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

Hasbullah Ashari

PhD

2008
THE ALIGNMENT OF COMPETITIVE PRIORITIES, PROCESS STRUCTURE, AND INFORMATION TECHNOLOGY AND ITS EFFECT ON FIRM PERFORMANCE: A STUDY OF MALAYSIAN MANUFACTURING FIRMS

HASBULLAH BIN ASHARI

A Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Manufacturing Engineering

Faculty of Manufacturing Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2008
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 : ........................................
ACKNOWLEDGEMENT

I would like to express my greatest gratitude to Allah S.W.T. the Almighty God for giving me the knowledge and the strength to complete this paper. I must express my sincere appreciation to those who have contributed in one way or the other to the full realisation of this study. My appreciation goes first to Prof Dr Mohd Razali Muhamad of the Universiti Teknikal Malaysia Melaka who without his guidance and intellectual inputs, this thesis would not have been possible. My appreciation too goes to my mother who through her prayers and in her own silent ways gave me the strength to persist and successfully finish this course. I am also indebted to Associate Professor Dr Abdullah Abdul Ghani for his patience to spare his valuable time to help me out whenever I need his assistance, to Dr Abd Isa Ismail for his efforts to proof read this thesis and to provide valuable advice and comments to make sure this study is a success, and to Dr Asmat Nizam for his consistent encouragement that has pushed me toward the end of this long journey. Last but not least, to my wife Nora and our children Sumayyah, Nusaibah, Yaaser, Ammar, Muaz, Asma’ and A’isyah, thank you for all of your patience, everlasting love and morale support that have helped me going through this long learning process without much difficulty. Finally, none of those who have helped me in this work should be held responsible for the form or any errors but me.
# TABLE OF CONTENT

DECLARATION
ACKNOWLEDGEMENTS
TABLE OF CONTENTS
APPENDICES
LIST OF TABLES
LIST OF FIGURES
GLOSSARY
ABSTRACT (ENGLISH)
ABSTRAK (BAHASA MELAYU)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>iv - viii</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>ix</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>x - xi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xii</td>
</tr>
<tr>
<td>GLOSSARY</td>
<td>xiii</td>
</tr>
<tr>
<td>ABSTRACT (ENGLISH)</td>
<td>xiv</td>
</tr>
<tr>
<td>ABSTRAK (BAHASA MELAYU)</td>
<td>xv</td>
</tr>
</tbody>
</table>

## CHAPTER ONE: INTRODUCTION

1.0 Introduction  
1.1 Problem Statements And Research Questions  
1.2 Objectives Of The Study  
1.3 Significance Of The Study  
1.4 Scope Of The Study  
1.5 Organization Of The Thesis  
1.6 Summary  

iv
CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.0 Introduction 13

2.1 Manufacturing Strategy Framework 15
   2.1.1 Competitive Priorities 16
   2.1.2 Structural and Infrastructural Decisions 18
   2.1.3 Alignment in The Context of Manufacturing Strategy 19
   2.1.4 The Importance of Process Structure and IT Applications As Research Variables 20

2.2 Trade-off Model and Cumulative Model- The Two Competing Models 23

2.3 Previous Studies on the Alignment of Manufacturing Strategy with IT Applications 27

2.4 Theoretical Framework Development 35
   2.4.1 Competitive Priorities, Process Structure, and Firms’ Performance 35
   2.4.2 Competitive Priorities, Process Structure, IT Applications, and Firm’s Performance 40

2.5 The Model 42

2.6 Hypotheses 43

2.7 Summary 44
CHAPTER THREE: METHODOLOGY

3.0 Introduction 45

3.1 Research Design 46

3.1.1 Purpose Of Study And Time Horizon 46

3.1.2 Population, Sample And Unit Of Analysis 47

3.1.3 Data And Data Collection 48

3.1.4 Pilot Test 48

3.1.5 Validity And Reliability 49

3.1.5.1 Validity Assessment 49

3.1.5.2 Reliability Assessment 53

3.2 Measurement 54

3.2.1 Competitive Priorities 54

3.2.2 Process Structure 55

3.2.3 IT Applications 55

3.2.4 Firm Performance 56

3.2.5 Summary on Measurement Instruments & Scales 60

3.3 Analytical Tools 61

3.3.1 Methods for Measuring Alignment 62

3.4 Linearity, Normality, And Homoscedasticity Condition 67

3.5 Summary 68
CHAPTER FOUR: RESULTS AND DISCUSSION

4.0 Introduction 69
4.1 The Alignment of Competitive Priorities with Process Structure 70
4.2 The Alignment of IT Applications with Process Choice 76
4.3 The Alignment of IT Applications with Competitive Priorities 80
4.4 Trade-off or Cumulative Theory 82
4.5 Performance Implications of Alignment 84
   4.5.1 Normalization 84
   4.5.2 Classification into Product Focus and Process Focus 85
   4.5.3 Computation of Alignment 85
   4.5.4 Performance Implications of Alignment 88
4.6 Summary 93

