

**RELATIONSHIP BETWEEN KNOWLEDGE AND INNOVATION
PERFORMANCE: THE MEDIATING ROLE OF ABSORPTIVE CAPACITY**

KHOO KAH KHENG

**Research report in partial fulfillment of the requirements
for the degree of Master of Business Administration**

MAY 2008

ACKNOWLEDGEMENT

I would like to thank my supervisor, Associate Professor T. Ramayah for his constant support, guide and supervise me throughout the whole research and thesis write up. He has been an outstanding advisor, who I would not have traded for anyone else.

My thanks also go out to my family, for making who am I today, and always being so supportive and patience during the course of my study.

Here at USM, my course mates at MBA have made my life at USM a blast. My deepest thanks go to my friends and course mates whose support, direction and encouragement have given me the confidence to come this far.

Last but not least, I am so much obliged and grateful to all the lecturers and staffs from School of Management especially those who have provided me a lot of help and guidance during my study. Also, thanks to those that I might have left out here for their much valuable help.

TABLE OF CONTENTS

	<u>Page</u>
ACKNOWLEDGEMENT	i
TABLE OF CONTENTS	ii
LIST OF TABLES	ix
LIST OF FIGURES	xi
LIST OF APPENDICES	xii
ABSTRAK	xiii
ABSTRACT	xiv
Chapter 1 INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement	3
1.3 Research Objective	4
1.4 Research Questions	4
1.5 Significance of Study	5
1.6 Definition of Key Terms	7
1.6.1 <i>External knowledge sources</i>	7
1.6.2 <i>Experience</i>	7
1.6.3 <i>Absorptive capacity</i>	7

1.6.4	<i>Innovation performance</i>	8
1.7	Organization of Remaining Chapters	9
Chapter 2	LITERATURE REVIEW	10
2.1	Introduction	10
2.2	Absorptive Capacity	13
2.2.1	<i>Knowledge Acquisition, Dissemination and Utilization</i>	16
2.3	Predictors of Absorptive Capacity	18
2.3.1	<i>Level of analysis</i>	18
2.3.2	<i>Predictors</i>	20
2.3.2.1	<i>External knowledge sources</i>	21
2.3.2.2	<i>Experience</i>	22
2.4	Organizational Outcomes	24
2.4.1	<i>Innovation Performance</i>	24
2.5	Environmental Dynamism	27
2.6	Research Model	28
2.7	Hypothesis Generation	30
2.7.1	<i>Relation between external knowledge sources, firm's experience and firm's process innovation performance</i>	30
2.7.1.1	<i>External knowledge sources</i>	30
2.7.1.2	<i>Firm's experience</i>	32

2.7.2	<i>Relationship between absorptive capacity and firm's innovation performance</i>	33
2.7.3	<i>Relationship between external knowledge sources, firm's experience and firm's innovation performance</i>	33
2.7.4	<i>Relationship between external knowledge sources, firm's experience and firm's innovation performance with absorptive capacity as mediator</i>	35
2.7.5	<i>Relationship between absorptive capacity and firm's innovation performance with environmental dynamism as moderator</i>	36
2.7.6	<i>Control variable</i>	37
Chapter 3	RESEARCH METHODOLOGY	39
3.1	Introduction	39
3.2	Research Design	39
3.3	Population/Samples	39
3.4	Unit of Analysis	40
3.5	Questionnaire Design	41
3.6	Measurement and Variables	41
3.6.1	<i>Independent variables</i>	42
3.6.2	<i>Mediating variables</i>	32

3.6.3	<i>Moderating variable</i>	43
3.6.4	<i>Dependent variables</i>	43
3.6.5	<i>Control variable</i>	43
3.7	Data Collection Procedure	45
3.8	Data Analysis	45
3.8.1	<i>Descriptive analysis</i>	45
3.8.2	<i>Factor analysis</i>	45
3.8.3	<i>Reliability analysis</i>	46
3.8.4	<i>Regression analysis</i>	47
3.8.5	<i>Multiple regression analysis</i>	47
3.9	Summary	47
Chapter 4	RESULTS	49
4.1	Introduction	49
4.2	Profile of Respondents	49
4.2.1	<i>Respondent's profile</i>	50
4.2.2	<i>Respondents' organization profile</i>	50
4.3	Goodness of Measures	52
4.3.1	<i>External knowledge sources</i>	53
4.3.2	<i>Experience of the organization</i>	54
4.3.3	<i>Absorptive capacity</i>	55
4.3.4	<i>Environmental dynamism</i>	56
4.3.5	<i>Performance innovation</i>	57

4.4	Reliability Analysis	58
4.5	Descriptive Analysis	59
4.6	Pearson Correlation Analysis	60
4.7	Revised Theoretical Framework and Hypothesis	62
4.8	Hypotheses Testing	65
4.8.1	<i>Effect of control variable on external knowledge sources, firm's experience, absorptive capacity and firm's process innovation performance</i>	65
4.8.2	<i>Independent variables on mediating variables</i>	67
4.8.3	<i>Mediating variables on dependent variables</i>	68
4.8.4	<i>Independent variables on dependent variables</i>	69
4.8.5	<i>Mediating effects</i>	70
4.8.6	<i>Moderating variables on mediating and dependent variables</i>	73
4.9	Summary	76
Chapter 5	DISCUSSION AND CONCLUSION	79
5.1	Introduction	79
5.2	Recapitulation of the Study Findings	79
5.3	Discussion	81
5.3.1	<i>Control variable</i>	81
5.3.2	<i>The relationship between firm's interaction</i>	

