CHAPTER THREE

IT IMPLEMENTATION

3.1 IT Implementation in Asia

3.1.1 Case Studies of IT Application in Manufacturing Sector

Realizing the surging needs for industry to be well-equipped with state of the art of IT to enhance productivity, the Asian Productivity Organisation (APO) as a body established to disseminate productivity information, has carried out the above survey among its members countries. The objective of the study is to present an understanding of IT applications in manufacturing and thereby indicate the present status while giving recommendations on what should be done to derive competitive advantage in the global economy.

The focus of the study is to determine:

i. critical success factors from the point of view of technical aspects and human resources management;
ii. methodology for IT implementation;
iii. problems to be overcome; and
iv. suggestions to support necessary action.

The following are summaries of several studies from member countries that have participated in the survey:

I) India

India now ranks among the top 15 industrial power in the world, where its industry accounts for more than 25% of the country's GDP, plus it is among the top countries in terms of scientific and technical manpower.

Since 1980s, India has made excellent progress towards IT, albeit with problems of poor infrastructure and other shortcomings. Several contributing factors recognised are availability of manpower, major declines in hardware and software cost, and a conducive IT policy.

Undoubtedly, the implementation of IT in its manufacturing sector has shown a positive impact, among which are:

i. productivity improvement in terms of better management of resources through a network of information system;
ii. improved quality of product and services where in an integrated IT environment, there is less scope for human error; and
iii. increased integration with suppliers and customers through supply chain management.

II) Japan

As one of the developed economies, Japan has emerged as a key player in the IT industry where it stresses on services and value-added electronics as the major support

of the economy. The factories and offices have both adopted advanced technologies, hence making the industries more sophisticated and highly specialised.

The IT implementation is effective in terms of reducing manual labour and enhance productivity. In particular, the use of CAD/CAM requires less input with enhanced quality, thus increases productivity.

Endowed with state of the art technology and as part of productivity initiatives, many Japanese corporations are managing their factories through the concept of "virtual factory". In this approach, all factories are linked with high speed digital lines and products are manufactured automatically, then distributed by remote operation from centralised factories. The parts centers, within the country and across the globe, are linked with each other and with the factories, so as to operate efficiently and economically.

III) Singapore

This island republic has invested extensively in building an urban and technological infrastructure which has enabled extremely rapid development. The IT 2000 plan for Singapore has helped to establish an excellent competitive spirit by way of constant effort towards reengineering and upgrading of technology and designs.

The application of IT has become quite high in manufacturing and production processes, particularly taking advantage of CAM, CAD/CAE, MRP, MRP II, and ERP. A strong

supply chain exists right from material suppliers to distribution to the customer. Extensive IT application has enabled a high competitive advantage for the Singapore industry.

3.1.2 IT Application in the Malaysian Industries

I) Manufacturing Sector

The manufacturing sector in Malaysia has transformed from a labour intensive to that of capital intensive with a particular surge in the use of IT. Under the Industrial Master Plan period of 1986-1995, the manufacturing sector contribution to the GDP, in terms of added value, increased to 33.1%, above its targeted level of 23.9%. Its share of total employment is 25.5%, about 2.1 million employees, at the end of 1995 (MITI, 1996).

The need to be competitive and able to survive in the era of globalisation and liberalisation, forces the industries at large to reengineer their strategic and organisational objectives in order to be more efficient and effective.

Moreover, responding to these challenges will require accurate and timely information, and IT has become indispensable as tool for enhancing efficiency and competitiveness. The use of IT is not only confined to production process per se, but also has increasingly used to facilitate and integrate various manufacturing activities such as design, marketing, and packaging.

In this regard, the NPC has conducted a biannual survey to examine the extent of IT application in the manufacturing sector in 1995, 1997, and 1999 being the latest survey. The 1999 survey drew a response rate of about 19% (347) from 13 sub-sectors, with the

electrical and electronic sub-sector contributed about 18%, while the chemical and chemical products sub-sector with about 12% response rate.