CHAPTER FIVE: TRIANGULATION OF RESEARCH FINDINGS

THROUGH CASE STUDY

5.0 Introduction 94
5.1 Data Collection Method 95
5.2 Background of the Company- ITSB 98
5.3 Competitive Priorities 99
5.4 Process Structure 100
5.5 IT Applications- Enterprise Resource Planning (ERP) 101
5.6 Analysis of the Alignment (or Misalignment)- Profiling Technique 103
5.7 Summary 106

CHAPTER SIX: CONCLUSION AND RECOMMENDATION 107

6.0 Introduction 107
6.1 The Research in a Nutshell 107
6.2 Major Findings of the Study 109
6.3 Implication of Study 111
   6.3.1 Management Implication 112
   6.3.2 Academic Implication 113
      6.3.2.1 Approach of the Study 113
      6.3.2.2 The Sand Cone Theory 114
6.4 Limitations of Study 114
6.4.1 Methodology Limitations 114
6.5 Study’s Obstacle 116
6.6 Future Research Direction 117

REFERENCES 120
## APPENDICES

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Survey Questionnaire</td>
<td>134</td>
</tr>
<tr>
<td>B</td>
<td>Linearity Tests</td>
<td>142</td>
</tr>
<tr>
<td>C</td>
<td>Homoscedasticity Tests</td>
<td>144</td>
</tr>
<tr>
<td>D</td>
<td>Normality Tests</td>
<td>147</td>
</tr>
<tr>
<td>E</td>
<td>Descriptive Study</td>
<td>150</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 2.1 Summary of Previous Research on Alignment of IT Applications with Manufacturing Strategy 33
Table 2.2 Competitive Priorities and Compatible Process Structure 39
Table 3.1 Factor Loading of Items on Construct 51
Table 3.2 Standardized Cronbach’s Coefficient Alpha Measures of Variables 53
Table 3.3 Summary of Measurement and Scales 61
Table 4.1 Expected Relationship for T-Test Between Means of Competitive Priorities with Regards to Process Structure 71
Table 4.2 Mean Differences Between Means for The Competitive Priorities of Product Focus and Means for Process Focused firms 73
Table 4.3 Comparison of Mean of the Competitive Priorities IN Relation to Two Types of Process Structure 75
Table 4.4 Comparison of Means Two Types of Process Structure 78
Table 4.5 Differences Between Means of IT Applications with Respect to Process Structures 79
Table 4.6 Differences between Means of IT Applications with Respect to Competitive Priorities 81
Table 4.7 Correlations Results of The Competitive Priorities 83
Table 4.8 Ideal Values of the Competitive Priorities and IT Applications Based on Type of Processes 86
Table 4.9 Implications of Alignment for Firms’ Performance 89
Table 4.10  Linear Regression Model For Product Focused Firms  90
Table 4.11  Model Summary For Product Focused Firms  90
Table 4.12  Linear Regression Model For Process Focused Firms  91
Table 4.13  Model Summary For Process Focused Firms  91
### LIST OF FIGURES

| Figure 2.1 | Manufacturing Strategy Framework | 15 |
| Figure 2.2 | Hayes And Wheelwright Product- Process Life Cycle | 37 |
| Figure 2.3 | Conceptual Model Of The Relationship Of The Variables | 42 |
| Figure 3.1 | Relationship of Competitive Priorities Measures and Other Performance Measures | 58 |
| Figure 3.2 | Six Perspectives for Measuring and Analyzing Alignment | 63 |
| Figure 3.3 | Profile Deviation Technique | 65 |
| Figure 3.4 | The Analytical Approach | 66 |
| Figure 5.1 | ITSB Production Line | 100 |
| Figure 5.2 | Profile of ITSB Manufacturing Strategy Components Alignment | 104 |
# GLOSSARY

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

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 widespread 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 explain 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 extent 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.