	<i>with external knowledge sources, firm's experience and absorptive capacity</i>	82
5.3.2.1	<i>External knowledge sources and absorptive capacity</i>	82
5.3.2.2	<i>Firm's experience and absorptive Capacity</i>	83
5.3.3	<i>The relationship between absorptive capacity and firm's process innovation performance</i>	85
5.3.4	<i>The relationship between external knowledge sources, experience and firm's process innovation performance</i>	86
5.3.4.1	<i>External knowledge sources</i>	86
5.3.4.2	<i>Firm's experience</i>	88
5.3.5	<i>The relationship between external knowledge sources, experience and firm's process innovation performance with absorptive capacity (knowledge acquisition, knowledge dissemination and knowledge utilization) as mediator</i>	90
5.3.6	<i>The relationship between absorptive capacity and firm's process innovation performance with environmental dynamism as moderator</i>	91
5.4	Limitations and Future Research	92

5.5	Conclusion	93
	REFERENCES	96
	APPENDICES	104

LIST OF TABLES

	<u>Page</u>	
Table 2.1	Absorptive capacity as mediator of various organizational outcomes	20
Table 3.1	Summary of instrument used to measure variables	44
Table 4.1	Respondents' personnel profile	50
Table 4.2	Number of years for the respondents' organization in the Industry	51
Table 4.3	Summary of respondents' organization profile	51
Table 4.4	Rotated factors and factor loadings of external knowledge	53
Table 4.5	Factor loadings of experience of the organization	54
Table 4.6	Factor loadings of absorptive capacity	55
Table 4.7	Factor loadings of environmental dynamism	57
Table 4.8	Factor loadings of process innovation	58
Table 4.9	Reliability coefficients for the major variables	59
Table 4.10	Descriptive for the major variables	59
Table 4.11	Intercorrelations of the major variables	65
Table 4.12	Test of significance of firm size on external knowledge sources and experience	66
Table 4.13	Test of significance of firm size on absorptive capacity	66

Table 4.14	Test of significance of firm size on firm's process innovation	67
Table 4.15	Result of regression analysis between IV (R&D cooperation, contracted R&D and firm's experience) and MV (knowledge acquisition capability, knowledge dissemination capability and knowledge utilization capability)	68
Table 4.16	Result of regression analysis between MV (knowledge acquisition capability, knowledge dissemination capability and knowledge utilization capability) and DV (process innovation performance)	69
Table 4.17	Result of regression analysis between IV (R&D cooperation, contracted R&D and experience) and DV (process innovation performance)	70
Table 4.18	Changes in β coefficient showing mediating effect of knowledge dissemination capability between independent and dependent variables	71
Table 4.19	Changes in β coefficient showing mediating effect of knowledge utilization capability between independent and dependent variables	72
Table 4.20	Hierarchical regression results using environmental dynamism as a moderator in the relationship between MV (absorptive capacity) and DV (firm's process innovation performance)	74
Table 4.21	Summary of the hypotheses results	76

LIST OF FIGURES

		<u>Page</u>
Figure 2.1	A model of absorptive capacity based on Zahra and George (2005)	15
Figure 2.2	Theoretical framework	30
Figure 4.1	Revised theoretical framework	62
Figure 4.2	Mediating effect of knowledge dissemination	72
Figure 4.3	Mediating effect of knowledge utilization	73
Figure 4.4	Moderating Effect of environmental dynamism on the relationship between knowledge acquisition capability and process innovation performance	75

LIST OF APPENDICES

	<u>Page</u>
Appendix A Questionnaire	104
Appendix B Descriptive Statistics: Respondent's profile	113
Appendix C Goodness of Measures: External Knowledge Sources	115
Appendix D Goodness of Measures: Firm's Experience	119
Appendix E Goodness of Measures: Absorptive Capacity	121
Appendix F Goodness of Measures: Environmental Dynamism	125
Appendix G Goodness of Measures: Process Innovation	127
Appendix H Descriptive Analysis: Major variables	130
Appendix I Pearson Correlation Analysis	131
Appendix J Linear regression analysis: Control variable	132
Appendix K Multiple Regression Analysis: Independent and Mediating Variables	140
Appendix L Multiple Regression Analysis: Mediating and Dependent Variables	144
Appendix M Multiple Regression Analysis: Independent and Dependent Variables	146
Appendix N Multiple Regression Analysis: Mediating Effects	147
Appendix O Hierarchical Multiple Regression Analysis: Moderating Variables on Mediating and Dependent Variables	150

