IT-FACILITATED ADAPTIVE-ORGANIZATIONAL-LEARNING IN SUBSIDIARIES OF MULTINATIONAL PHARMACEUTICAL CORPORATIONS IN THAILAND

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การใช้เทคโนโลยีสารสนเทศเพื่อเสริมสร้างความเป็นองค์กรเรียนรู้แบบปรับตัว ในบริษัทย่อยของบริษัทยาข้ามชาติในประเทศไทย

นายประเสริฐ ศิริเสรีวรรณ

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ประเสริฐ ศิริเสรีวรรณ : การใช้เทคโนโลยีสารสนเทศเพื่อเสริมสร้างความเป็นองค์กรเรียนรู้แบบปรับตัวในบริษัทย่อยของบริษัทยาข้ามชาติในประเทศไทย (IT-FACILITATED ADAPTIVE-ORGANIZATIONAL-LEARNING IN SUBSIDIARIES OF MULTINATIONAL PHARMACEUTICAL CORPORATIONS IN THAILAND) อ.ที่ปรึกษา: ศ.ดร. สุชาดา กีระนันทน์, อ.ที่ปรึกษาร่วม : Prof. Dr. Phillip H. Phan , 190หน้า. ISBN 974-347-154-5.

ความเป็นองค์กรเรียนรู้ ได้รับความสนใจในฐานะเป็นเครื่องมือทางการบริหารและเทคโนโลยีสารสนเทศก็เป็นเครื่องมือที่เริ่มเป็นที่นิยมนำมาช่วยสำหรับการบริหารในธุรกิจระหว่างประเทศ การวิจัยนี้ได้ประยุกต์ทฤษฎีความเป็นองค์กรเรียนรู้ (organizational learning theory) และ ทฤษฎีเกี่ยวกับเทคโนโลยีสารสนเทศ มาช่วยหาความสัมพันธ์ระหว่าง กระบวนการสร้างความเป็นองค์กรเรียนรู้ (process) เทคโนโลยีสารสนเทศ และ ความสามารถเป็นองค์กรเรียนรู้ (capabilities) งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบของ เทคโนโลยีสารสนเทศ และ กระบวนการสร้างความเป็นองค์กรเรียนรู้ (process) ที่มีต่อความสามารถเป็นองค์กรเรียนรู้ (capabilities) ในบริษัทย่อยของบริษัทยาข้ามชาติในประเทศไทย

การวิจัยครั้งนี้เลือกศึกษาเทคโนโลยีสารสนเทศที่เสริมสร้างองค์กรเรียนรู้ในอุตสาหกรรมยา ซึ่งจัดเป็นอุตสาหกรรมที่ใช้ความรู้เป็นหลักใหญ่ในการดำเนินธุรกิจ และจำกัดบริบทของการศึกษาในเรื่องการถ่ายทอดเทคโนโลยีการตลาด จากสำนักงานใหญ่ในต่างประเทศมายังบริษัทย่อยในประเทศไทย การเก็บข้อมูลในการวิจัยนี้เป็นการประยุกต์แนวคิดไตรประสม (triangulation concept) ซึ่งใช้วิธีการประสมวิธีเก็บข้อมูลสองวิธีจากสองกลุ่มข้อมูลในองค์กรเดียวกัน ทั้งนี้เพื่อเสริมความตรง (valid)กัน วิธีเก็บข้อมูลวิธีแรกคือการวิจัยกึ่งทดลอง(quasi-experimentation) ทำในกลุ่มทดลองที่เป็นผู้จัดการระดับกลางและได้รับสิ่งกระทำ(treatment)ที่เกี่ยวกับอุปกรณ์สารสนเทศที่เสริมสร้างความเป็นองค์กรเรียนรู้ (organizational learning tools)(ซึ่งในการทดลองนี้ใช้อุปกรณ์แบบผ่านเครือข่ายอินเตอร์เนท) โดยทำการทดลองเป็นระยะเวลา 12 สัปดาห์ วิธีเก็บข้อมูลวิธีที่สองคือการวิจัยเชิงสำรวจ(Survey) กระทำหลังจากวิธีแรกเสร็จสิ้นแล้ว โดยทำในกลุ่มผู้บริหารระดับสูงของบริษัทเดียวกัน อัตราการตอบรับจากทั้งสองวิธีคือ 82-87% โดยมีบริษัทที่ปฏิเสธการดำเนินการวิจัยต่อเนื่อง จำนวน 21 บริษัท การวิเคราะห์ข้อมูลประกอบด้วย การวิเคราะห์องค์ประกอบ การวิเคราะห์ความแปรปรวนแบบพหุ และ การวิเคราะห์คาโนนิคอล

ผลของการวิจัยนี้สนับสนุนสมมติฐานที่ว่า เทคโนโลยีสารสนเทศ มีผลกระทบทางบวก ต่อ ความสามารถการเป็นองค์กรเรียนรู้ และ สนับสนุนสมมติฐานบางส่วนที่ว่า กระบวนการสร้างความเป็นองค์กรเรียนรู้ มีผลกระทบทางบวกต่อ ความสามารถการเป็นองค์กรเรียนรู้เช่นกัน

ผลของการวิจัยนี้ ช่วยเสริมสร้างความเข้าใจเกี่ยวกับความสัมพันธ์ระหว่างเทคโนโลยีสารสนเทศ และ ความเป็นองค์กรเรียนรู้ในองค์ประกอบต่างๆ และยังช่วยให้บริษัทไทย และ บริษัทข้ามชาติทั้งหลายนำความรู้นี้ไปเสริมสร้างความเป็นองค์กรเรียนรู้ของตน

ภาควิชาพาณิชยศาสตร์ ลายมือชื่อนิสิต .....

สาขาวิชาธุรกิจระหว่างประเทศ ลายมือชื่ออาจารย์ที่ปรึกษา .....

ปีการศึกษา 2543 ลายมือชื่ออาจารย์ที่ปรึกษาร่วม .....

PRASERT SIRISEREEWAN : IT-FACILITATED ADAPTIVE-ORGANIZATIONAL-LEARNING IN SUBSIDIARIES OF MULTINATIONAL PHARMACEUTICAL CORPORATIONS IN THAILAND. THESIS ADVISOR : PROF. SUCHADA KIRANANDANA, Ph.D. THESIS CO-ADVISOR : PROF. PHILLIP H. PHAN, Ph.D. 190 pp. ISBN 974-347-154-5.

Organizational learning has been increasingly interested as the management tool, and information technology has been widely used as the essential facilities for management in the borderless global businesses. This study applied the theories of organizational learning and information technology to the relationship of organizational learning process, information technology, and organizational learning capabilities. The research aimed to study the impacts of information technology and organizational learning process on organizational learning capabilities in Thai subsidiaries of pharmaceutical multinational corporations.

The pharmaceutical industry, which was classified as knowledge intensive industry, was appropriately chosen to study IT-facilitated organizational learning in the context of marketing technology transfer from the head-office to the subsidiaries. The triangulation concept of combined two methods of data collection, the quasi-experimentation and the survey, was implemented to enhance the validity of the research. The quasi-experimentation was performed with the subjects of middle-managers exposed to treatment of organizational learning tools (web-based training or online-computer based training). The survey was conducted after finishing quasi-experimentation with the subjects of top-executives in the same companies. Response rates from the two methods were 82-87% with 21 companies rejected to continue the research project. Data analysis included factor analysis, MANOVA, and canonical correlation analysis.

Results of this study support the hypothesis that information technology positively impacts on organizational learning capabilities. Moreover, the results also partially support the hypothesis that organizational learning process positively impacts on organizational learning capabilities.

The results of this research help develop better knowledge of relationship among information technology and organizational learning components, and also facilitate Thai and global companies in improving their organizational learning capabilities.

Program: Joint Doctoral Program in Business Administration **Student's signature** ……

Field of study: International Business **Advisor's signature** ……

Academic year 2000 **Co-advisor's signature** ……

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As with all other research projects, debts are owed by the researchers. First of all, I would like to express my appreciation to my thesis advisor, Prof. Dr. Suchada Kiranandana, my thesis co-advisor, Prof. Dr. Phillip H. Phan. During the process of doing dissertation, both of them have supported me not only the academic knowledge and will-power, but also the partial expenses in covering this research process. Moreover, I would like to show my impression on all the committee members of my dissertation, Prof. Dr. Uthai Tanlamai, Dr. Pipop Udorn, and Dr. Tippawan Lorsuwannarat. They have not merely examined my research works, but also supplied me valuable knowledge and will-power. Without the kind contributions and helpful supports from these five professors, I would not have the full knowledge and strength to complete this research.

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I feel indebted with authors of articles or books I have read, cited or uncited, related to organizational learning, information technology, global business management, strategic management, organizational behavior, human resource management, technology transfer, and research methodology. Their capabilities and intelligence have motivated me to conduct this research project and continue other research projects in the future.

Many organizations must also be acknowledged for their supports of this research project. I was partially funded by grants from my workplace, the University of the Thai Chamber of Commerce (UTCC.), and from the Joint Doctoral Program in Business Administration (JDBA). I am indebted with subsidiaries of pharmaceutical multinational corporations in Thailand, whose managers and top-executives had participated in the research projects and supported the related data for this study. I would like to thank for all officers in the Department of Food and Drug Administrtion (FDA) who supply essential data for this research. Moreover, I am grateful for SPSS, Inc. (Thailand), Microsoft (Thailand), U-Lead (Thailand), and Macromedia (Thailand) in supporting essential knowledge for related computer programs used in this research (SPSS. Advanced Models V. 9.0; Macromedia Authorware 5.0, FrontPage 2000, DreamWeaver 3.0, CourseBuilder 2.0, and PhotoImpact 5.0).

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This research work is dedicated to all the above mentioned people and organizations, who have sculptured my learning capabilities. I promise to contribute the knowledge learned from them to the less-opportunated and to the development of our global villages.

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CHAPTER 1
INTRODUCTION

1.1. Rationale

The world is now rapidly evolving from the industrial era to the knowledge era and information era (Laudon and Laudon, 1998). Information-intensive or knowledge-intensive products, such as computer software, pharmaceuticals, or electronics, require a great deal of learning to produce (Sinkula, 1994). Some organizations have exceeded other organizations by utilizing information technology and information system to accumulate, dissemination, and store knowledge to achieve their objectives and also have enjoyed using information technology to build organizational learning capabilities to enhance their knowledge-creating skills (Hult and Ferrell, 1997; Laudon and Laudon, 1998). Consequently, IT and organizational learning in the context of international business will be the focus of interest in this study.

Information Technology (IT)

In an information economy, knowledge (or information) and capabilities are key organizational assets (Laudon and Laudon, 1998) *(NB: the difference between 'knowledge' and 'information' is concluded by Sveiby, 1997, in page 23).* Knowing how to do things effectively and efficiently in ways that other organizations cannot is the primary sources of profit (Moingeon, 1996). Producing unique products or services at lower cost than competitors is based on superior knowledge (or information) of the production processes and superior design (Sinkula, 1994). Some management theorists believe that these information-assets are as important as the physical and financial assets in ensuring the competitiveness, performance, and survival of the firm (Turban and Mclean, 1999). As knowledge (information) becomes a central productive and strategic asset, the success of the organization increasingly depends on its ability to gather, produce, and disseminate knowledge (information) (Laudon and Laudon, 1998). Developing procedures and routines to optimize the creation, flow, learning, and sharing knowledge (information) in the firm becomes a central management responsibility. (Hult and Ferrell, 1997; Sinkula, 1994; Senge, 1990).

