Faculty of Manufacturing Engineering

THE ALIGNMENT OF COMPETITIVE PRIORITIES, PROCESS STRUCTURE, AND INFORMATION TECHNOLOGY AND ITS EFFECT ON FIRM PERFORMANCE: A STUDY OF MALAYSIAN MANUFACTURING FIRMS

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THE ALIGNMENT OF COMPETITIVE PRIORITIES, PROCESS STRUCTURE, AND INFORMATION TECHNOLOGY AND ITS EFFECT ON FIRM PERFORMANCE: A STUDY OF MALAYSIAN MANUFACTURING FIRMS

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DECLARATION

I declare that this thesis entitle "The alignment of competitive priorities, process structure, and information technology and its effect on firm performance: a study of Malaysian manufacturing firms" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : .....

Date : .....

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GLOSSARY

Alignment	The match among a set of theoretical dimensions.
Cellular layout	Grouping of machines into cells that function like product focused layout island within a larger job shop or process focused layout
Competitive Priorities	Generic operations or manufacturing capabilities which are derived from understanding of the market or competition.
Homoscedasticity	The appearance of constant error over a range of predictor variables.
Information Technology Applications	Information Technology based manufacturing systems which aid in decision making process.
Linearity	The assumption that there is a straight line relationship between variables.
Normality	Degree to which the distribution of the sample data corresponds to a normal distribution.
Process Structure	Types of process in a manufacturing firm which generally can be categorised into four types of processes: Job shop, Batch, line and continuous line.
Process Focus	A production that deals with low volume, high variety production; intermittent process; similar machines and equipment are grouped together.
Product Focus	A production process built around a product and seeking the best personnel and machine utilization via repetitive or continuous production.

ABSTRACT

Gaps in the existing literature especially with respect to Manufacturing Strategies components alignment and its effect on firm performance provide the rationales to the current studies. This study examines specifically the alignment of three components of Manufacturing Strategies namely competitive priorities, structural decision represented by process structures, and infrastructural decision represented by IT applications, and their effects on firms' performance. In doing so, various relationships between the components have been examined and using Profile Deviation Method the overall alignment of the three components and its effect on performance has been assessed. A research framework was developed and five hypotheses were tested. Primary data was collected from Production or Manufacturing Managers or senior Engineers using mailed questionnaire while a case study was conducted to a company that has invested large amount to have an integrated IT applications system in place. Although the recommended sample size is 330, to ensure sufficient participation, 800 hundred questionnaires were sent out to 800 companies. 104 questionnaires were returned which represented for about 12.88 % participation rate or a representative rate of 5.2 % of the population. Four types of statistical analyses were utilized namely Descriptive, Simple T- test, Profile deviation technique, and Simple Linear Regression. The following results were obtained (i) in general the results of the hypotheses testing on the various relationships between Process Structure and Competitive Priorities, Process Structure and IT Applications, and Competitive Priorities and Process Structure did not support the hypotheses; (ii) companies understudy exhibited the pattern of the Sand Cone theory; (iii) Profile Deviation technique employed to determine the effect of alignment or misalignment on performance yielded mixed results for Product Focused companies and Process Focus Companies. The case study indicated that there were indeed misalignments between the variables under study. Limitations to the current findings were also discussed and directions for future research proposed.