ABSTRAK

Kepesatan dalam bidang teknologi telah mewujudkan daya saing di antara sector perindustrian terutama dalam bidang inovasi. Oleh sebab itu, syarikat pengeluaran perlu mengembangkan lagi pengetahuan dalam bidang teknologi yang sedia ada serta mencipta teknologi baru supaya dapat meningkatkan daya saing dan mewujudkan lebih banyak peluang perniagaan baru. Keupayaan sesebuah syarikat menjana pengetahuan merupakan salah satu aspek penting untuk meningkatkan lagi sikap berinovasi serta lebih berdaya saing. Daya penyerapan telah dianggap sebagai salah satu faktor kejayaan sesebuah syarikat. Dengan adanya daya penyerapan yang berkesan, syarikat mampu mengecam dan memanipulasikan pengetahuan luar demi meningkatkan inovasi sesebuah syarikat dan mencapai kejayaan dalam bidang yang diceburi. Tujuan penyelidikan ini adalah untuk menyelidik sama ada prestasi inovasi boleh ditingkatkan melalui daya penyerapan (pengumpulan, penyebaran dan penggunaan pengetahuan) yang disokong oleh pengetahuan lampau. Soal selidik digunakan untuk mengumpul data. Sebanyak tiga ratus lima puluh soal selidik telah dihantar kepada kilang pengeluaran di utara semenanjung Malaysia. Hanya enam puluh sembilan soal selidik yang boleh diguna dapat dikumpul kembali. Berdasarkan analisi, pengalaman syarikat dan kontrak R&D mempunyai kesan ke atas prestasi inovasi sesebuah syarikat. Selain itu, analisi juga mendapati bahawa syarikat yang beroperasi dalam persekitaran yang kurang dinamik memperolehi pengetahuan luar yang kurang berbanding daripada syarikat yang beroperasi dalam keadaan yang lebih dinamik.

ABSTRACT

One of the defining features of competition in many industries has been the extremely rapid pace of technological change, marked by a continuous stream of innovations. Manufacturing firms, therefore, face the challenge of nurturing existing knowledge and developing novel knowledge in order to create new business opportunities. The firm's knowledge processing capabilities have a central role in endeavors to achieve firm's innovation performance and competitive advantage. Absorptive capacity capabilities and innovation is viewed as an essential part of the firm's success. Absorptive capacity is a highly important organizational capability to recognize value and assimilate external knowledge in order to increase firm's innovativeness. The aim of this study is to determine if the innovation performance can be improved through the absorptive capacity (knowledge acquisition, dissemination and utilization) that is supported by prior knowledge. Structured questionnaire was used in this study. Three hundred and fifty questionnaires were distributed to the manufacturing firms located at the northern region of Malaysia. Only sixty nine useable questionnaires have been collected back. Based on the analysis, firm's experience and contracted R&D was found significantly related to firm's innovation performance. It was also found that the firms operating in a fast-changing environment acquire less external knowledge than those operating in more stable and predictable conditions.

CHAPTER 1

INTRODUCTION

1.1 Background

In a world of greater globalization and tougher competition, firms have become increasingly knowledge-based in order to compete against with each other to grasp more market share to survive. Firms strive to learn and to develop capabilities faster than their rivals. As the innovation paradigm has changed from being discovery-based to being centrally learning-based (Lundvall and Borras, 1997), the way in which knowledge processes are managed within and between firms has emerged as a major theme in recent research.

The concept of manufacturing today does not solely concern with transforming raw material into products on a factory floor but is becoming more holistic, concerning as they do a wide range of skills, knowledge and competency that need to be managed over functional, corporate and cultural borders. The sources of manufacturing competitiveness have shifted from managing tangible resources efficiently into both the integration and co-ordination of knowledge (Kogut and Zander, 1996) and the creation of valuable and idiosyncratic organizational capabilities (Helfat and Lieberman, 2002; Helfat and Peteraf, 2003; Makadok, 2001). Manufacturing firms, therefore, face the challenge of nurturing existing knowledge and developing novel knowledge in order to create new business opportunities.

This rapid rate of knowledge obsolescence makes it imperative for firms to renew their technological bases constantly. The ability of a firm to commercialize new ideas and products is crucial for their survival. The fast and changing business environment that characterizes many firms today means that the role that absorptive capacity plays is an important focus of all firms.

Cohen and Levinthal (1990) defined absorptive capacity as a firm's "ability to recognize the value of new external knowledge, assimilate it and apply it to commercial ends". Given the wide array of technological fields to draw on, no one firm can possibly hope to come up with all the required research on its own, therefore, every firm needs to look outside its boundaries. Firms are increasingly dependent on their customers, suppliers and other complementary capabilities as initiators of product and process improvement and sources of new ideas (Ari, 2005). With the greater availability of external knowledge source in modern economics, a dynamic capability that influences a firm's ability to target, absorb and deploy the external knowledge necessary to feed the internal innovation process becomes a crucial source of competitive advantage.

This research largely focuses on knowledge acquisition, knowledge dissemination and knowledge utilization as dimensions that make absorptive capacity potentially valuable for increasing strategic flexibility in dynamic environment. Knowledge acquisition refers to a firm's capability to identify and acquire externally generated knowledge (Zahra and George, 2002). Knowledge dissemination refers to the processes that convert knowledge into a transferable form and distributed internally so that it can be used in business, and knowledge-utilization capabilities indicate how effectively it can exploit acquired knowledge in the form of new and improved products (Ari, 2005). The

research identifies external knowledge sources and firm's experience as the major predictors for the absorptive capacity. Vekstein (1998) shows that in the automobile industry the complementary use of external and internally developed knowledge is an important source of competitive advantage.

Recognizing the critical need for knowledge as input, Malaysia through the Knowledge-Based Economy Master Plan has embarked on the transformation from an input-driven growth strategy to one that is increasingly driven by knowledge in order to achieve sustainable high growth and development. The intention is to migrate from a production-based economy to a knowledge-based economy. Therefore, this study can make a valuable contribution toward understanding the behavioral of Malaysia manufacturing firms towards the various aspect of innovation.