In this new millennium, the highly competitive globalization power and technological power enforce any organizations, small or large, private or public, to sustain their competitive capabilities. The two forces, globalization and technology lend itself to the integration of bodies of knowledge in international business, IT, and organizational learning. From integrated bodies of such knowledge, various kinds of strategies and tools have been implemented to manage knowledge (information) and learn to match this dynamic world. Information technologies (IT) are one of the key strategic tools used to facilitate such purposes. Various kinds of advanced information technology (IT) help enhance the efficiency and efficacy of organizational capabilities (Laudon and Laudon, 1998), specifically organizational learning capabilities (OLC) (Hult and Ferrell, 1997).

In this era, any organizations can learn to create organizational learning capabilities to achieve their objectives, but not many can speed up this creation by using varieties of advanced information technology (IT). Thus, the present study is planned to research for some specific tools related to information technology (IT), which enhance the creation of organizational learning capabilities (OLC).

Organizational Learning

Barney (1991) proposes that an organization has a foundation for sustained competitive advantage when it possesses skills or resources that 1) provide superior value to customers, 2) are difficult to imitate, and 3) are capable of multiple applications. An organization provides superior value to customers when its culture and climate foster behaviors that lead to improvements in effectiveness or efficiency, which provide additional benefits or lower prices for customers. Organizations that can learn faster, more effectively, more efficiently, and more relevant to their environment, will have better chances in creating sustainable competitive capabilities over their competitors (Senge, 1990; Garvin, 1993; Sinkula, 1994; Slater and Narver, 1995; Goh, 1997; Hult and Ferrell, 1997). Thus, the problem of organizational learning capabilities is fundamental and critical to the survival of any global corporations. Developing a learning organization is not a random but a deliberate intervention by leaders, organizational members, and proper management of organizational assets, in order to establish the necessary internal conditions for facilitating creation of 'organizational learning capabilities' (Hult and Ferrell, 1997).

Related to 'organizational learning capabilities' (Hult and Ferrell, 1997), Sinkula (1994) and Slater and Narver (1995) propose the concept of 'organizational learning process' which potentially impacts on building learning organization. This 'organizational learning process' potentially influences 'organizational learning capabilities' by the key mediator, information or knowledge (Sinkula, 1994; Goh, 1997; Laudon and Laudon, 1998). So, the present study is planned to test the relationship of such organizational learning concepts and research for the potential relationship between IT and 'organizational learning capabilities' in the context of technology transfer in Thai firms.

Technology Transfer in International Business

One of the key factors, which business organizations in developing countries succeed in industrializing themselves, is creating their ability to absorb, transfer, learn, and modify technologies from the developed countries (ESCAP/UNCTC, 1987). Organizations in the less developed countries have little power to perform research & development activities themselves or require considerable resources (time, money, etc) to do so. So, transferring relevant technologies from organizations in the developed countries is one shortcut in building their competitive advantage. Some organizations have succeeded in their missions and developed their own technologies after the transfer, but others have repeatedly failed. One of the important reasons behind such failure and success is the smart management of 'technology transfer' and 'learning' (Tiralap, 1992).

Technology transfer is one important way to systematically move knowledge, skills, or other capabilities from transferors to transferees in various kinds of organizations. However, technology transfer should be valued as the short or medium term of technology strategy. But, in the long run, transferees should be prepared to be self-reliant in adaptation, creation, and research by developing their ability to absorb, learn, and modify such knowledge or skills (Brunell, 1998; Tamratanaporn, 1995; Shiowattana, 1990; ESCAP/UNCTC, 1987). One of the most popular barriers in technology transfer is the inability of transferees to develop absorptive and learning capability (Grosse, 1996; ESCAP/UNCTC, 1987). Thus, success in transferring technology is connected to the organizational learning capability and information technology of the firm. Thus, the present research is planned to study organizational learning capabilities in the context of international technology transfer in Thai pharmaceutical subsidiaries of multinational corporations (MNCs).

Justification of the Research

The increasing significance of IT (information technology) and the necessity of efficient organization management have been widely accepted to be one of the important factors for competitive edge. The forces of globalization and world competitiveness lead to research for innovations in international management. Creative implementation of IT and organizational learning are the two issues most researchers have paid attention.

So far, there have been many separated studies related to concepts of ‘organizational learning’, ‘organizational learning capabilities’, ‘information technology’, ‘computer-based training’, and ‘technology transfer’. However, there is no integrated research focusing on the combination of such concepts, especially in the context of subsidiaries of global multinational corporations in pharmaceutical industry. Moreover, trends of international business research represent an excellent testing ground for multidisciplinary research and international business research has been considered as a test case for a unified social science approach (Punnett, 1996). There have been calls for interdisciplinarity (or transdisciplinarity) in approaches to international business (Teece and Pizano, 1976; Dunning, 1989). Thus, this research was proposed to use the interdisciplinary approach, involving in international business, information technology (IT), strategic management, human resource management, organization behavior, and international marketing. This research, implemented such integrated disciplines, is aimed to help all Thai firms, and also firms from other developing countries, efficiently create competitive capabilities and successfully participate in global businesses.

1.2. Research Objectives

The objectives of this research are as follows.

1. To test the impacts of 'organizational learning tools' (OLT) on 'organizational learning capabilities' (OLC), and to assess the relationships of 'organizational learning process' (OLP) and 'organizational learning tools' (OLT) with 'organizational learning capabilities' (OLC).

2. To operationalize the constructs of 'OLT', 'OLP', and 'OLC'.

3. To suggest (from the findings of research) the appropriate 'OLT facilities' and the optimum 'OLP' in creating 'OLC' in global multinational corporations.

1.3. Research Questions

1. Do IT-based organizational learning tools have the positive impacts on the creation of organizational learning capabilities in the technology transfer of Thai pharmaceutical subsidiaries of the global MNC's?

If yes, what are specific types or features of 'organizational learning tools' that work for Thai firms?

2. Does organizational learning process have the positive impacts on the creation of organizational learning capabilities in the technology transfer of Thai pharmaceutical subsidiaries of the global MNC's?

1.4. Contributions

The contributions of this study are threefold, theoretical, practical, and methodological contributions.

1.4.1. Theoretical Contributions

a). This research creates a new model which links the relationship of 'adaptive organizational learning capability' (OLC), 'organizational learning process' (OLP), and 'organizational learning tools' (OLT) in the context of technology transfer in global corporations. Integration of concepts of 'organizational learning capability', 'organizational learning process', and 'IT-based organizational learning tools' has never been studied (ABI, 1971-1999; DAO, 1961-1999).

b). This research applies organizational learning theories and theories in information technology (IT) to international business management study.

c). This research tests the validity and applicability of organizational learning capabilities measures (OLC., Hult and Ferrell, 1997) to Thai subsidiaries of global multinational corporation (MNCs).

1.4.2. Practical Contribution

a). The results of this research will show how the IT-based organizational learning tools (OLT), linking with other IT-tools (e.g., Internet, Database, MS. Outlook) influence the organizational learning capabilities. Moreover, this study also shows how organizational learning process affects the organizational learning capabilities. Practically, results of this research will ensure the executives to grasp their opportunities in utilizing IT-tools and in developing organizational processes to upgrade their organizational learning capabilities.

b). Due to its research context of technology transfer, findings from the present research will be beneficial to the pharmaceutical firms in Thailand (transferee) and the related MNCs from the Triads (transferors). In the short term, both kinds of firms will be able to maximize their profits and sustain their competitive edge in the long term. In the long term, results of this study will motivate both transferees and transferors to prepare and develop themselves to be self-reliant and responsive to dynamic technological changes. Furthermore, most pharmaceutical companies in Asian, less-developed, or developing regions will also be able to apply such findings to their countries.

c) The computer-based training (CBT or OLT: IT-based organizational learning tools), titled as 'Organizational Learning Development Program', is developed and experimented as part of the quasi-experimental research in the present research. Companies, either in pharmaceutical industry or not, may apply the concepts and methods in this research to their organizations to create or enhance 'organizational learning capabilities'.

1.4.3. Methodological Contribution

The quality of dissertation may partly be evaluated from its originality and creativity, either in topic, contents, or methodology (Punnett, 1996). This research demonstrates some originality and creativity in methodology as follows:

a) Implementation of quasi-experimentation to gather data is unique in this type of research.

b) Application of 'triangulation concept', combination of two data collection methods of quasi-experimentation and survey, is also a creative methodology in management research. (Comparison of the pros and cons in conducting quasi-experimental research and survey research is discussed in Chapter 4).

c) Construct operationalization of 'organizational learning capabilities' goes beyond traditional measures.

d) On-line research and electronic real-time research utilizing computerized tools (via the web and non-web programs developed by the researcher using FrontPage and Authorware) are the challenging initiation for conducting cyber-research in this new millennium.

1.5. Scope of the Study

The frame of this research is confined to the knowledge transfer of subsidiaries of pharmaceutical multinational corporations in Thailand.

1.6. Organization of the Study

The remaining of this thesis will start with Chapter 2 which details the review of literature in organizational learning, capabilities, and information technology in the related contexts of the technology transfer from subsidiaries of the Triads MNCs. Chapter 3 describes the research model and proposed hypothesis. Chapter 4 discusses the research methodology and operationalization. Chapter 5 provides the results from two different data analysis methods. Finally, Chapter 6 discusses the research findings, makes conclusive statements, offers implications, delineates limitations, and suggests future research.

CHAPTER 2
LITERATURE REVIEW

The objectives of this chapter is to review the theories and concepts of related construct in this research. The literature review of this chapter is organized into **three** sections. The **first** section, the main theme of this research, is related to 'organizational learning capabilities' and 'organizational learning process'. These two constructs are closely related to capabilities and resources, which influence organizational performance. The **second** section is mainly involved in 'IT-based organizational learning tools' (OLT) and their positive impacts on 'organizational learning capabilities'. The **third** section, the technology transfer in international business, is the context of this research, which is influenced by 'organizational learning capabilities'. Moreover, the weaknesses of past research and the gaps for the present research are conclusively discussed at the end of this chapter.

2.1. Organizational Learning

Theorists in organizational learning proposed various different theories and concepts, which are mostly inter-connected. Moreover, resource-based theories are closely linked with capabilities and learning-based theories. Thus, this sections will review and synthesize such literature in the orientations of 'organizational learning process' and 'organizational learning capabilities'.

2.1.1. Types of Organizational Learning

- Individual Learning and Its Relationship with Organizational Learning

'Organization' is a consciously coordinated unit, composed of two or more people that function on a relatively continuous basis to achieve a set of common goals (Daft, 1995). David Kolb (1984) posits his vital identification of individual learning styles as a major feature to accompany his version of a learning cycle. The Kolb's learning cycle is helpful in encouraging educators and trainers to consider how to design learning experiences effectively so that they embrace all aspects of the cycle at some stage in the experience. In his theory of experiential learning cycle, Kolb (1984) suggested that learning begins with an experience which learners will make observations & reflection, then draw conclusions, before entering the final stage which individuals will test new concepts to see if they work. Honey and Mumford (1994) modified Kolb's learning cycle by developing their diagnostic instrument, called the 'Progressive learning cycle', which consists of many steps of learning – gaining experience, reviewing, and planning. Honey and Mumford (1994) also stressed that **individual learning** in any organizations is inevitably connected, in some ways, to **organizational learning**. They also proposed the four I's in work-centered learning – ***interaction*** with colleagues, boss, mentors, ***implementation*** of the accountability not consultancy, ***integration*** of the off-the-job designed to aid on-the-job, and ***integration*** of the continuous learning.