ABSTRAK

Jurang yang wujud di dalam penulisan akademik berkaitan pensejajaran komponen-komponen Strategi Pengilangan dan kesannya terhadap prestasi firma menjadi asas dan pencetus kepada kajian ini. Kajian ini akan mengkaji secara khusus pensejajaran tiga komponen Strategi Pengilangan iaitu Keutamaan Kompetitif, Keputusan berkaitan Stuktur yang diwakili oleh Struktur Proses dan Kuputusan berkaitan infra struktur yang diwakili oleh Aplikasi Teknologi Maklumat. Seterusnya kajian ini juga akan mengkaji kesan pensejajaran tadi ke atas prestasi firma. Pelbagai hubungan di antara komponen- komponen di atas telah dikaji dan dengan menggunakan kaedah Sisihan Profil (Profile Deviation Method), pensajaran ketiga-tiga komponen tadi dan kesannya kepada prestasi telah dinilai. Satu kerangka kajian beserta lima hipotesis telah dibentuk dan diuji. Melalui set soal-selidik yang telah diposkan, Data Primer telah dikumpulkan daripada pengurus- pengurus Pengeluaran, Pengilangan atau Jurutera- jurutera Kanan kilang yang terbabit. Satu kajian kes telah dilaksanakan terhadap sebuah syarikat yang telah melabur dengan jumlah yang besar untuk mewujudkan rangkaian applikasi IT di dalam syarikat tersebut. Walaupun 330 saiz sampel diperlukan oleh kajian ini, 800 set soal- selidik telah dihantar kepada 800 syarikat untuk data dapat dikumpul secukupnya. 104 set soal-selidik yang telah dijawab telah dikembalikan dan ianya mewakili 12.88% kadar partisipasi atau 5.2% kadar representasi dari keseluruhan populasi. Tiga jenis analisa statistik telah dimanfaatkan iaitu kaedah diskriptif, Ujian T mudah, kaedah Sisihan Profil (Profile Deviation) dan Analisis Regresi Linear. Berikut adalah hasil- hasil kajian yang diperolehi: (i) Secara umumnya hasil ujian hipotesis terhadap pelbagai hubungan di antara Struktur Proses dan Keutamaan Kompetitif, Struktur Proses dan Aplikasi Teknologi Maklumat, serta Keutamaan Kompetitif dan Aplikasi Teknologi Maklumat tidak menyokong hipotesis; (ii) Syarikat- syarikat yang dikaji menunjukkan kecenderungan mengikuti teori Kon Pasir (Sand Cone theory); (iii) Kaedah Sisihan Profil (Profile Deviation) yang telah digunakan untuk menentukan kesan pensejajaran terhadap prestasi telah memberi keputusan yang bercampur di antara syarikat-syarikat Fokus Produk dan syarikat- syarikat Fokus Proses. Kajian kes yang telah dilaksanakan menunjukkan kewujudan ketidak sejajaran di antara pemboleh ubah yang dikaji. Keterbatasan atau limitasi hasil kajian juga telah dibincangkan dan arah tuju kajian akan datang juga telah dimajukan.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

Since its independence 50 years ago, Malaysian economy has transformed drastically from a small and average country into one of the Asian economic tigers. The transformation is due to the changes in the country's economic policies. From an agricultural- based country whose main exports were commodities like rubber, palm and tin, Malaysia has moved to become an industrialized country. Industrialization policies that have brought about transformation to the country's economic structure started with the establishment of the Industrial Master Plan (IMP) in 1985. Together with the Second Outline Perspective Plan (1991- 2000) which started with the Sixth Malaysia Plan (1991-1995), Malaysia has taken steps to become an industrialized country by focusing on the manufacturing sector (Kechot. & Jusoh, 2000).

Manufacturing sector has played and will play an important and dominant role in determining the economic growth of the country. However, with the rapid change in technological development and customer preferences, coupled with the current trend

of globalization, the future of the manufacturing sector will depend on its ability to adapt to the various changes. The coming of Asian Free Trade Area (AFTA) agreement and the World Trade Organization directives will force the country to deregulate our economy and expose our much-protected industries to global competition.

Realizing the challenging future of this sector in particular and the Malaysian economy in general, the Malaysian government has outlined strategies in handling the phenomenon. One of the strategies outlined in the country's Eighth Malaysia Plan is the utilization of the latest technology especially the Information and Communication Technology (ICT) (Rancangan Malaysia ke lapan 2001- 2005, 2001). By utilizing the latest technology and the advanced information technology, the country's manufacturers are expected to match their global counterparts in term of efficiency and effectiveness.

Information Technology (IT) has tremendous impact on the industry's products and services, the industry's market, and the industry's economics of production (Parson, 1983). The impact of IT on products and services is that it can substantially reduce the product development and product life cycle and speed up the distribution of products to the market. The application of Computer Aided Design (CAD), Computer Aided Manufacturing (CAM) and Computer Aided Engineering (CAE) in the product design process for example, has tremendously improved the product development time. This

will eventually lead to the improvement of the time to market. Furthermore, the advancement of IT has eliminated the geographic market limitations. Product information, financial transactions, and ordering can be done virtually through the Internet. The application of e- commerce has wide spread the competition as it increases the overall demand and supply of the global market (Parsons, 1983). Furthermore, the introduction of Flexible Manufacturing System (FMS) for example, has challenged the classical trade-off theory (Skinner, 1969) by proving that mass production and customization could somehow be achieved with the help of advanced IT. In total, the application of IT in today's business and manufacturing is a strategic issue that could determine a company's competitiveness and survival.

Although it is generally accepted that IT is important in determining company future and survival, the impact of IT on performance or productivity is still not fully understood. Researches to date have shown that the impact of IT on firms' performance has been mixed. Studies at the macro or industry- wide level since the early of 1970s have shown that IT investment resulted in very little gain or no gain at all (Tatcher & Oliver, 2001). These studies have led to the term "IT productivity paradox". In the words of Robert Solow, a Nobel Prize- winning economist, the situation was that "we see the computer age everywhere except in the productivity statistics (Tatcher and Oliver, 2001). The same phenomenon was observed at the company level. Researchers like Brynjolfsson (1993), Landauer (1995), and Weill

(1992) have found that there was no relation or a slightly negative relationship between IT investment at company level and firm performance.