1.2 Problem Statement

The research build upon the model developed by Ari Jantunen (2005) to further empirically explore the predictors of absorptive capacity. Ari Jantunen's model presents the concept of the firm's absorptive capacity of knowledge-processing capabilities on the firm's innovative performance.

This research attempts to explore if the innovation performance can be improved through the absorptive capacity (knowledge acquisition, dissemination and utilization) that is supported by prior knowledge (external knowledge sources and firm's experience). The research able to assess whether firms' innovations incorporate or are based on knowledge obtained from external partners. The research argues that firms that introduce innovations, which are based on external knowledge, necessarily have the ability to

exploit knowledge from external sources, thus evincing absorptive capacities. However, a firm which is able to exploit external knowledge usually also has the ability to identify and assimilate it (Schmidt, 2005).

In addition, the paper also investigates the effect of environmental dynamism on innovative performance. It studies the relationship between firm's absorptive capacity and innovation performance moderated by environmental dynamism. By linking absorptive capacity to firm's innovation performance, it is hope that we will move closer to an understanding of how Malaysia firms response when confronted by environmental changes that present opportunities and threaten survival.

1.3 Research Objective

The purpose of this study is to investigate the relationship between firm's innovation performance and prior knowledge (external knowledge sources and firm's experience) by taking into consideration of absorptive capacity as a multidimensional, dynamic construct consisting of capabilities for organizational knowledge processing. The research will also discuss on the findings and explain the behavioral of Malaysia manufacturing firms towards the various aspect of innovation.

1.4 Research Questions

After identifying the problem for this research and with the objective being set, following are the questions that attempts to answer by this research:

- (1) Does higher level of R&D cooperation lead to higher level of innovation performance?

- (2) Does higher level of contracted R&D lead to higher level of innovation performance?
- (3) Does higher level of experience of the organization lead to higher level of innovation performance?
- (4) Does high level of absorptive capacity lead to higher level of innovation performance?
- (5) Does higher level of R&D cooperation lead to higher level of absorptive capacity?
- (6) Does higher level of contracted R&D lead to higher level of absorptive capacity?
- (7) Does higher level of firm's experience lead to higher level of absorptive capacity?
- (8) Does absorptive capacity mediate the relationship between external knowledge sources, experience and firm's innovation performance?
- (9) Does environmental dynamism moderate the relationship between absorptive capacity and firm's innovation performance?

1.5 Significance of Study

The research attempts to explore the predictors (prior knowledge) of absorptive capacity and its impact on the innovation performance. There is also little empirical research looking on the impact of knowledge-processing capabilities on the firm's innovative performance in Malaysia. This model will provide an insight on the importance of absorptive capacity by leveraging external knowledge sources and firm's experience to achieve superior innovation performance in Malaysia's manufacturing environment.

One of the defining features of competition in many industries has been the extremely rapid pace of technological change, marked by a continuous stream of

innovations. To survive, organizations need to move out of the traditional way of conducting business and focus more on knowledge-based business.

The research attempts to look into the impact of knowledge-processing capabilities on the firm's innovative performance. It also studies the mediating effect of absorptive capacity on relationship between prior knowledge and innovation performance. With the research finding from this study linking absorptive capacity to firm's innovation performance, it may convince the organizations to leverage more on absorptive capacity capabilities to enhance the firm's innovation activities.

In terms of benefits to the management of firms, the study on absorptive capacity can provide useful insights on the characteristic of the today's manufacturing firm in Malaysia because the study generally shows what most of the manufacturing firms are practicing today. This enables the firms which are lacking behind to improve themselves and for those firms which are in the frontier to do something differently to maximize its absorptive capacity capabilities.

The research studies the innovation performance of Malaysia manufacturing firms and the empirical evidence reported here makes a valuable contribution toward Malaysia vision of setting a knowledge-based industry. Knowledge is the key to innovation, and therefore it is of great importance for an organization to be able to absorb knowledge from all available sources. It is hoped that the knowledge gained from this study can improve the absorptive capacity capabilities of the manufacturing firms, which is a vital key element to enhance the firm's innovation performance.

1.6 Definition of Key Terms

The following key terms are defined for the purposes of this research study:

1.6.1 External knowledge sources

Many researches have studied and conclude the important role of external knowledge sources in innovation activities (Cohen & Levinthal, 1990; Fosfuri & Tribo, 2006; Kim & Inkpen, 2005; Zahra & George, 2002). In this research, the external knowledge sources were divided into R&D cooperation and contracted R&D. R&D Cooperation is defined as active participation with other organizations or non-commercial institutions to generate innovations. Contracted R&D is defined as outsource of innovation or R&D activities to other organizations (paying other organizations for their innovation effort but keep the innovation right).

1.6.2 Experience

Experience measures the prior knowledge and experience in the organization. According to Schmidt (2005), a firm is better able to acquire and use external knowledge from areas it has some prior experience or related knowledge. Experiences are gained from training, bench-marking, scanning the environmental, attend conferences or seminars, contribute to journal and publication.

1.6.3 Absorptive capacity

Cohen and Levinthal (1990) defined absorptive capacity as a highly important organizational capability to recognize, value and assimilate external knowledge in order to increase firm's innovativeness. The research presents the concept of the firm's

absorptive capacity of knowledge-processing capabilities on the firm's innovative performance. The research will study on three dimensions of absorptive capacity, namely knowledge acquisition, knowledge dissemination and knowledge utilization. Knowledge acquisition capability is defined as a firm's capability to identify and acquire externally generated knowledge that is critical to its operations (Zahra & George, 2002). Knowledge dissemination involves the assimilation and communication of the generated knowledge to all relevant departments and individuals (Liao, Welsch, & Stoica, 2003). Knowledge utilization refers to an organization's timely response to technological change by utilizing the acquired knowledge generated into new products and processes.