The survey looks at several aspects of IT implementation, among them are extent and intensity of IT usage in administrative activities, extent and intensity of IT usage in supporting and primary activities, and use of IT-based software and hardware.

Table 1: Extent of IT Usage in Administrative Activities

Sub-sector	1995 (%)	1997(%)	1999(%)
Machinery & Equipment	83	95	98
Metal & Metal Products	67	94	99
Wood & Wood Products	80	93	96
Non-metal Products	69	93	97
Chemical & Chemical Products	90	90	95
Electrical & Electronics	85	90	96
Textile & Apparel	77	89	94
Rubber & Rubber Products	80	86	92
Food & Food Products	76	84	93
Plastic & Plastic Products	84	81	92

Source: National Productivity Corporation(1999b)

A glance through at the table above shows an increasing trend of IT usage in administrative activities among the manufacturing sub-sector, with a usage level of 90%. Several sub-sectors in particular display a positive usage, among them are plastic and plastic products (11%), food and food products (9%), and both rubber and rubber products and electrical and electronics with 6%.

The administrative activities included are payroll, accounting and finance, transaction processing, and personnel; of which accounting and finance application is the most extensive among industries with 99%, an increase of 2% over 1997. Other applications also show a higher degree of IT utilisation: payroll at 97%, personnel records at 94%, and transaction processing at 91%.

Table 2: Extent of IT Usage in Supporting and Primary Activities

Sub-sector	Supporting Activities (%)		Primary Activities (%)	
	1997	1999	1997	1999
Machinery & Equipment	80	83	57	67
Metal & Metal Products	72	82	61	69
Wood & Wood Products	43	62	57	62
Non-Metal Products	58	75	52	70
Chemical &Chemical Products	63	75	52	68
Electrical & Electronics	78	89	72	84
Textiles & Apparel	77	68	64	52
Rubber & Rubber Products	62	52	51	53
Food & Food Products	52	63	57	56
Plastic & Plastic Products	62	73	61	72

Source: National Productivity Corporation(1999b)

Looking at the extent of IT usage in manufacturing primary activities (machining, production, quality control, and packaging) and supporting activities (process planning, product design, staff scheduling, material planning, and inventory control), majority of the sub-sectors shows an upward trend over the last two years. Several sub-sectors have increased the level of IT usage 10% and over in their supporting activities: metal and metal products (10%), wood and wood products (19%), non-metal products (15%)

chemical and chemical products (12%), food and food products (11%), plastic and plastic products (11%).

In the primary activities, significant improvement has taken place in which most of the sub-sectors have displayed a positive trend of IT usage. Of these ten sub-sectors, machinery and equipment, electrical and electronics, plastic and plastic products have increased their IT usage to 10%, 12%, and 11% respectively over the past two years. Nevertheless, the overall level of usage is still low at 75% for supporting activities (1997:65%) and 65% for primary activities (1997:58%).

II) Service Sector

The service sector has assumed an important role in the Malaysian economy with an output contribution to GDP at 50.7% in 2000 as compared to 49.7% in 1996. The sector contribution to total employment is about 46.9%, representing 4.2 million employees (NPC, 2000).

As in the manufacturing sector, a similar survey was carried out by the NPC, in 1996 and 1998, to gauge the current trends of IT application in the service sector. The 1998 survey drew a response rate of 21% from eleven service sub-sectors. The service sub-sector that responded with a ratio above 20% are Insurance (32%), Finance (42%), Wholesale/Retail (26%), Hotel (24%), Telecommunications (100%), and Education (22%). In terms of ownership, about 92% locally-owned companies responded to the study while 8% are foreign-owned companies (NPC, 1998).