However, in the late 1990s researchers (Brynjolfsson and Hitt, 1995; Dewan and Min, 1997; Lichtenberg, 1995; and Stratopoulos and Dehning, 2000) have found the existence of positive relationship between IT spending and firms' performance. The question now has changed from whether IT investment results in better performance to why and when IT lead to better performance (Dehning and Richardson, 2002). The question of why IT investment lead to a better payoff to a company is very important to answer since it will help managers to make better decision in selecting the right IT applications and in investing in IT.

Researches in the relationship between IT and performance or productivity are numerous and encompass various disciplines such as accounting, information system, economics, and production and operation management. A large body of research, such as Dos Santos, Perrers, and Mauer (1993), Hitt and Brynjolfsson (1996), Tam (1998), Sircar, Turnbow, and Bordoloi (2000), and many others, is an accounting with information system (IS) based research. Synthesis of research by Dehning and Richardson (2002) indicates that much of the researches in accounting analyze the direct relationship between IT investments and firms' performance, omitting the intermediate effects of business process that stand between the two. The understanding of how IT affect business processes and in turn how the processes affect performance

is, however, crucial since it can help explains what determines the success of the IT investment or implementation and the question of how to make IT investment effective (Dehning and Richardson, 2002).

In contrast to the aforementioned researches which are accounting- inclined research, researchers focused on the relationship between IT and manufacturing (or production and operation management) or business competitiveness issues tend to analyze the effect of IT on business process (production related processes in particular) and how IT align with business or manufacturing strategy to improve firms' performance. The issue of IT alignment with manufacturing strategy or business strategy has received considerable attention from the researchers. Parsons (1983); Cooper and Zmud (1990); Floyd and Wooldridge (1990); Chin-Fu (1996); Berry and Hill (1992); Kathuria and Igbaria (1997); Gupta, Karimi and Somers (1997); Luftman and Brier (1999); Grover and Malhotra (1999); Sohal, Moss and Ng (2001); and Kini (2002) are examples of researchers in the field.

The term alignment refers to the match among a set of theoretical dimensions (Venkatraman, 1990). In the case of manufacturing strategy, alignment means the match among the manufacturing strategy contents namely the competitive priorities, structural decisions, and infrastructural decisions. The study of alignment in relation to performance could be in terms of its interactive effects or could be in terms of the

differing patterns among set of variables between successful and unsuccessful firms (Venkatraman, 1989). All of these will be dealt in detail in the following chapter.

Although there are a growing number of researches in this area, they are very much case studies, anecdotes, and consultant framework, with "little solid empirical work or synthesis of findings" (Sohal, Moss, and Ng, 2001). As suggested by Sohal, Moss, and Ng (2001), there should be more empirical research in the area of IT. Hence, this thesis attempts to fill some gaps left by the above-mentioned researchers.

1.1 Problem Statements And Research Questions

Review of existing literature on the manufacturing strategy components and information technology established the need for an empirical research to test the various relationships among the said components of manufacturing strategy namely the competitive priorities, process structure (structure), and information technology applications (infrastructure) and how they contribute to firm performance. In order to understand the various relationships a model need to be developed and tested. By doing so it will answer the following questions:

1. Do competitive priorities of manufacturing firms, with regard to primary product line produced in a particular plant, align with the plants' process structure?

2. Do IT applications of manufacturing firms, with regard to primary product line produced in a particular plant, align with the plants' process structures?

3. Do IT applications employed by manufacturing firms align with the competitive priorities of the firms?

4. Does the relationship among the competitive priorities, process structure, and IT applications follow any specific manufacturing strategy model or theory?

5. Does the alignment among competitive priorities, process structure, and IT applications affect firms' performance?

6. If the alignment does affect firms' performance, to what extend is the effect?

1.2.1 Objectives Of The Study

The research objectives are as follows:

1. To determine whether or not Competitive Priorities of manufacturing firms, with regard to primary product line produced in a particular plant align with the plant's process structure.

2. To determine whether or not IT applications of manufacturing firms, with regard to primary product line produced in a particular plant align with the plants' process structure.

3. To determine whether or not IT applications employed by manufacturing firms are in alignment with the competitive priorities of the firms.

4. To determine whether or not the relationships among competitive priorities, process structures, and IT applications follow any specific manufacturing strategy model or theory.

5. To determine whether or not the alignment or misalignment among competitive priorities, process structures, and IT applications affect firms' performance.