1.6.4 Innovation performance

There are numerous variations have been used to measure innovation performance of the organizations. The study adopted the product innovation and process innovation concept to measure the innovative performance in the manufacturing firms. Product innovation is defined as ideas generating or the creation of something entirely new or a significantly improved with respect to its capabilities that is reflected in changes in the end product or service offered by the organization, such as improved software, user friendliness, components or sub-systems. Process innovation represents changes in the way firms produce end-products or services through the diffusion or adoption of an innovation developed elsewhere or new practices developed internally (Prajogo & Ahmed, 2006).

1.7 Organization of Remaining Chapters

This research is divided into five chapters. Chapter 1 looks at the background of the study. It is followed by problem statement, research objectives, research questions, significance of the study and thy key terms used in this study. Chapter 2 presents the literature review of previous studies concerning all the variables used in this research. Then, this chapter discusses on the theoretical framework and the hypotheses formulation of this research. Chapter 3 presents the methodology used in this research. Research design, population/samples, unit of analysis, questionnaire design, measurement and variables, data collection technique, and statistical analysis will be discussed in this chapter. Chapter 4 outlines the result of the data analysis and summarizes the findings. Finally, Chapter 5 discusses the research findings, implications, limitations of the study and recommendation for future research. The chapter ends with conclusion for this research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Many researches writing about global competition and knowledge management tends to reflect the experience of large multinational corporations. However, it is not easy for firms to be very efficient in maintaining their competitive knowledge base especially to those small and medium industry firms (SMI). Besides facing tougher resource and time constraints, these firms also face tougher competition for necessary competences and skills in local labor markets due partly to a poor supply of such skills and partly to intensified competition from other larger firms. This happened a lot in Malaysia and only in early year 2000, Malaysia government through its Knowledge-Based Economy Master Plan, vision to drive the national growth and transforming Malaysia into a knowledge-based economy by year 2010.

In recent literature on strategy research, endeavors to explain performance differences between firms have shifted in focus from industry-level external factors to firm's internal elements. Several studies have demonstrated that firm-specific factors play an important role in explaining performance differences between firms (Cohen & Levinthal, 1990).

The dynamic capability view of the firm (Teece et al., 1997; Zott, 2003) considers the firm essentially a knowledge processing and utilizing entity. This approach seeks

determinants for inter-firm performance differences mainly from dissimilar abilities among firms to exploit existing assets and to build up new capabilities. The basic assumption of the dynamic capabilities framework is that today's fast changing markets force firms to respond quickly and to be innovative.

The essence of the firm is its ability to create, transfer, assemble, integrate and exploit knowledge assets. Knowledge assets underpin competences and competences in turn underpin the firm's product and service offerings to the market (Teece, 1998). The firm's capacity to sense and seize opportunities, to reconfigure its knowledge assets, competencies and complementary assets essentially contribute to innovative performance and constitute its dynamic capabilities.

The absorptive capacity theory was first introduced in 1990 by Cohen and Levinthal. It involves organizational learning, industrial economics, the resource-based view of the firm and dynamic capabilities. This theory has undergone major refinement, and today a firm's absorptive capacity is mostly conceptualized as a dynamic capability (Zahra & George, 2002). Absorptive capacity is a limit to the rate or quantity of scientific or technological information that a firm can absorb.

According to Liao et al. (2003), "potential absorptive capacity (PAC) has received disproportionately less empirical scrutiny when compared to realized absorptive capacity (RAC)". This means that less attention has been paid to how firms acquire and use external knowledge and this is where Malaysia manufacturing firms seem to be at a disadvantage and is the focus of this article.

Modern technologies create flexibility and provide huge amount of information and knowledge for organization to achieve competitive advantages that will ultimately

enhance the performance of the companies. The companies can acquire its external knowledge or internal knowledge to generate organizational outcomes. Internal knowledge refers to the experience and knowledge that the organization already poses. Beside internal knowledge, organizations need to continue improving the skills by acquiring external knowledge to maintain its competitive advantages. External knowledge sources include acquisitions, licensing, contractual agreements and inter-organizational relationships such as R&D consortia, alliances, and joint ventures. The greater the interaction with external knowledge sources, the larger the experiential learning accumulated by an organization in dealing with outside information.

This study focuses on the organizational knowledge-processing capabilities of absorptive capacity and empirically explores its predictors (external knowledge sources and experience) and its impact on innovation performance by drawing on results from survey on innovation activities and organizational practices. The effect of environmental dynamism on innovative performance is explicitly taken into account as well.

This chapter is structured as follow. The next section contains the theoretical discussion and findings from the past studies. The discussion begins with the theoretical foundation behind the research and also the variables to this research. This chapter will also list down the key variables for the topic of research and the proper literature to support them. The key variables will form the research framework with the setting up of hypotheses for testing.

2.2 Absorptive Capacity

Some 15 years ago, Cohen and Levinthal (1990) identified the problems suffered by firms, with such gaps in capabilities and knowledge, in effectively managing inwards technology transfer and R&D programs. They introduced the term absorptive capacity to label the capabilities of the firm to innovate and, thus, to be dynamic. Absorptive capacity consists of the capabilities to recognize the value of new knowledge, to assimilate it, and to apply it to commercial ends.