In general, the IT usage in this sector is dominant with the ratio of IT users to PC/terminal is 2:1, besides an increase of 86% in the form of electronic communication or linked in a network. Electronic mail emerged at the top of the list with a usage level of 78% in 1998 as compared to 59% in 1996.

Looking at the IT applications in this sector, the percentage of usage in the primary activities in operations is about 97%, where the intensity of usage is also high with 64% of companies indicating that more than 75% of operation tasks are performed with the help of computers. Industries where operations are mainly supported by IT include banks, insurance, and tours and travel. The service sector supporting activities, finance and accounting, and general administration, see a usage level of 97% and 96% respectively with a varying degree of intensity.

In terms of IT management, about 61.4% respondents indicate that at least 50% of their workforce are IT users, an improvement from 52.9% in 1996. For those who do not have any IT staff, the 1998 survey shows a moderate decrease of 0.7% from 19.3% (1996) to 17.6% (1998).

In determining the problems faced when implementing IT, two issues have been identified as the most crucial (Table 3). The first issue is cost-related whereby 54.9% has problem of high cost of installation and 53.9% says the cost of maintaining IT is high. The second issue is related to technological progress where 47.8% finds it difficult to keep

pace with the changes of technology. The ranking for the bottom three places remains unchanged as organisations are still facing problems such as high retraining cost for their staffs, plus the vendors are unable to provide adequate training and support services.

Table 3: Problems in IT Implementation

Problems	1998		Rank 1996
	Rank	%	
High cost of installation/budget constraint	1	54.9	2
High cost of maintenance	2	53.9	3
Keeping pace with technological changes	3	47.8	1
High retraining cost	4	34.5	4
Insufficient training by vendors	5	27.4	5
Poor vendor support	6	26.5	6

Source: National Productivity Corporation(1998)

Nevertheless, organisations cannot deny the benefits accrue from implementing IT (Table 4). About 73.9% favours IT as able to enhance customer service at the top of the ladder. This is followed by promoting revenue growth (44.8%) and providing opportunity to innovate new products and processes (44.4%). Interestingly, these benefits are ranked the same as in the 1996 survey, indicating the importance of IT in enhancing the products and services provided by organisations.

Table 4: Benefits in IT Implementation

Benefits	1998		Rank 1996
	Rank	%	
Provide better customer service	1	73.9	1
Promote revenue growth	2	44.8	2
Innovate new products/processes	3	44.4	3
Form business alliances	4	39.8	6
Increase supplier responsiveness and quality	5	35.6	4
Lower cost	6	33.7	5

Source: National Productivity Corporation(1998)

3.2 *The Productivity Paradox*

Brynjolfsson and Yang (1996) suggest that a consensus on the relationship between IT investment and economic performance is still elusive which tends to substantiate the so-called productivity paradox. The phrase, coined by Robert Solow in 1987, succinctly describes the phenomena that computers are everywhere except in the productivity figures; and Bakos and Kemerer's summation that these studies have fueled a controversial debate , primarily because they have failed to document substantial productivity improvements attributable to information technology investments.

In the same article, Brynjolfsson and Yang (1996) review various literatures on the relationship between and IT and productivity at firm-level, in the service sector, and manufacturing and cross-sector. They are able to observe an interesting trend in the results of these studies; the use of larger and more recent datasets tends to generate evidence of IT's positive effect on firm performance. They further conclude that research

results in manufacturing often shows stronger effects than studies of services, due to better measurement.

In addition, an earlier study by Crowston and Treacy conclude that attempts to measure the impact of IT were surprisingly unsuccessful, and attribute this to the lack of clearly defined variables, which in turn stems from inadequate reference disciplines and methodologies (Brynjolfsson and Yang, 1996). Strassman offers a similar argument that emphasises the importance of having adequate access to productivity-related information so as to enhance productivity measures. He quotes the findings of Steven Roach, who has noted consistently that many of the productivity problems relate to accounting measurements which do not show the full costs of the information technology and do not adequately measure productivity (Strassman, 1990).

