such as business processes and work practices. They also add that these investments in turn lead to productivity increases by reducing costs, and more importantly, by enabling firms to increase output quality in the form of new products or in improvements in intangible aspects of existing products like convenience, timeliness, quality, and variety.

Evaluating contribution of IT per se requires a framework so as to assign value into the investment. As such, measuring IT returns can be analysed in terms of a cost/contribution framework (Wilcocks and Lester, 1999).

Diagram 3 : Finding IT Value - A Cost/Contribution Framework



As in any other investment, the primary purpose of IT contribution is cost efficiency in terms of infrastructure, operations, and R&D. These basic elements are crucial for a successful and effective IT implementation in organisation.

Accordingly, the value of IT investment can be interpreted as a service to the business, where in this context IT will be assessed against organisation's mission and objectives, and P&Q planning. This is where the integration of IT planning with that of organisational needs come into play. Moreover, IT value can be gauged in terms of enable or support business change and improvement, in cases of applying new business process.

In addition, investment in IT can generate direct revenue and profit to organisation when its applications and systems are offerred externally. Finally, IT may be chanelled into differentiating the business competitively in relationship to customers, suppliers, and/or through partnering arrangements.

Nonetheless, what is the significant of having IT investment evaluation? Ballantine, Galiers, and Stray (Wilcocks and Lester, 1999) found out that evaluation has several merits, among them are:

i. as a means of justifying IS/IT investments;
ii. to enable organisation to decide between competing projects, particularly if capital is limited;

iii. as a control mechanism over expenditure, benefits, and the development and implementation projects;

iv. as a learning device enabling improved evaluation and systems development to take place in the future; and

v. to enable decisions concerning expansion, improvement, or the postponement of projects to be taken.

Within the above context, there are a number of evaluation techniques that can be applied (Wilcocks and Lester, 1999). Some of them are:

*i) Return-On-Investment (ROI)*

The best known of the ROI methods are those which are based on evaluating the current value of estimated future cash flows, on the assumption that future benefits are subject to some discount factor. The most widely used method is probably internal rate of return (IRR). This can be compared with a hurdle rate of return, set by the financial management of the organisation, to decide whether the project should go ahead.

*ii) Cost-benefit analysis (CBA)*

This approach attempts to find a money value for each element contributing the cost and benefit of a development project. The approach is used in circumstances where ROI methods are generally appropriate but where there are costs and benefits that are difficult to quantify.

*iii) Return on Management (ROM)*

ROM is the value attributable to an information system as an incremental change to an already established level of management productivity. The method is to express the outcome of the introduction of a new system as the change to the value added by management stemming from the introduction of a new system.

*iv) Information economics*

The method is a variant on cost-benefit analysis, tailored to cope with the particular uncertainties and intangibles found in IS projects. It therefore attempts to bridge the quantitative/qualitative divide and has the capability to recognise "cost" such as strategic and technological uncertainty and organisational risk.

*v) Critical Success Factors (CSFs)*

This approach requires executives to express their opinions as to which factors are critical to the success of the business. They then rank them according to their significance and go on to examine the role that IT in general, or a specific system, can play in supporting the executive in dealing with the critical issues. The importance of the method is that it provides a focus on those issues which the respondents regard as important - the ones they will back if it comes to a choice of issues which have to be dealt with.