An organization needs prior related knowledge to assimilate and use new knowledge. The firm's absorptive capacity is a concept that has subsequently been broadened to include a firm's overall capacity for learning, implementing new knowledge, disseminating new knowledge internally and making use of new resources, including new technologies. Absorptive capacity is a function of the organization's existing resources, existing tacit and explicit knowledge, internal routines, management competences and culture.

Cohen and Levinthal (1990) have offered the most widely cited definition of absorptive capacity. Cohen and Levinthal (1990) defined absorptive capacity as a highly important organizational capability to recognize, value and assimilate external knowledge in order to increase firm's innovativeness. The firm's ability to absorb new knowledge and practices is largely determined by its prior related knowledge stock. Its absorptive capacity consists of its abilities "to recognize the value of new information, assimilate it, and apply it to commercial ends" or "to evaluate and utilize outside knowledge" (Cohen and Levinthal, 1990).

Mowery and Oxley (1995) define absorptive capacity as a broad set of skills needed to deal with the tacit component of transferred knowledge and the need to modify this imported knowledge. Kim (1998) offers another definition of absorptive capacity. They conceptualize absorptive capacity as learning capability and problem-solving skills that enable a firm to assimilate knowledge and create new knowledge. Combining all the definition, the general consensus is that absorptive capacity is a multidimensional construct involving the ability to acquire, assimilate, and exploit knowledge (Liao et al., 2003).

Many studies have pointed out the importance of absorptive capacity in improving the performance (Cohen & Levinthal, 1990; Fosfuri & Tribo, 2006; Liao et al., 2003; D. J. Teece, 2004; Zahra & George, 2002). The ability to acquire and utilize knowledge effectively is argued to be critical for the firm's innovation activities and performance (Cohen & Levinthal, 1990).

More recently, Zahra and George (2002) conceptualize the construct of absorptive capacity as a dynamic capability pertaining to knowledge creation and utilization that enhance a firm's ability to gain and sustain a competitive advantage. They divide the absorptive capacity into potential absorptive capacity (PAC) and realized absorptive capacity (RAC). PAC refers to the firm's ability to be receptive to external knowledge, while RAC reflects the firm's capacity to leverage the knowledge that has been absorbed (see figure 2.1).

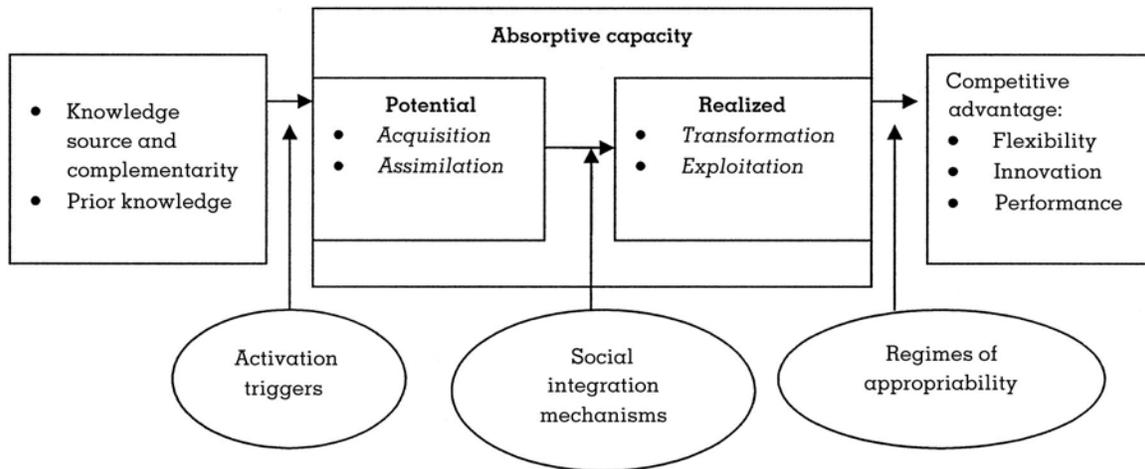


Figure 2.1. A model of absorptive capacity based on Zahra and George (2005)

Absorptive capacity is based on the firm's prior knowledge. According to Todorova and Durisin (2007), the capability to recognize the value of new external knowledge represents an important component of absorptive capacity because the valuing is not automatic, it is biased, and it needs to be fostered to allow the absorption to begin at all.

Consistent with Ari (2005), this study posits that absorptive capacity consists of three major components: external knowledge acquisition, knowledge dissemination and knowledge utilization. The study does not include knowledge transformation as one of its component. Todorova and Durasin (2007) argue that the knowledge transformation component is not the step after knowledge assimilation like in Zahra and George's (2002) model but represents an alternative process linked to assimilation by multiple paths. They also argue that potential absorptive capacity and realized absorptive capacity does not hold anymore and they introduced an alternative approaches namely, the efficiency of absorptive capacity. Schmidt (2005) argued that the transformation dimension need not be made explicit, as it is an integral part of the "exploitation" component. Cohen and

Levinthal (1990), Liao et al. (2003) and Van Den Bosch et al. (2003) also studied on only three dimensions, namely ability to recognize, assimilate and utilize useful external knowledge. The understanding of knowledge transformation is rather scarce. There is no consensus among researchers on how to measure knowledge transformation. Each study that measures this tends to so it using its own unique operationalization.