Luthans (1995) stressed that individual learning is a major psychological process and there is no single perfected theory of learning explaining all aspects of learning (how, when, why, applications, and prediction & control of learning situations). Pavlov's classical conditioning experiment (using dogs as subjects) concerned with individual conditioning learning.

Tolman's cognitive (individual) learning theory (1980) with a relationship between cognitive environmental cues & expectation also relates to individual learning and environmental settings. Social learning theory (Miller, 1996) opposed that individual learning need not result from discrete stimulus-response or response-consequence connections. Instead, individual learning can take place through imitating others. Bandura (1986) supported this view by his modeling theory associated with the modern view of modeling as an explanation of learning. He has done considerable research that demonstrates that people can learn from others. This individual learning takes place in two steps. First, the person observes how others act and then acquires a mental picture of the act and its consequences (rewards and punishes). Second, the person acts out the acquired image, and if the consequences are positive, he or she will tend to do it again. If the consequences are negative, the person will tend not to do it again. Individual learning is mostly influenced by organizational settings and related to organizational learning. The following sections will focus on definitions and theories of organizational learning.

Organizational theorists have studied the issue of 'organizational learning' for a long time, however, there is still considerable disagreement (Garvin, 1993). Most scholars view 'organizational learning' as a process that underfolds over time and link with knowledge acquisition and improved performance. But they differ on other important matters. Some believe that 'organizational learning' required behavioral change, organizational change, or organizational development; others insist that 'new ways of thinking' are enough (Fiol and Lyles, 1985). Some cite information processing as a mechanism through which 'learning' takes place, others propose shared insights, organizational routines, even memory (Argyris,1992). Some scholars emphasize concrete 'information processing systems' as the mechanism through which 'organizational learning' should take place (Sinkula, 1994); others stress the need for shared mental models, shared organizational visions, and open-minded approaches to problem solving (Senge, 1990). Some scholars link 'organizational learning' to knowledge acquisition; others link 'organizational learning' to value creation (Senge, 1990).

Fiol and Lyles (1985) defines organizational learning as the process of improving actions through better knowledge and understanding. But Stata (1989) believes that organization learning occurs through shared insights, knowledge, and mental models and builds on past knowledge and experience on memory. Argyris (1992) positions organizational learning as a process of detecting and correcting error. Furthermore, he classified two types of organizational learning - single-loop learning and double-loop learning. 'Single-loop learning' asked a one-dimensional question to elicit a one-dimensional answer.

'Single-loop learning' occurs when a manager shifts responsibility from employees to himself or herself by asking simple uni-dimensional questions that produce simple impersonal responses. On the contrary, to enter into double-loop learning, executives would have to shift accountability back to employees. This kind of learning shifts accountability for actions and learning to employees by having a manager ask complex questions about employee's motivation for problem solving.

Senge (1990, 1994) popularizes the concept of "learning organization." He said : "Learning organizations learn faster than the competitors, change before they're forced to , and always try to integrate personal performance with financial performance. Learning organization develop tools and methods to analyze their organizational systems". He revealed limited strategies for substantial double-loop learning. Senge (1990) classifies 'organizational learning' into two types, adaptive learning and generative learning (the same connotation as Argyris, 1992). His theory of five disciplines (personal mastery, mental models, shared vision, team learning, and systems thinking) which potentially created organizational learning is still popular and well accepted.

Huber (1996) defines organizational learning as a process that enables an entity to increase its range of potential behavior through its processing of information. Organizational learning occurs when any organization's units acquires knowledge that the unit recognizes as potentially useful to the organization.

Sinkula (1997) proposes that organizational learning is the development of new knowledge or insights that have the potential to influence behavior. Presumably, learning facilitates behavior change that lead to improved performance. Despite the growing interest in organizational learning (Garvin, 1993) and emerging appreciation of its relevance to organizational competitiveness, an ambiguity remains about the interrelationships among the factors that breed a desire to learn versus information-related behaviors that facilitate learning versus the changes in organizational learning systems & procedures.

The present research will use the definitions of Senge (1990), Huber (1996) and Sinkula (1997), which are mostly related to adaptive learning, information, and knowledge. The next section will compare the different classifications of organizational learning by various scholars.

- Fundamental Versus Advanced Organizational Learning

Types of organizational learning are classified in different notations but seemingly the same conceptual configurations. Of all the discussions of organizational learning (or learning organizations), the most frequently heard is the one about the distinction between two kinds, or levels, of learning. Various scholars have coined the classifications of such two levels of learning to make basically the same distinction. Senge (1990), Argyris and Schon (1977), Kim (1995), and Ulrich, et al. (1992) called the fundamental level and advanced level of organizational learning differently but defined the same meaning, as concluded in Table 2-1.

Author	Fundamental level of organizational learning	Advanced level of organizational learning
Senge (1990)	Adaptive learning	Generative learning
Argyris and Schon (1977)	Single-loop learning	Double-loop learning
Kim (1985)	Operational learning	Conceptual learning
Ulrich, et al. (1992)	Superficial learning	Substantial learning

Table 2-1: Levels of organizational learning

Details of adaptive, generative, single-loop, and double-loop learning will be reviewed in the following sections. However, the operational, conceptual, superficial, and substantial learning, which are the same connotations but not widely accepted, will not be reviewed in this research.

- Adaptive Versus Generative Organizational Learning

Adaptive (organizational) learning, the most basic forms of learning, occurs within a set of recognized and unrecognized constraints that reflect the organization's assumptions about its environment and itself (Senge, 1990). Senge (1990) suggests two kinds of learning, adaptive and generative. Adaptive learning is fundamental form, which related to routines, but generative learning will be related to creating innovation or new routines, which drastically change organizational performance. He also posits that organization will enhance its capacity to create its future by joining adaptive learning with generative learning.

Prahalad and Bettis (1986) argue that businesses can be managed effectively using a dominant general management logic that focuses the conceptualization of the business and guides the development of core capabilities. However, an unintended consequence is that the dominant logic may allow core capabilities to become 'core rigidities' that can inhibit innovation (Leonard-Barton, 1992). Furthermore, Hamel and Prahalad (1994) describe the 'tyrany of the served markets,' in which narrow business definitions impede the search for unconventional business opportunities. The learning boundaries may constrain organizational learning to the adaptive level that are within the traditional scope of the organization's activities (Slater and Narver, 1995).

Lant (1992) also argued that the processes of expectation formation and aspiration formation are similar and that studies of **learning of expectations** indicate that historical data are used to form aspirations. Adaptive **learning** focuses on responding to and coping with environmental demands in an effort to make incremental improvements to existing services, products, and markets (Barnett 1998).

In contrast, what Senge calls generative learning occurs in learning arrangements that are more innovative and experimental, allowing the analysts (physicians and administrators in this case) to think systematically. Generative learning goes beyond soliciting defensive and coping reactions from the organizational participants and instead considers how the organizational parts make up the system as a whole. These interactions, unlike those of **adaptive** organizational learning, provide a synergy of fresh organizational intelligence.

Watson (1998) supports this view that there are 2 foundations that must be developed before the vision of the future can be described. The first is how to transfer knowledge from one person to another applying the principles of adult learning theory. The second is the set of technological enablers that make adaptive learning systems possible. Technology provides enablers that accelerate the deployment of quality methods to the appropriate point of application by an organization's internal customers. The following technologies could enable the achievement of this possible future state: 1) expert systems, 2) relational databases, 3) groupware, 4) agent technology, 5) electronic books, 6) adult learning theory, 7) contextual information, and 8) adaptive systems.

Generative (organizational) learning occurs when the organization is willing to question long-held assumptions about its mission, customers, capabilities, or strategy. It requires the development of a new way of looking at the world based on an understanding of the systems and relationships that link key issues and events. Systems thinking disciplines the organization to focus on interrelationships and dynamic processes of change rather than on linear cause-effect chains (Senge, 1990). Moreover, Stalk (1988) offers the proposition that time is the key linkage in organizational systems of manufacturing, sales and distribution, and innovation.

However, reducing the time in one of these systems requires a fundamental change in the way a company accomplishes its work and serves its customers. Stalk (1988) also explains how companies focused their strategic efforts on speeding new products to market and reducing manufacturing time, which provided timing and quality advantages. In contrast, their competitors focused on optimizing activities that occurred within traditional functional areas, such as the quality improvement efforts in manufacturing. Thus, some companies focused on systems of business practices and redefined business processes, while others concentrated on making functions more efficient. Generative learning is frame-breaking and more likely to lead to competitive advantage than adaptive learning (Slater and Narver, 1995).

Fiol and Lyles (1985) posits two aspects of learning - behavioral and cognitive learning. **Behavioral learning** refers to changes in routines, procedures, process, actions, and structures. **Cognitive learning** refers to changes in cognitive maps, conceptual representations, mental associations, shared beliefs and understanding. Learning systems are developed by organizations, and are transferred through organization histories and norms.

Moreover, organizational learning is different from the sum of each member's learning. Goh (1997) analyzed the commonalties among the various recommendations found in many other literature. Goh (1997) identified five major organizational characteristics and management practices that are key factors to create organizational learning capabilities. Those five factors are 1) clarity of purpose and mission, 2) leadership commitment and empowerment, 3) experimentation & rewards, 4) knowledge transfer, and 5) teamwork & group problem solving.

- Single-Loop Versus Double-Loop Organizational Learning

In a series of literature written in the 70s, Argyris and Schon (1978) elaborated a theory that apparently has had wide impact, although that impact took a while to register. Argyris and Schon (1978) develop a three-fold typology of learning. They are described as single-loop, double-loop, and deutero-learning. Argyris's theory (1978) states that we can view individual and organizational learning as working at two different levels. Organizational learning involves the detection and correction of error. The first level is called single-loop learning to denote what we colloquially call 'staying inside the box'. Corporations continually respond to the changing pattern of external competition, regulation and demand, and to the changing internal environment of workers' attitudes and aspirations. Thus, single-loop learning is the process of error detection and correction and it permits the organization to carry on its present policies or achieve its present objectives. Single learning is sufficient where error correction can proceed by the changing organizational strategies and assumptions within a constant framework of norms for performance. Note that single-loop learning is about more than finding things that don't work and fixing them. It extends to all kinds of initiatives to make things better than they presently are : working procedures, purchasing practices, scheduling, etc. But single-loop learning tends to focus more on knowing how to get things done, rather than on knowing why we're doing these things, and whether we should instead be doing something completely different.

Double-loop learning occurs when errors is detected and corrected in ways that involve the modification of an organization's underlying norms, policies, and objectives. Deutero-learning is the process that members in the organization discover what they do facilitate or inhibit learning from previous contexts for learning. They invent, produce, evaluate, and generalize new *strategies for learning*. Borys and Jemison (1987) summarize Argyris (1978) single- and double-loop learning by referring to the former as the acquisition of knowledge through normal operations and the latter as learning how to learn. Double-loop learning can be said to involve 'outside the box' thinking. It allows that there is often another path to following knowledge building that takes us beyond the first path, or loop. Double-loop learning seeks to resolve inconsistencies in our understandings. It probes the basic assumptions and norms that underpin and explain our present theories of action. It asks 'why' questions. We will give the name 'double-loop learning' to those sorts of organizational inquiry which resolve incompatible organizational norms by setting new priorities and weightings of norms, or by restructuring the norms themselves together with associated strategies and assumptions.