Despite the difficulty and inadequacy in formulating a proper measure of impact of IT on productivity, researchers recently began to find positive relationship between IT investment and various measures of economic performance at aggregate and micro-level studies.

In this perspective, Brynjolfsson and Hitt (1998) argue that while studies generally found little evidence of a relationship between IT and productivity, there is also little evidence that computers are unproductive. They cite an example in the banking operation whereby the investment in IT looks unproductive as the cost is easily measurable but not the benefits. This is due to the fact that at an aggregate level, banking labour productivity is

difficult to be measured, hence, most conventional analyses have shown that labour productivity has essentially been flat.

They further elaborate an initial firm-level study of IT and productivity which found that a dollar of IT capital is associated with a substantial increase in revenue each year. On the same note, other analyses have replicated these basic findings using different sets of econometric assumptions, different characterisations of IT (mainframes, PCs, IS staff or some combination), and different subsets of the economy (manufacturing vs. services). Across all these studies there is a consistent finding that IT has a positive and significant impact on firm output, thus contradicting the above claim of a productivity paradox.

Another study by Van Nievelt on organisational performance in terms of efficiency and effectiveness, it shows a strong evidence of the application of information technology in business organisation in affecting productivity level (Wilcocks and Lester, 1999). Using the productivity equation of output over input, the basis of his argument is that operational efficiencies affect the denominator (input), concentrate on reducing costs and have frequently involved the application of IT in the form of automation. Organisational effectiveness involves the creation of value and affects the numerator (output) of the productivity equation.

On the same note, Brynjolfsson and Hitt also conclude that while gross marginal produc of non-computer capital ranges from 4.14% to 6.86%, that of computer capital average

565 to 68%, indicating a favourable impact of IT on productivity. They are further able to confirm this scenario in their 1994 study through the rejection these null hypotheses:

H1: IT capital has a *zero gross* marginal product.

H2: IT capital has *zero* net marginal benefit, after all costs have been subtracted.

H3: IT capital's marginal product is *not different* from that of other capital's. (Brynjolfsson and Yang, 1996)

The controversy surrounding the impact of IT on productivity is somewhat resolved when Brynjolfsson (1993) suggests four explanations for the seeming IT productivity paradox. He states that the shortfall of IT productivity is as much due to deficiencies in our measurement and methodological tool kit as to mismanagement by developers and users of IT.

The four categories are:

i) Measurement error in terms of outputs and inputs as the traditional measures of the relationship between inputs and outputs may have failed to account for non-traditional sources of value. Low measured productivity of IT can imply that output is not being measured correctly. In the service industries, as the highest contributor of IT capital, productivity has low or negative. The benefits accrued from the use of IT; increased quality, output variety, customer service, speed and responsiveness, are the aspects of output measurement that is poorly accounted for in the productivity statistics.

ii) Lags due to learning and adjustment in which the benefits of IT can take several years to show results. Using IT successfully is not a matter of overlaying the new technology on old processes. It is frequently the transforming of business processes by "doing new things all together" rather than improving the old ways. This requires a paradigm shift in the organisation, and this requires a long learning curve.

iii) Redistribution and dissipation of profits, a rather pessimistic view in the sense that IT may not be contributing to overall returns. Redistribution argues that IT may be a zero-sum development, where the gain from one user comes from the loss of another. It is argued that those investing in the technology benefit privately at the expense of others, and as a result, no net benefits showed up at the aggregated level. Brynjolfsson suggests, however, that the redistribution hypothesis would not explain any shortfall in IT productivity at the firm level.

iv) Mismanagement of information and technology argument that points the finger towards the management itself. The managers are blamed for the slack and inefficient system, resulting in IT being unproductive at the firm level. IT is a powerful enabler that will result in large impact on the whole organisation. IT may make the enterprise outdated as its real benefits come from transforming the total business processes and not merely making the existing method more efficient.