2.2.1 Knowledge Acquisition, Dissemination and Utilization

Zahra and George (2002) put the acquisition as the first component of a firm's capability to identify and acquire externally generated knowledge that is critical to its operations. Knowledge acquisition capabilities as a first consist of processes and mechanisms for collecting information and creating knowledge from internal and external sources. Acquisition of external knowledge reflects the identification function, which represents the "generator" of intelligence for the organization. External environmental signals are identified, and information on those signals is gathered and transmitted across the organizational boundary. The more knowledge that can be collected over a given period, the better the acquisition capability works.

Information and knowledge may be acquired through several processes from variety of source and media, by learning when observing other organizations, and by grafting knowledge-possessing components such as other firms, by intentional search and monitoring, for example. There is some indication that the most important areas of knowledge come from competitors and customers, the organization uses many more than the usual data collection sources from competitors and customers (Liao et al., 2003).

Effort expended in knowledge acquisition routines has three attributes that can influence absorptive capacity: intensity, speed, and direction. The intensity and speed of a firm's efforts to identify and gather knowledge can determine the quality of a firm's acquisition capabilities. The greater the effort, the more quickly the firm will build requisite capabilities (Kim, 1997).

The information and knowledge gathered from the individuals or business environment has to be converted into a transferable form and distributed internally through the internalization process that requires dissemination and assimilation. The second component of absorptive capacity - dissemination - involves the communication of the generated knowledge to all relevant departments and individuals (Liao et al., 2003).

The dissemination of knowledge does not always happen spontaneously. Especially, people with a technical background often are highly individualistic and do not disseminate knowledge naturally (van der Bij, Michael Song, & Weggeman, 2003). Therefore, this must be fostered by the organization. The organization must be well structured so that both formal and informal networks are maximized to transfer knowledge within the organization and across different functional departments. The best ways to disseminate knowledge are interdepartmental meetings or cooperation and a primary system or network to store all the lessons learned (know-how) and others.

Effective innovation processes require the collection of information about new technology and new knowledge development. Greater dissemination of knowledge leads to a better understanding of technology capabilities and trends. This knowledge helps

guiding R&D design and contributes to technical development. It also helps manufacturing firms to generate better manufacturing-process designs.

Knowledge utilization or knowledge exploitation is of key importance in the development of successful new products. Knowledge utilization refers to an organization's timely response to technological change by utilizing the acquired knowledge generated into new products and processes. A firm with advanced knowledge-utilization capabilities is quick to respond to signals it receives.

Firm that is sensitive to recognizing changes in the market and is able to identify opening opportunities, but without the necessary capabilities to transform its knowledge into valuable products or profitable business models, does not improve its performance (Ari, 2005).

Knowledge utilization is evident, for example, in new ventures that capture knowledge from their market, competition, and customers, and then in which knowledge is used to create new competencies.

The firms that practice the knowledge-processing capabilities get different result. According to McKenna (1995), the key to this difference involves not just the quality and quantity of information and knowledge that companies acquires and assimilates but, above all, the velocity with which they can move through the cycle.

2.3 Predictors of Absorptive Capacity

2.3.1 Level of analysis

Cohen and Levinthal (1990) pointed out two important issues: (1) the level of analysis and (2) the impact of the organizational context on absorptive capacity by emphasizing

that: an organization's absorptive capacity will depend on the absorptive capacity of its individual members, however a firm's absorptive capacity is not simply the sum of the absorptive capacity of its employees, and it is therefore useful to consider what aspects of absorptive capacity are distinctly organizational. Both issues gave rise to extensions and reconceptualizations regarding the definition, the antecedents, dimensions and outcomes of absorptive capacity (F. A. J. v. d. Bosch, Wijk, & Volberda, 2003).

Absorptive capacity is a multilevel construct. The lowest level to apply absorptive capacity is the individual level. It is at this level that the link between absorptive capacity and learning is most evident. In this connection, Cohen & Levinthal (1990) refer to memory development, in which accumulated prior knowledge enables the ability to store new knowledge into one's memory and to recall and use it.

The next level of analysis discussed by Cohen & Levinthal (1990) is the firm level. A firm's absorptive capacity is not simply the sum of the absorptive capacity of the organizational members. Therefore it is useful to consider what aspects of absorptive capacity are distinctly organizational (Cohen & Levinthal, 1990). Absorptive capacity refers not only to the acquisition or assimilation of information by an organization but also to the organization's ability to exploit it. Therefore, an organization's absorptive capacity does not simply depend on the organization's direct interface with the external environment. It also depends on transfers of knowledge across and within subunits that may be quite removed from the original point of entry.

Although Cohen & Levinthal (1990) primarily focus on absorptive capacity at the firm level, several observations are made regarding the interfirm level. For example,

critical remarks are made regarding a firm “buying” absorptive capacity through hiring new personnel, contracting for consulting services or even through corporate acquisitions.

2.3.2 Predictors

Table 2.1 illustrates a brief overview of the absorptive capacity as mediator of various predictors and organizational outcomes. Absorptive capacity can be used as mediator to study on various topics related to knowledge transfer, management capabilities, corporate culture, human capital and many other areas. This study tends to focus on external knowledge source and experience as the predictors of the knowledge-processing capabilities.