Adjusting to new situations can lead to restructuring of fundamental understandings, from which new, more versatile and serviceable understandings emerge. Thomas Kuhn (1962) was alluding to this phenomenon when he coined the term paradigm shift in 1962. Kuhn's discussion of revolutions in scientific thinking presented a rather grand model of double-loop learning, which we have watered down somewhat with our incessant use of the term.

Today, the organization learning literature urges us to confront and examine our existing mental models, to engage in generative thinking, and to seek breakthroughs, emanate from this notion of double-loop learning. The two kinds of distinction between two kinds of learning is a useful one, but it also can be misleading. For there is a tendency in the literature to focus much more attention on double-loop learning. However, organizations also tend to underestimate the importance of single-loop learning. In many manufacturing and service companies, the power of single-loop learning, especially with problem solving teams looking for ways to improve productivity and quality, to ignite some dramatic rethinking of basic operating premises. Many simple ideas have also triggered a broader questioning of business policies and practices (Mai, 1995).

In conclusion, the 'adaptive' or 'single loop' organizational learning is the 'fundamental' level of organizational learning. But the ' generative' or 'double loop' organizational learning is the 'advanced' level of organizational learning. Development of each level requires the overcoming of 'learning barriers' or 'learning boundaries', which are different in various situations. Either what they are called, the organizational learning should be classified in only two levels, the fundamental level and advanced level. Different calling, but nearly the same connotations by different scholars studying additional related factors or changing contexts, is the standpoint that we should hold in order to understand or extend the concept of 'organizational learning'. Studying such similarities and differences from various scholars will also help us perceive the gaps and opportunities for future research. Thus, from such varieties of classifications in organizational learning, the present research will mainly focus on 'adaptive' organizational learning . 'Organizational learning' is closely related to 'capabilities'. So, the next section will be literature review of relationship between 'capabilities' and 'organizational learning'.

2.1.2. Organizational Learning Process (OLP)

Various scholars in different disciplines studied organizational learning process in different focuses. Sinkula (1994) proposes the three-stage process of organizational learning, which includes information acquisition, information dissemination, and shared interpretation. **Information acquisition** is from direct experience, the experiences of others, or organizational **memory**. **Information dissemination** or **information sharing** distinguishes organizational learning from personal learning. Effective **dissemination** increases information value when all organization players can see each piece of information in its broader context. These players are able to feed back questions, amplifications or modifications that provide new insights to the sender (Quintas, 1997).

Shared interpretation implies a consensus on the meaning of the information and its implications for the business, brings about organizational learning (Slater and Narver, 1995).

Daft and Huber (1987) compare 'system-structural' with 'interpretive perspectives' of organizational learning. They propose that systems-structural perspective deals with both information acquisition (through monitoring or probing) and information distribution. The interpretative perspective focuses on the underlying purpose and meaning of things. Essence of organizational learning is subject to both the interpretative level and the system-structural level. Huber (1989) analyzes the framework on Daft and Huber (1987) of systems-structural and interpretative perspective framework (Simonin, 1997). Four learning-related axes are suggested. These axes are information acquisition, information distribution, information interpretation, and organizational memory. Details of such four learning-related axes are: 1) Information acquisition refers to five processes by which information leading to learning is obtained. Five distinct processes are inherited knowledge, experiential learning, imitation associated with corporate intelligence, grafting new members or a whole organization possessing the knowledge in default, and searching information of the internal or external environment; 2) Information distribution is still offering some unexplored research questions such as the synergistic effect of information possessed by different units (Simonin, 1991) ; 3) Information interpretation involves the development of shared meaning and understanding relative to new information across units ; 4) Organizational memory is related to the effectiveness of organizational learning.

Daft and Huber (1987) also suggest that four important variables include turnover, information distribution and interpretation, norms and methods of storing information, and methods for locating and retrieving information. Inkpen (1996) posits that there are five learning processes or learning dimensions. Such dimensions are environment, task process, skills, and goals, which are all interrelated. Levitt and Maas (1998) suggest that organizations learn by encoding inferences from history into routines that guide behavior. Such routines can be transferred in many different ways such as socialization, education, imitation, personnel movement, mergers, and acquisitions. Organizational learning can be created through direct experience or through the experience of others.

2.1.3. Organizational Learning Capabilities (OLC)

- Capabilities

Nanda (1996) defines *'capabilities'* as the potential applications of resources. Grant (1996) defined capability as the integration of resources which are planned to perform some task or activity. Teece, Pisano, and Shuen (1990) defined capabilities as the assets, tangible or intangible, that are firm-specific and are built over time through complex interactions among resources. *'Capabilities'* may be created from several firm resources. Teece, Pisano, and Shuen (1990) propose the concept of 'dynamic capabilities' as the mechanisms by which firms accumulate and dissipate new skills and capabilities.

They elaborate that capabilities operate on resources in two ways, refinement and renewal. Strategic resources may become constraints of circumstances change. Renewal capability initiates the increase of new knowledge and innovation (Prahalad and Hamel, 1990).

'Resources' are defined as the tangible and intangible assets semi-permanently tied to the firm (Caves, 1980). There are three types of firm-specific resources, physical capital, human capital, and organizational capital (Barney, 1991). Grant (1991) categorizes the resources into three groups, financial (internal), technological, and reputational resources. The most likely sources of sustainable advantage are the "core competencies" (Prahalad and Hamel, 1990) or "invisible assets" (Itami and Roehl, 1987) of human resources (e.g. training, experience, learning, and relationships) and organizational skills (e.g. formal reporting structures, control and coordination systems, and informal relationships). These firm-specific resources are organizationally embedded, socially complex, and difficult to identify and copy. Barney (1991) posits that physical resources (e.g. physical technology, plants and equipment, geographic location, and raw materials access) hardly generate sustainable advantage because these resources are relatively easy to copy or work around. Itami and Roehl (1987) support that invisible assets (e.g. technology, specific information, corporate culture, organizational skills, etc.) are the real source of competitive advantage. In conclusion, resources and capabilities are interrelated terms, that is, capability arises from the possession of resource, and access to resource leads to capability.

- Capabilities and Organizational Learning

Hedberge (1981) defines organizational learning as the capability of an organization to adapt to its environment. Huber (1991) defines learning as a process that enables an entity to increase its range of potential behavior through its processing of information. Learning is a source of competitive advantage (Stata, 1989). Organizational learning then occurs when any of an organization's units acquires knowledge that the unit recognizes as potentially useful to the organization. Prahalad and Hamel (1990) propose that organizational learning can occur from firms' acquiring new and complementary competence, a possibility not directly emerging from the idea of resource utilization. Moingeon and Edmondson (1996) identify that capabilities of organization to learn includes encoding and modifying routines, acquiring knowledge useful to the organization, increasing the organizational capacity to take productive action, interpretation and sense-making, developing knowledge about action-outcome relationships, and detection and correction of error.

The process by which resources end up being components of core capabilities in firms is a learning process that can be explained by using the concepts of resource-based view of the firm (RBVF). Furthermore, the development of IT strategic applications (strategic information system : SIS) follows patterns that closely parallel the structure of that learning process. The superior ability to learn is 1) critical because of the acceleration of market and technological changes, explosion of available market data, and importance of anticipatory action; and 2) a competency-based source of competitive advantage

because of its complexity, usefulness , and difficulty to imitate (Day, 1994). Behavior change is the link between organizational learning and its performance improvement. There are three ways that learning can influence organization behavior (Menon and Varadajan, 1992). First, action-oriented use is the direct application of knowledge to solve a problem. Second, knowledge-enhancing use influences managerial perspectives on problems, but is less likely to change behavior directly. Third, effective use increases satisfaction or decreases dissonance with a change that already has been made. Consequently, it is incorrect to expect direct and immediate behavior change on the basis of new knowledge. The three types of knowledge-use form a continuum, from direct to indirect, of the effects of organizational learning on behavior change (Slater and Narver, 1995).

The resource-based view of the firm (RBVF) conceives a firms as seeking to acquire resources and capabilities which are valuable and hard to imitate (Amit and Schoemaker, 1993). The firm's quest for differentiation is a process that develops distinctive capabilities (core capabilities). Core capabilities are those that beneficially differentiate a company from competitive firms (Leonard-Barton,1992). A capability has strategic potential, and become competitive advantage when it is : 1) valuable (Barney, 1991); 2) rare (Hirshleifer, 1980); 3) imperfectly imitatable (Lippman and Rumelt, 1982); 4) with no strategically equivalent substitutes (Leonard-Barton,1992).

The core capabilities are developed in organization through a fundamental transformation (change) process by which standard resources are used and combined within the organizational context of each firm. Since this transformation process takes place within an organizational context and uses specific organizational routines, the resulting core capabilities are highly dependent on them. As the process unfolds, the path-dependency or acquisition-dependency degree increases, making the results more idiosyncratic to the firm. Hence, the transformation is a path-dependent learning process which is iterative and evolving with some specific resources and capabilities (Amit and Schoemaker, 1993).

Capabilities are developed by combining and using resources (capabilities) with the aid of organizational routines. An organizational routine is a particular way of doing that an organization has developed and learned, and in the utilization of which that organization is effective and efficient. These routines are depositories of organizational knowledge acquired through learning (Dosi, 1990). Thus, routines have strong tacit dimension which makes them difficult to imitate and change.

Andreu and Ciborra (1996) posit that the fundamental learning processes taking place in organizations are the processes that lead to the development of core competence. Adopting the perspective of the resource-based view of the firm (RBVF), which focuses on the firm's resources and capabilities to understand business strategy and to provide direction to strategy formulation. Appropriate IT (Information Technology) can participate in the fundamental process that transforms resources into capabilities and eventually into core capabilities - through the development and implementation of appropriate IT-based information system (IT/IS).

The transformation (change) process which produces core capabilities from standard resources involving learning (Collis, 1991). Initially, the first transformation step develops capabilities from standard resources. The learning take place at this step which aims at mastering the use of standard resources, and produces what we call efficient work practices. Individuals and groups in the firm learn how to use resources to solve problems in the context of a organizational situation. Thus, there is a learning loop between resources and work practices. We call it the routinization learning loop.

The environment in which learning occurs is an organizational context, which influences the learning process and is influenced by its result. New working practices become part of the context and increasing the knowledge base of the organization and enhancing its learning capabilities (Dosi, 1990; Ghemawat and Ricart, 1993). The driving force for continuous capability improvement is static efficiency, and the change agents are individuals and groups in the organization, who are repositories of capabilities (Penrose, 1959).

Moreover, Leonard-Barton (1992) also posits that core capabilities can enable new missions, which trigger new capabilities transformations. All these interrelationships give rise to another learning loop. Some of the dynamics in this loop are close to what has been called ‘renewing a firm’s capabilities’, and described as fundamental for long-term competitive strength. The strategic learning loop also takes place within the firm’s organizational context. Furthermore, its outcome (core capabilities) reshapes the context itself.

It must be noted that inertial belongs to the nature of organizational contexts, as a consequence of the learning involved in their continuous development and updating. Drastically changing the context is difficult, although sometimes necessary. However, drastic changes in the mission of the firm are not likely to happen, as its evolution also occurs within the organizational context. Hence, revolutionary changes in the organizational context or the mission of the firm require radical learning - becoming aware of what the context is and explicitly stepping out in order to innovate in a radical manner. As core capabilities are components of the organizational context, radical learning means learning how to do radically new things (Argyris and Schon, 1978).

- Organizational Learning Capabilities (OLC) and Organizational Orientations

Hult and Ferrell (1997) operationalize concepts of organization learning capabilities (OLC) by synthesizing the four organizational orientations, team orientation, systems orientation, learning orientation, and memory orientation. These ‘orientation’ synthesize the means for operationalizing the OLC constructs, incorporating the encompassed subprocess of learning (information acquisition, information dissemination, shared interpretation) and cognitive levels of learning.

The idea of organization learning was popularized by Senge (1990), who argued that organizational learning incorporates the five 'disciplines' of system thinking, personal mastery, mental model, shared vision, and team learning. within the marketing literature, Day (1994) introduced four learning capabilities (i.e., open-minded inquiry, synergistic information distribution, mutually informed interpretations, and accessible memory) as the basis for organizational learning. Moreover, Sinkula (1994, 1997) argues that organizational learning is composed of a set of learning 'foundations' (i.e., shared vision, learning axioms, cross-functional teamwork, open-mindedness, and experience sharing). Similarly, Tobin (1993) proposed a set of different 'foundations' as the criteria for organizational learning (i.e., visible leadership, thinking literacy, functional myopia, learning teams, and managers as enablers). Other scholars have conceptualized the organizational learning construct similarly, introducing different yet related elements that compose some broader organizational learning constructs. While the terms vary, the common thread is that organizational learning is multifarious and involves mechanisms in a number of unique yet related areas.

Williams (1992) studied sustainability of competitive advantage and found that all industries undergo substantial change, whether driven by customers, competitors, or technology suppliers. This change creates continuous pressure for businesses to augment their products and services to maintain or increase their value to customers, because no customer benefit is safe from being matched or exceeded by competitors. So, 'the ability to learn faster than your competitors' is one of the important factors to sustain competitive advantage (Day, 1994).

Laudon and Laudon (1998) propose the concept of 'knowledge-based view of the firm'. This concept focuses on organization more than on manager or personnel. The main premise of this concept is that success of the organization depends on the ability of the organization to gather, storage, produce, maintain, disseminate, and utilize knowledge & information, which is used to produce products and services (Laudon and Laudon, 1998). Moreover, knowledge is the central productive and strategic asset of the firm (Arrow, 1972; Quin, 1992).

Knowledge can be explicit or tacit (Kogut and Zander, 1993). Explicit knowledge is codified in books, manuals, pictures, video, etc. Tacit knowledge is implicit know-how, or a social relationship needed to complete a task, built over years of experience (Jensen and Meckling, 1992). Tacit knowledge includes craftsmanship, teams that work together well, values, culture and attitudes, which support learning, and decision-making patterns based on knowledge. Tacit knowledge is embedded in individuals and organizations, is not easily marketed, and tends to be sticky (Bartlett and Ghoshal, 1988; Jensen and Meckling, 1992; Kogut and Zander, 1993). Laudon and Laudon (1998) propose that knowledge includes information, social relations, a personal know-how, and skills. Knowledge is an attribute of both individuals and organizations. Personal knowledge can be appropriated and encoded by the organization in the form of manual, software, operating procedures. Firms must concentrate and manage explicit and tacit knowledge better than markets.

Otherwise, organizations would not exist (Laudon and Laudon, 1998). Creation of value by organization requires application, integration and memory of different types of knowledge (Quinn, 1992). Sveiby (1997) posits that the economy of the knowledge era offers unlimited resources because the human capacity to create knowledge is infinite.

Prahalad and Hamel (1990) propose that organizational learning can occur from firms' acquiring new and complementary competence. The capability-building perspective emphasizes organizational learning as an important feature in the evolution of rent-generating capabilities (Stata, 1989). Moingeon and Edmondson (1996) stress that organizational learning includes encoding and modifying routines, acquiring knowledge useful to the organization, increasing the organizational capacity to take productive action, interpretation and sense-making, developing knowledge about action-outcome relationships, and detection and correction of error.

According to Hult and Ferrell (1997), the orientations of OLC consists of four conceptual components, team orientation, systems orientation, learning orientation, and memory orientation.

Team orientation is defined as the degree to which the corporate center and the SBU field officer/operator in the organization stress collaboration and cooperation in performing activities and in making decisions (Hult and Ferrell, 1997). In order for the team to function effectively, a dialogue must exist among members focused on sharing assumptions, thinking together to solve problems, and charting the future operations of the organization (Senge, 1990). Thinking together fosters a climate focused on creating a genuine vision, subsequently leading to excellence and learning because the employees feel that they are pursuing their own goals (Argyris and Schon, 1978). As such, each organizational member has an input in the process of creating, developing, and implementing a team orientation that leads to a commonality of direction and the harmonization of individuals' energy. Team orientation builds on the idea of the subprocess of shared interpretation (Sinkula, 1994; Slater and Narver, 1995).

System orientation is defined as the degree to which the SBU field officer/operator in the organization stress the broad 'picture' of the activities in their main organizational process and thus a reason certain activities exist : 'system thinking is a discipline for seeing the wholes' (Hult and Ferrell, 1997; Senge, 1990). A systems orientation focuses on structuring and making sense of the multiple marketing inputs from the environment, the organization, the immediate work group, the task, relationships will colleagues, and outputs in terms of performance and satisfaction in relation to the broad 'picture' created by these multiple inputs. In addition, a systems orientation fuses the other three orientations into a coherent whole identified as the 'fifth discipline' by Senge(1990) that keep them from turning into 'fads' or 'gimmicks'. This means that system orientation is a crucial component of organizational learning because it guides the organization's cognitive levels of learning, by that helping to identify market patterns and the reinforcement or changing of these patterns at the adaptive to generative learning levels (Senge, 1990; Slater and Narver, 1995; Hult and Ferrell, 1997).

Learning orientation is defined as the degree to which the SBU field officer/operator in the organization stress the value of organizational learning for the long-term benefits of the organizational process (Hult and Ferrell, 1997). Thus, an important component of organization learning is the set of fundamental axioms or truths that the organization hold regarding the value it places on learning (i.e. learning orientation). Norman (1985) notes that "every organization learns, and every organization has a set of dominating ideas. They may be more or less consciously formulated and more or less visible, and they may represent good or bad interpretations of what has led to success or failure, but they are always there". Senge (1990) also states that this is due to the concept of mental model. Developing an organization's capacity to work within the environment of a high degree of learning orientation requires both learning new skills and implementing an institutional climate that helps bring these skills into a regular practice (Slater and Narver, 1995). As such, learning orientation relates to the subprocess of information dissemination (Sinkula, 1994; Slater and Narver, 1995). Thus, learning orientation builds on the notion that a learning organization improves its understanding of the environment over time, a prerequisite of which is 'a culture amenable to learning' (Galer and Heijden, 1992). This includes the ability to think and reason and to disseminate, diffusion, or transfer the subsequent thoughts to the organizational members (Tobin, 1993).

Memory orientation is defined as the degree to which the SBU field officer/operator in the organization stress communication, distribution, or transfer of organizational knowledge (Hult and Ferrell, 1997). The means of achieving a climate where organizational memory is readily accessible vary. Related to this notion, Cohen (1991) explores organizations as 'processing information to learn and apply skilled routines'. However, once the routine is in place, substantial barriers to information could contradict it. In this regard, a memory orientation is identified largely with the subprocess of information acquisition (Sinkula, 1994). A memory orientation incorporates the idea that by repeatedly performing a set of activities, organizational members develop a knowledge base of those activities and a means for performing better the next time. The individual member's experience leads to the modification of organizational knowledge, and thus, to a better understanding of the interactions between the organizational systems and the environment (Hult and Ferrell, 1997).

- Organizational Learning Capabilities (OLC) and Organizational Structures

Organizational learning is a multidimensional construct characterized by being composed of 'disciplines' (Senge, 1990), 'foundations' (Tobin, 1993), 'skills' (McKee, 1992), 'elements' (Slater and Narver, 1994), or 'checklist' (Galer and Heijden, 1992). From an organizational structure standpoint, these characterizations involve organizational learning through four subprocess of learning : 1) adaptation, 2) assumption sharing, 3) developing a knowledge base, and 4) institutionalized experience effect (Shrivastava, 1983). Each subprocess of learning takes place on a continuum defined by two cognitive levels of learning - single-loop and double-loop learning (Argyris, 1978; Slater and Narver, 1994). Based on Senge (1990), these various characterizations of organizational learning manifest themselves as the degrees of two structural learning 'prototypes', openness and localness.

Openness : Openness in the organization emerges when the SBUs and the related units become willing to suspend their certainty when communicating with each other about their work or routines (Senge, 1990). Similarly, Hult and Ferrell (1997) suggest that high-performing organizations, competing in complex global industries, adopt an organic form of organizational architecture with extensive lateral communication processes. This means that the SBUs recognize their interdependence and are willing to cooperate and share information to sustain the effectiveness of their working system and organization. (Miles and Snow, 1992). The necessity of effective information sharing demands that structural constraints on information, such as a lack of openness, be dismantled (Slater and Narver, 1995) state that openness to learning partners 'leads to information sharing that benefits both partners. These partnerships provide access to a greater number of information sources, force the development of mechanisms that facilitate the sharing of information, and offer alternative perspectives on the meaning of critical information that could lead to generative learning. Furthermore, Slater and Narver (1995) state that an organization focusing on decentralized strategic planning, where openness is stressed, needs to have a process in place for the critical evaluation of key assumptions about the business and the environment. Similarly, Kogut and Zander (1993) state that multinational corporations attain competitive advantage based on their ability to transfer knowledge more effectively than other firms. Further, Roth and Morrison (1992) state that a multinational corporation creates competitive advantage by 'linking different value activities across locations,' similar to the function of openness within the organization is proposed to positively affect acquisition and dissemination of information across the environmental challenges presented by the international settings.

Localness Hult and Ferrell (1997) define localness as moving organizational decisions down the organization hierarchy to the greatest degree possible where local SBU decision makers confront the full range of their work (Senge, 1990). This means that organizational learning in the organizational process is created by giving SBUs the freedom to act, to try their own ideas and be responsible for results, leading to reduced levels of bureaucratization and an organic organizational structure (Slater and Narver, 1995). Whereas a lack of localness has been shown to positively influence performance outcomes of an organization under certain circumstances, organizational learning theory suggests that bureaucratization hinders the learning process by limiting creativity, responsiveness, timeliness, and innovativeness (Argyris, 1978; Senge, 1990). High-performing firms competing in global environments adopt a learning organization structure that is decentralized and highly flexible (Senge, 1990).

Gupta (1991) state that high environmental uncertainty requires high frequency and informality in communication patterns among organizational units for effective diffusion of information. Gupta (1991) also found that managers who were a part of an interdependent network were not able to make decisions that benefited the total system because they lacked the information to adequately assess the effect of such decision. Yet, Morrison (1991) found that administrative mechanisms stressing informal structures may provide the most efficient coordination in the multinational setting.