Table 2.1

Absorptive capacity as mediator of various organizational outcomes

Example of predictors	Examples of organizational outcomes	Illustrative references
Prior related knowledge, knowledge source	Innovative performance (R&D spending/sales)	Cohen & Levinthal (1990)
External knowledge sources; experience	Percentage of annual sales	Fosfuri and Tribo (2006)
Leadership; people management; knowledge management; creativity management	Innovative performance (product innovation & process innovation)	Prajogo and Ahmed (2006)
Experience, knowledge source and complementary	Competitive advantage	Zahra & George (2001)
Technology opportunity; knowledge spillovers	Spending on R&D/volume of sales	Nieto and Quevedo (2005)
Foreign acquisitions; international alliances; corporate venture capital;	Return on equity (ROE); change in company's overall revenue	Zahra and Hayton (2007)

international venturing

Organizational culture; technical diffusion channel; interaction mechanism; R&D resources; technology absorptive ability	Technology transfer performance	Lin, Tan and Chang (2002)
R&D alliances; technological strength; alliance experience; technology learning	Number of patents; count of citations received by a firm's patents	Kim and Inkpen (2005)
Structural capital organization systems and culture; human capital & employee characteristic; relational capital	Intellectual property (new product, new process, patents and organization learning)	Rajiv and Karuna (2006)
Corporate culture (developmental, group, rational and hierarchical)	IT implementation	Maria do Carmo, Tor and Susan (2006)

2.3.2.1 External knowledge sources

This study is likely to focus on the firm level predictors from a particular subset of predictors. Zahra and George (2002) identify two channels through which experiential learning, significantly influence absorptive capacity: interaction with external knowledge sources and knowledge complimentary. External knowledge sources include acquisitions; purchasing, through licensing and contractual agreements and inter-organizational relationships, including R&D consortia, alliances, and joint ventures. The greater the interaction with external knowledge sources, the larger the experiential learning accumulated by an organization in dealing with outside information.

The ability to exploit external knowledge is thus a critical component of innovative capabilities. Cohen and Levinthal (1990) argued that the ability to evaluate and utilize outside knowledge is largely a function of the level of prior related knowledge and the organization needs prior related knowledge to assimilate and use new knowledge. At its lowest level, they see this prior knowledge as including basic abilities or even just shared language, but it can also refer to awareness of the most recent technological or scientific advances in a given field.

Firm's exposure to knowledge will influence decision making and the development of future capabilities. Accumulating absorptive capacity in one period will permit its more efficient accumulation in the next (Cohen and Levinthal, 1990). Fosfuri and Tribo (2006) in their research also indicated that firms which are involved in R&D collaborations and market-based transactions in R&D develop a stronger ability to understand and assimilate knowledge flows pertaining to the external environment. This shows that the breadth and depth of knowledge exposure positively influence a firm's propensity to explore new and related knowledge.

2.3.2.2 Experience

Nieto and Quevedo (2005) measured the level of know-how and experience in the organization. Cohen and Levinthal (1990) point out that in order to grasp what the sources of firm's absorptive capacity are, one should concentrate on the "way the communications between the firm and the external environment' are organized, and also on the 'nature of the know-how and experience within the organization". Nieto and Quevedo (2005) see the trade-off between internal and external components in the

absorptive capacity as requiring attention to be directed onto how the relationship between 'shared knowledge and range of knowledge' among individuals affects the development of organizational absorptive capacity.

Zahra and George (2002) define past experience as the locus of a firm's technological search - firms search for information in areas where they have had past successes. According to them, by directing knowledge search areas, past experience influences the development of future acquisition capabilities. Organizational experience with knowledge search can also reduce uncertainty and thus increase a firm's procedural rationality, which is defined as the extent to which decision makers collect, analyze and rely upon relevant information (Fosfuri and Tribo, 2006). The outcome of greater procedural rationality is an enhanced ability to identify and assimilate external knowledge.

According to Zahra and George (2002), firms gain experience through exposure to, impact of, and knowledge of particular skills and capabilities. Experience is the product of environmental scanning, bench-marking, interactions with customers, and alliances with other firms. Experiences are also gained from learning-by-doing, which enables the firm to develop new routines that influence the locus of a firm's future search for knowledge. These align with the fact that a company's absorptive capacity in the present depends on the efforts it has made to innovate in the past (Cohen and Levinthal, 1990).

2.4 Organizational Outcomes

Many researchers recognize that a firm's absorptive capacity is not a goal in itself, but that it mediates important organizational outcomes. According to Zahra and George (2002), absorptive capacity can be a source of a firm's competitive advantage. Cohen and Levinthal (1990) relate absorptive capacity to, among others, innovative capabilities, innovative performance and expectation formation.

In subsequent research efforts several related organizational outcomes have been addressed. Table 2.1 gives some examples of organizational outcomes and illustrative references.

2.4.1 Innovation Performance

Here, the study focuses specifically on how a firm's ability to first recognize external knowledge and then adapt it to its organization routines is mapped onto innovation outcomes. An important implication is that heterogeneity in the level of absorptive capacity translates into differences in the benefits from otherwise similar stocks of external knowledge. Hence, absorptive capacity is a source of competitive advantage in innovation.

What is innovation? Although the term is often used to refer to new technology, many innovations are neither new nor involve new technology. It may involve running a business in a different way rather than making a technological breakthrough.

Innovation is not about an invention. New products might be an important part of process but they are not the essence of it. These days much innovation happens in processes and services. Innovation can be defined as "new products, business processes