- Positive and Negative Conditions to create 'Organizational Learning Capabilities'

McGill and Slocum (1993) suggest that openness to different experiences, a willingness to acknowledge failures and to learn from them, and an orientation to continuous experimentation are important behaviors that promote organizational learning. From an organizational design perspective, structures that are flexible and permeable, information systems that provide timely information and a reward system that recognizes creativity and experimentation are required if organizations aim at effectively learning . Furthermore, they also review a number of strategic approaches to managing adaptation and learning (e.g., SWOT analysis, BCG product portfolio, etc.) and suggest that the new learning strategy for organizations must include a strategic intent to learn, a commitment to continuous experimentation, and an ability to learn from past success and failures. These practices, the authors suggest, will enable organizational renewal and develop important sources of competitive advantage of organization.

Nevis, Dibella, and Gould (1995) propose the stages of organizational learning process (knowledge acquisition, knowledge sharing, knowledge utilization), and develop a comprehensive model of organizational learning that includes seven learning orientations (sources of knowledge, learning culture, openness, freedom to experience, closeness in planning and action, capture of lessons learned, mutual trust and coordination of activities). They also conclude that organizations can acquire, share, and utilize knowledge in different ways depending on how the orientation and facilitating factors are coordinated. Before introducing interventions to improve learning, an organization should assess its current practice and capabilities with respect to learning.

According to Slater and Narver (1995), culture is the deeply rooted set of values and beliefs that provide norms for behavior in the organization, but climate describes how the organization operationalizes its culture, the structures and processes that facilitate the achievement of the desired behaviors. It is important for the organization’s culture and climate to be complementary appropriate. Thus, there is a synergistic relationship among the elements of culture and climate that maximizes organizational learning and organizational performance.

Slater and Narver (1995) also identify five critical components of the organizational learning capabilities - the two elements of culture : Market orientation and entrepreneurship; and the three elements of climate : Facilitative leadership, organic & open structure, and an decentralized approach to planning. These elements are believed to have a synergistic influence on learning and performance.

In conclusion, organizational learning capabilities are closely related to properly management of information and information technology. The next section will be review of organizational learning process, which is potentially related to organizational learning capabilities.

2.1.4. Conclusion and Critique of Theories in Organizational Learning

From the literature review in the present research, the orientations of organizational learning can be concluded by depictions and related elements, as in Table 2-2.

Table 2-2: Conclusion of theories in organizational learning

Author (s)	Depiction	OL. Components / Elements
Senge (1990)	**Five learning disciplines**	1. Personal mastery 2. Mental models 3. Shared vision 4. Team learning 5. Systems thinking
GalerandVan Der Heijden (1992)	**Learning checklist**	1. Learning culture 2. Openness 3. Freedom to experience 4. Commitment to learning 5. Closeness in planning and action 6. Capture of lessons learned 7. Mutual trust 8. Coordination of activities
McKee (1992)	**Learning skills**	1. Interpersonal skills 2. Analytical skills 3. Organizational skills 4. Ecological skills
Garvin (1993)	**Five activities to build-learning organization**	1. Systematic problem solving 2. Experimentation with new approaches 3. Learning from their own experience and history 4. Learning from others' experiences & best practices 5. Transferring knowledge throughout organization
Tobin (1993)	**Learning foundations**	1. Visible leadership 2. Thinking literacy 3. Functional myopia 4. Learning teams 5. Managers as enablers
Wick and Leon (1993)	**Learning elements**	1. Defined vision 2. Measurable action plan 3. Sharing of information 4. Inventiveness 5. Implementation ability
Day (**1991,1994**)	**Learning process**	1. Open-minded inquiry 2. Synergistic information distribution 3. Interpretation capability 4. Accessible memory

Author (s)	Depiction	OL. Components / Elements
Sinkula (1994)	**Learning foundations**	1. Shared vision 2. Learning axioms 3. Cross-functional teamwork 4. Open-mindedness 5. Experience sharing
	OL. Process	1. Information acquisition 2. Information dissemination 3. Shared interpretation
Andreu and Claudio (1995)	**Core capability & IT. in creating organizational learning**	1. Capability development process 2. Role of IT/IS in organization learning processes.
Gephart and Marsick (1996)	**Types of leaders for-learning organization**	1. Local line leaders 2. Executive leaders 3. Internal networks or community builders
Gephart and Marsick (1996)	**Facilitative systems-for learning organization**	1. Vision and strategy 2. Leadership and management 3. Culture 4. Structure of organization 5. Change management 6. System & process of communication, information, knowledge storage, performance management, technology transfer
Slater and Narver (1995, 1997)	**Learning elements**	1. Entrepreneurship 2. Facilitative leadership 3. Organic structure 4. Decentralized strategic planning 5. Market orientation
	OL. Process	1. Information acquisition 2. Information dissemination 3. Shared interpretation 4. Organizational memory
Hult and Ferrell (1997)	**Global organizational-learning-capacity (GOLC.)**	1. Team orientation 2. Systems orientation 3. Learning orientation 4. Memory orientation
Goh and Richards (**1997**)	**Benchmarking the-learning capacity**	1. Clarity of mission and vision 2. Leadership 3. Experimentation 4. Transfer of knowledge 5. Teamwork and group problem-solving
Bood and Postma (1997)	**Strategic learning cycle**	1. Assimilation / Accommodation 2. Exploitation / Exploration 3. Active implementation / Reflective observation 4. Concrete experience / Abstract conceptualization
Romme and Dillen (1997)	**Learning as information process**	1. Information acquisition 2. Information distribution 3. Interpretation of information 4. Storage of information

From literature review in this chapter, there are many agreeable and conflicting schools of organizational learning. The agreeable parts are that organizational learning is viewed as a complex '<u>process</u>' of strategically organizational management. Organizational learning <u>capabilities</u> (competence, capacity) is the results or products of such '<u>process</u>'. Moreover, organizations have various different

boundaries (barriers) of learning to develop from fundamental (adaptive, first-loop) level towards advanced (generative, second-loop) level. In conclusion, the present research will use the studies of Hult and Ferrell (1997), Slater and Narver (1995), Sinkula (1994), and Senge (1990) as the key theoretical foundations. This research will also focus on only adaptive organizational learning (1^{st}-loop learning or fundamental learning, and the theories related to the present research can be concluded integratedly as in the following conceptual framework.

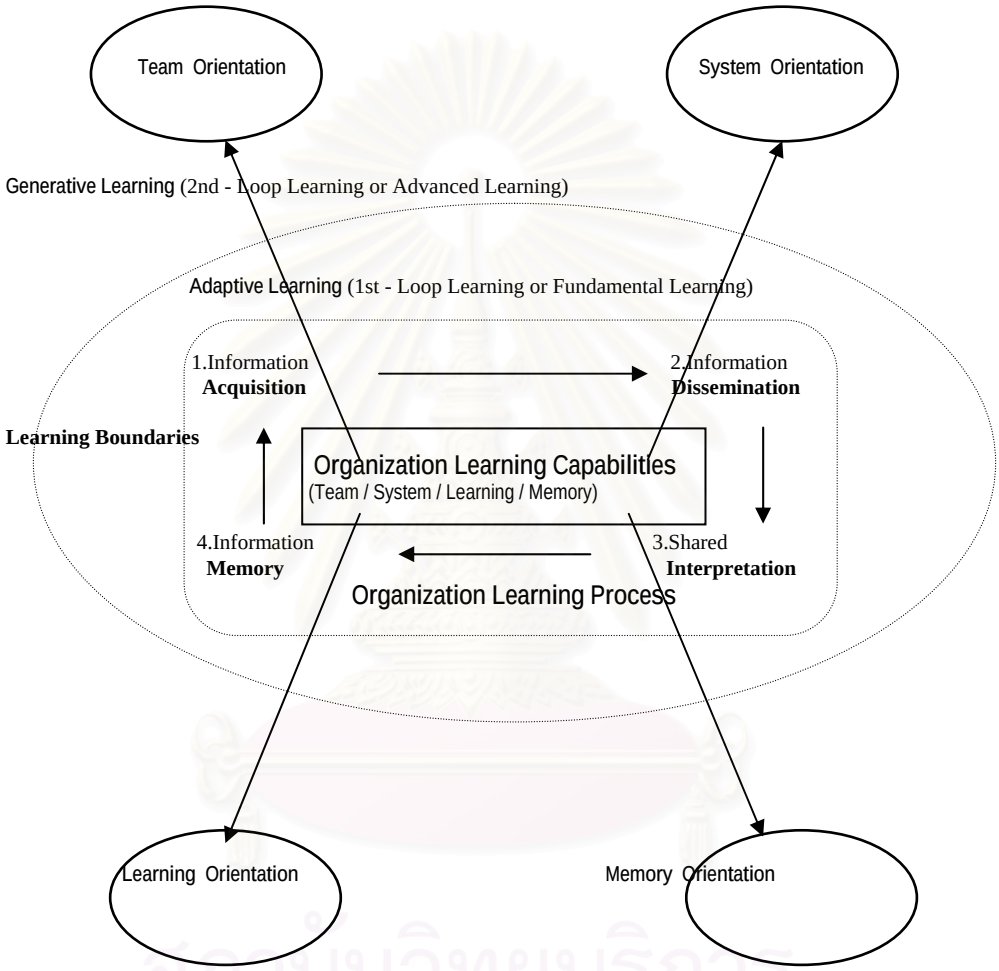

Figure 2-1: Conclusion of organizational learning theories implemented in this research

There have been different views of organizational learning components created from different factors. These factors positively or negatively influence organizational learning. Some scholars posit that individual features are the factors, such as, leadership, personal mastery, systems thinking, or cognitive abilities. Some propose that organizational features are the factors, such as, team learning, culture, organizational climate, or information transfer. But others stress the advanced technological features are the factors, such as, telecommunication, database system, or computerized network system. Many scholars (e.g., Slater and Narver, 1995; Sinkula, 1994; Romme and Dillen, 1997) confirm that 'information' and 'information management' are the important factors to create organizational learning. However, none of such scholars considers information technology (IT) infrastructures, specifically related to computer-based training, as the facilitator of organizational learning. Such IT infrastructures, if properly used, will potentially build up and speed up 'organizational learning capabilities'. Thus, the organizational learning theories, implemented in this research, are theories involving information and teamwork (theories by Senge, Sinkula, Slater and Narver, Hult and Ferrell). These theories are linked with IT-based organizational learning tools (OLT), which will be reviewed in the next section.

2.2. IT-Based Organizational Learning Tools (OLT)

2.2.1. IT and CBT

Zuboff (1997) defines 'information technology' (IT) as the convergence of several streams of technical developments that dramatically increase the ability to record, store, analyze, and transmit information in ways that permit flexibility, accuracy, immediacy, geographic independence, volume, and complexity. Zuboff also posits that IT has the potential to change the ways we do our jobs and interact with our colleagues.

Kiranandana (1998) defines IT as various kinds of technology or interrelated and integrated components which work together in the processes of acquiring, restoring, creating, processing, retrieving, transmitting, disseminating, and communicating information in order to support decision making, ordination, control, analysis, and visualization in an organization.

Laudon and Laudon (1998) classifies types of 'information technology' (IT) into computer systems, data processing & database managing systems, and networking & communicating systems. They stress that information system (IS) covers the wider meaning than IT. In other words, IS includes the perspectives of IT with management, behavior, sociology, politics, and various environment, while IT means narrowly about technologies in hardware, software, database, networking system.

Sveiby (1997) defines 'information' and 'knowledge' differently. He suggests that when human beings speaking or writing, they use language to articulate some of their tacit knowledge in an attempt to pass it on to others. This communication is information. In the information technology industry, they are even used as synonyms. The word information is usually associated with both facts and the communication of facts. Information is in many ways ideal for communicating explicit knowledge. Sveiby (1997) also posits that knowledge can be transferred in two ways, directly and indirectly. Information transfers knowledge indirectly through media such as lectures and audio-visual presentations. Tradition transfers knowledge directly, from person to person, through learning by doing. Moreover, Sveiby (1997) also proposes that information and knowledge should be seen as distinctly different. Information is entropic (chaotic); knowledge is non-entropic. The receiver of information gives it meaning. Information is perfect for broadcasting articulated knowledge but it is unreliable and inefficient for transferring knowledge from person to person. Tradition should be used to transfer knowledge. In order to use a computer-based metaphor, facts might be considered digital while skills might be considered analog. Sveiby (1997) exemplifies the computer-based tools for information/knowledge transfer as games, simulation models, computer-based training (CBT) or computer-based instruction (CAI), artificial intelligence (AI), or expert systems (ES).

In modern organizations, computer-based training (CBT) tools, either web-based or non-web-based formats, are the important parts of IT-infrastructures that help create knowledge management systems and organizational learning and that help sustain competitive advantage of organizations (Laudon and Laudon, 1998). Wynn (1997) defines computer-based training (CBT) as an effective and flexible training method, computerized or electronic, which can be used by all levels of staff . He confirms that CBT is effective because of its real-time interactivity of learning and test, its learner's engagement, its

controllable speed of learning up to each learner, and its cost-effectiveness of distributing or sharing knowledge all over the organization at lower cost.

Wynn (1997) exemplifies CBT as computer-managed learning, tracking and recording systems of training result, interactive audio, and interactive video. Farrer and Leibowitz (1991) define CBT as an interactive learning-experience between a learner and a computer in which the computer provides the majority of the stimulus, the learners must respond, and the computer analyzes the response and provides feedback to the learner. They conclude that CBT is one of many terms (e.g., computer-based learning, computer-assisted instruction, computer-interactive learning, computer-based education) used to refer to a class of instructional methods that rely on computers or computer-related systems. They view CBT in the context of human resource development (HRD) implementation, and they suggest that 'learners' may be individual (e.g., employees, managers) or organization (teams, strategic business units). CBT provides 'feedback' which can take the form of an assessment results, report, database, and CBT may records such 'feedback database' for evaluating and *sharing* in the organization.

Ravet and Layte (1997) define computer-based training (CBT) as computerized systems, webbed or non-webbed, that organize or support learning, training, and developing to help upgrade the efficiency and efficacy of organization staff in working. Donald Bitzer defines computer-based learning as 'anytime a person and a computer get together in any ways and one of them learns something' (Kelly, 1995). Computer-based learning is more than the mere encounter of a person and a computer. It is the encounter of a person (a learner) with another person (the designer of the learning program) using the computer as a proxy (Ravet and Layte, 1997). Ravet and Layte (1997) posit that computer programs in any case tend to reproduce a certain model of reality, which is the common practice in human-computer interface design to use models, or metaphors, to present the information in a way that is familiar to the users. ***Reality model*** is the model that reproduces objects from the real world The ***Reality model*** is the objects, environment, or systems the learners interact with, which are books, tape, real object system, mental model, abstractions (e.g., concepts, rules, laws, arguments). Moreover, Ravet and Layte (1997) also propose other models in a learning situation related to CBT, such as learning model, activity model, space model, and assessment model. ***Learning model*** is the theory of learning underlying the intervention, related to experiential learning, learning by doing, and programmed learning. ***Activity model*** is the model of actions the learner actually does during training, which are listening to trainers, reading, watching, searching information, drill and practice, responding to trainers, reporting, analyzing data or experimenting results, manipulating the systems, designing a model, interacting with other learners. The ***Space model*** is the objects, environment, or systems the learners interact with, which are home, workplace, workshop, classroom, etc. ***Assessment model*** is the type of performance the learner is assessed on, which is related to questioning, examination, assignment, and observation at the learner's own pace. Ravet and Layte (1997) coined the term ***'computence',*** which is the contracted combination of the two words computer and competence. It means the ability of a computer to execute certain performances, like presenting information, maintaining and updating information or creating simulations. In other words, ***computence*** may be defined as the ability of a computer program to

support users' performance at a specific level of competence. They suggest various activities, which support performance, e.g., organizing knowledge, manipulating concepts and rules, practicing in simulated settings, communicating, etc. Ravet and Layte (1997) conclude that technology offers a wide range of possible activities to support the acquisition of new skills and new types of individual learning and organizational learning. The important point is not only the degree of advanced technology used in CBT and in learning but the ***approach*** or ***how*** the technology or media is used (Laudon and Laudon, 1998).

Hart (1993) studies the cost-effectiveness of CBT and finds that CBT can reduce cost of training (reduce living and travelling costs, reduce length of training, provide timely training, increase learner to trainer ratio, reduce cost of operational hardware, and reduce equipment damage) and also can increase effectiveness of learning or training (provide standardized delivery, ensure standardized feedback, record all beneficial responses to share with other learners, repeat learning process without additional costs, produce tailor-made content and format appropriate for each group of learners, and increase performance practice). Hart (1993) also forecasts the trends of advance in IT and CBT tools as videodisc-based training (DVD or digital video-disc), CD-ROM, OD-ROM (optical disc), expert systems, artificial intelligence systems, and web-based CBT.

In conclusion, IT and CBT can be applied in considerable parts of business management and organizational development. As in the study of Hart (1993), various advanced technologies in CBT provide international learning and development with cost-effectiveness. Moreover, transferring knowledge from head-office to subsidiaries all over the world will be efficiently possible. The *sharing* of knowledge (or '*organizational learning*' as in the previous chapter) within the same organization or among other networked organizations will also be effectively possible. In other words, IT and CBT may be used as facilitator for organizational learning in global business management. The next section will be the review of relationship among IT, CBT, organizational learning capabilities, and process.

2.2.2. IT-Based Organizational Learning Tools (OLT)

Piskurich (1993) proposes the 'technology-based learning' concept and technology-based instructional tools, which play an important role in individual learning, organizational learning, and human resource development. He exemplifies such tools as hypertexts, interactive multimedia, database system, computer-based training (CBT), expert system, artificial intelligence, etc. Piskurich (1993) also stresses that computer-based training (CBT) is formerly designed and used for individual learning. However, because of recent advance in computer technology, the computer-based training (CBT) can be designed and utilized to facilitate organizational *sharing of knowledge*.

Newman and Smith (1999) suggest the unique IT-concept of 'virtual learning community', which reinforces organizational learning, facilitates team working, and opens constructive communication. They propose many ways of implementing such the concept, e.g., designing web-based applications, using groupware (such as, Lotus Notes or MS. Outlook) as routine, etc. They also conclude that creating a virtual place for a community of employees to meet virtually and share learning is a rewarding approach to increase organizational performance. Employees need a place outside classroom where they can learn at leisure time interactively, where they can learn from each other, and where they can make continuous learning an every-day reality. In the same concept but different approach. Barron (1999) proposes the concept of 'online-learning'. He posits that using web-based learning (WBL) will help create *organizational communication* and *information sharing*. WBL is the information technology infrastructures that can be used and distributed multinationally at lower cost and higher speed than other conventional tools or medias.

In conclusion, computer-based training (CBT) or 'IT-based tools' may potentially be used to facilitate organizational learning, via webbed or non-webbed IT-facilities. So, this study will coin the term of 'IT-based organizational learning tools' (OLT) to be used in the same connotation as 'computer-based training' (CBT). This OLT will include any IT-based tools, webbed or non-webbed, which intend to use as tools to facilitate, train, or create organizational learning.

2.2.3. Organizational Learning Tools (OLT) / Organizational Learning Capabilities (OLC)

Organizational learning theorists have argued that effective learning tends to be incremental, intensive, immediate, and action-oriented (Fichman and Moses, 1999). They elaborate that effective organizational learning is *incremental* because new knowledge is easily distributed, shared, and absorbed when it can be layered on top of existing knowledge by using conventional tools (e.g., training, meeting, book, movie, VDO) or advanced tools (e.g., networked computer, CBT, artificial intelligence). Hult and Ferrell (1997), Slater and Narver (1994), and Sinkula (1995) confirm that proper management of relevant information (e.g., information acquisition, information dissemination, shared interpretation, memory of information or database systems, and team learning) can influences positive impact on organizational learning.

Hult and Ferrell (1997) propose the concept of global organizational learning capacity (GOLC). Moreover, they create and test the practical measurement of GOLC, which consists of four major constructs (teamwork orientation, system orientation, learning orientation, and memory orientation). This measurement is related to management of information and knowledge in the organization. Laudon and Laudon (1998) suggest various kinds of information technology (IT), which may facilitate the efficient management of information and knowledge (e.g., database systems, computerized telecommunication systems, computer-based training and sharing knowledge systems, artificial intelligence, expert systems). Laudon and Laudon (1998) also posit that information technology can not work alone by itself to increase organizational performance. But proper management of such information technology by human is the critical factor that facilitates such information technology to work successfully.

According to Laudon and Laudon (1998), there are two schools within the cognitive perspective - the managerial sense-making school and the knowledge-based view of the firm. Both of them address the same problem of searching for an effective and efficient organization via information (knowledge) management. **a) Managerial Sense-Making Perspective:** This school emphasizes the key roles of managers in appropriately perceiving and interpreting environment events, conceptualizing the problems faced by an organization, defining the solution set, and making the solution decision. Managers create mental models, which can serve as the basis for the organization's action plans. The main premise is that managers create knowledge structures (mental maps), which transform the chaotic, ambiguous stream of events in the environment into tractable 'problem', and become the foundation for organizational programs and policies for coping and survival. Managers do this by applying various filters of information from the environment (Starbuck and Milliken, 1988). March and Sevon (1984) conclude that managers are information processors from external and internal environments of the firm and IT increasingly aid such information processing processes. **b) Knowledge-based view of the firm:** This school confirms that knowledge management is the process of systematically and actively managing and leveraging storage of knowledge in an organization. Knowledge is a central productive and strategic asset. IT can play a valuable role in knowledge management, helping the organization optimize its flow of information and capture its knowledge base. Office automation system (OAS), knowledge work systems (KWS), group collaboration systems, and artificial intelligence applications are useful for knowledge management because they focus primarily on supporting information and knowledge work and on defining and codifying and organization's knowledge base. Daft and Huber (1987) compare 'system-structural' with 'interpretive perspectives' of organizational learning. They propose that systems-structural perspective deals with both information acquisition (through monitoring or probing) and information distribution. The interpretative perspective focuses on the underlying purpose and meaning of things.

The essence of organizational learning is subject to both the interpretative level and the system-structural level. Huber (1989) analyzes the framework on Daft and Huber (1987) of systems-structural and interpretative perspective framework (Simonin, 1991). Four learning-related axes are suggested.

These axes are information acquisition, information distribution, information distribution, and organizational memory. Information acquisition refers to five processes by which information leading to learning is obtained. Five distinct processes are inherited knowledge, experiential learning, imitation associated with corporate intelligence, grafting new members or a whole organization possessing the knowledge in default, and searching information of the internal or external environment.

Information distribution is still offering some unexplored research questions such as the synergistic effect of information possessed by different units (Simonin, 1991). Information interpretation involves the development of shared meaning and understanding relative to new information across units. Organizational memory is related to the effectiveness of organizational learning. Daft and Huber (1987) also suggest that four important variables include turnover, information distribution and interpretation, norms and methods of storing information, and methods for locating and retrieving information.

Andreu and Ciborra (1996) propose that the most obvious roles of information technology & information systems (IT/IS) in the organizational learning process is the component of creating capabilities. Many of the organizational routines, employed for coordinating purposes in the formation of capabilities, are information handling routines. The roles of IT/IS in learning processes are four folds: **a) IT/IS as ingredients of capabilities:** IT/IS can be part of capabilities in many ways, such as, in the form of data and information manipulation procedures, in part of well coordinated 'primary value-chain activities information subsystems', or in part of well coordinated 'support value-chain activities information subsystems' combination'. **b) IT/IS in the routinization and capability learning loops:** IT/IS can contribute to the routinization and capability learning loops in several ways, such as, support the firm's capability creation process, share work practices and facilitate communication within groups and among groups, facilitate reflection/experimentation/training on routines and work practices, and support/enable capability diffusion. **c) IT/IS in the strategic loop:** IT/IS can be instrumental in making capabilities to be core (or making them rare, valuable, difficult to imitate, and with no strategically equivalent substitutes). Some guidelines to achieve this purposes are looking out for IT/IS applications hat help make capabilities rare, concentrating on IT/IS applications that make capabilities valuable, identifying IT/IS contributions that make capabilities difficult to imitate, and concentrating on IT/IS applications with no clear strategically equivalent substitutes. **d) IT/IS supporting and communicating organizational contexts:** IT/IS can play an active role in the diffusion of knowledge and know-how relevant to capabilities throughout the organization, such as, IT/IS applications that support organizational context, communicating the organizational contexts to all levels in the organization, and IT/IS systems that help shift organizational contexts.

In conclusion, this section reviews the impacts of information technology and information management, specifically IT-based organizational learning tools (OLT), which potentially affect the creation organizational learning capabilities. Team learning, information acquisition, dissemination, sharing, and memory are major factors to create organizational learning capabilities (Hult and Ferrell, 1997; Slater and Narver, 1994; and Sinkula, 1995). In global business, technology transfer or information transfer involves with such factors. The next section will be the review of 'technology transfer in international business', which is the context of this research.

2.3. Technology-Transfer in International Business

The present research is focused on 'organizational learning capabilities, 'organizational learning process' and 'IT infrastructures related to CBT'. However, the context of this research is related to the performance of 'organizational learning capabilities'. Such performance is specifically studied in the context of technology transfer in international business. Thus, this section will review the literature in technology transfer in international business.

2.3.1. Success and Failure of Technology Transfer Affected by OLC.

'Technology' can be described in many approaches, depending on its related disciplines, e.g., science, engineering, anthropology, economics, business, strategic management (Grosse, 1996). According to Grosse (1996), technology may refer to product, process, or knowledge or information. 'Technology transfer' is the diffusion of technology from the place of its introduction to other markets around the world (Grosse, 1996). This diffusion may take place through market transactions, with one firm selling a product, process, or skill to another. Alternatively, it may be carried out within a firm through its network of affiliates (Contractor, 1989; Davidson and Mcfetridge, 1984; UNCTC, 1987).

Yoshihara (1990) specified the four interrelated human's capabilities of learning process, which closely related to effective technology transfer: acquisitive capabilities, operative capabilities, adaptive capabilities, and innovative capabilities. Furthermore, Yoshihara (1990) also identified two key players who are related to technology transfer, the recipient (transferee) of technology and the technology donor (transferor). Byars, Rue, and Zahra (1996) proposed many methods of technology transfer, related to organizational learning, such as 1) the exchange of technical information between individuals or divisions in a company, 2) the purchase of the technology, or having long-term support agreements with the technology developers.

UNCTC (1987) suggested the efficient process of technology transfer. In practical views, technology transfer may be analyzed in the national perspective or company level. A company may completing a deal of technology transfer through five steps : 1) analyzing and planning , 2) finding sources of technology, 3) evaluating sources of technology, 4) negotiating a contract, 5) writing a formal contract. UN / ESCAP (1992) proposed the alternative channels of technology transfer as, 1) the free flow of information, 2) flow accompanying the purchase of a product, 3) flow funded by a government or agency, 4) flow through a commercial contract with a technology component, 5) flow through a technology acquisition contract. Byars, Rue, and Zahra (1996) posit that technology transfer is a complex process. It requires an appreciation of the new operating environment where the technology will be produced or used. Technology transfer requires familiarity with the social system within which technology will be used.

Attention should be given to the individuals responsible for the transfer, their values, and the needs of their respective firms. These individuals often serve as the 'gatekeepers' and 'opinion leaders'. Their experience with the technology can affect its successful transfer.

Several theorist explained the emergence and potential of international technology transfer. The framework for explaining the global technology transfer was developed by Magee (1977), using the "industry technology cycle". Magee's analysis suggested that industries, in a similar fashion to Vernon's analysis of product lifecycle, proceed through a development cycle composed of three stages : invention, innovation, and standardization.

Chitrakar (1994) concluded that positive and negative factors for technology transfer are not much different from such factors for foreign direct investment. The positive factors for technology transfer can be analyzed in two dimensions, the macroeconomic and sectoral. Furthermore, the general positive factors are 1) political stability (in term of low levels of industrial disputes), 2) strategic location (and distance between two transferor and transferee), 3) trainable and qualified workforce, 4) low setting-up costs, and 5) low wages.

In conclusion, technology transfer can be analyzed in various approaches, e.g., process or product (Grosse, 1996). The process of technology transfer is much like the process of organizational learning, in that they are both related to knowledge or information flow, distribution, shared, and finally creation. The organizational learning capabilities are, thus, closely related to the success or failure of technology transfer. The success or failure of technology transfer, in view of 'organizational learning capabilities', is involved in various factors of two partners, transferees and transferors.

a) Transferee (Recipient, Receiver, Target)

In the process of technology transfer from abroad, local organizational learning capability plays a significant role in success or failure of technology transfer. This comprises the capability to acquire knowledge, the ability to manage know-how, and the skill and experience to adopt and adapt the technology transferred. Management skill and experience are the prime and crucial requirements in most transfer of technology (Tamratanaporn, 1995). Many multinational firms have found that the absorptive capability of host countries is a major problem for activities related to technology transfer. In some cases, absorptive capacity increases when local control is increasingly involved. However, it is partly the desire to increase absorptive capacity that leads to a simple asset-transfer contract becoming more complicated because a larger burden is placed on the transferring firm to ensure effective transfer. The lack of expertise in host countries will raise the costs of technology transfer and increase the benefits of internalization (Buckley and Brooke, 1992; Baronson, 1967).

The capability to absorb or organizational learning capability in transferred technology depends on 1) indigenous research and development efforts of transferees (host countries), 2) skills, capabilities,

and technological bases of transferees (host countries), and 3) commitment of transferors (Balasubramanyam, 1973). The capability to absorb and improve the acquired technology is much more important in order to ensure healthy industrial development (Shiowattana, 1990). Jeremy (1992) suggested that sources of obstacles in technology transfer are technical vocabularies, technical measuring systems, patents, and technical handbook.

Shiowattana (1990) proposed many practical examples of measuring degree of success or failure in technology transfer by using "depth" and "width" in the learning process. If a firm started from only assembly of end products and has accumulated enough technological knowledge to adapt and even to develop its end product, it can be evaluated that this firm has been successful in transferring technology and deepening its technological capability. If a firm extended from mere assembly into production of important parts or other components, it can be evaluated that this firm has been successful in transferring technology and widening its technological capability. On the other hand, if a firm only repeated the continually similar operations with no deepening or widening effects, it can be evaluated that this firm has been limited in transferring technology.

Considering the characteristics of "depth" and "width" in the learning process can help analyze the basic measurement indicating the degree of success or failure of "technology transfer". The "depth" in learning process depends on four interrelated capabilities: acquisitive, operative, adaptive, and innovative capabilities.

According to Byars, Rue, and Zahra (1996), there are several barriers to effective technology transfer within a company. Three such barriers are 1) resistance to innovations, not developed within the company, which causes the rejection of technologies developed externally (This is often called the ‘not invented here syndrome’); 2) absence of a technological gatekeeper that informs employees and managers of the availability of the technology and explains its merit (The gatekeeper performs many valuable roles, including explaining relevant technological development, connecting different parties with an interest in the technology to gain a mutual understanding, and championing emerging technology ideas); 3) complexity of the technology.

Helleiner (1975); Buckley and Brooke (1992) studied the successful absorption of foreign technology. They suggest that host country is the key to judge the success of any form of international industrial cooperation and technology transfer. However, international technology transfer can only be achieved at a cost. The minimization of the cost of transfer to transferee is a further criterion of success. There may be a trade-off between the objective of minimizing transfer cost and host-country political control of projects involving foreign technologies.

Fallenbuchl (1983) studied the East-West technology transfer to Poland, and concluded that the R&D units experienced difficulties with adjusting the newly purchased licenses to local conditions. There were shortage of experienced managers, technical personnel, and skilled workers.

The learning process had to take some time but because of the large number of new project transferred, it was impossible to prepare it carefully. There were also certain weaknesses in the absorptive capacity, which related to the country's level of economic development. These have had an adverse impact on the process of technology transfer. Fallenbuchl (1983) also suggests number of factors affected the flow of technology and its absorption or diffusion. They included the political situation and the objectives of government or political leaders, the national development strategies, the national planning and managing system, fluctuation in the local economic situation of country, macroeconomic balance, balance of payment situation, etc.

According to Fallenbuchl (1983), "technology transfer" process, leading to "technology mastery", has to gain both in "depth" and "width" of learning process. The "depth" in the learning process means a process wherein engineers, operators, scientists, or workers continually gain a deeper understanding of the technology related with them. The "depth" in the learning process depends on four interrelated capabilities: acquisitive, operative, adaptive, and innovative capabilities.

However, the "depth" in the learning process alone would not enough in "mastery of technology" because the technologies are fragmented and usually medium or low end. In other words, this learning process is limited in "width". The "width" in the learning process means extending knowledge accumulation from the existing one to related areas. In the case of developing countries, combination of "depth" in the learning process and "width" in the learning process will help create efficient "mastery of technology". This means, initially, to master technology at the peripheral, which is the part that most foreign investors bring in, and, finally, to extend its coverage closer to the core technology.

Garvin (1993) studied the ‘organization learning’ and ‘how to build a learning organization’. He suggested that a ‘learning organization’ is an organization skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights. He proposed that the building blocks of efficient ‘learning organization’ are activities in systematic problem solving, experimentation with new approaches, learning from their own experience and past history, learning from the experiences and best practices of others, and transferring knowledge quickly and efficiently throughout the organization. Some of his significant criteria in ‘measuring the learning’ are reduction in relevant cost, price, production increase, and productivity increase. He used ‘learning curves’ and ‘manufacturing progress function’ as major tools in facilitating such measuring.

Cyert and Goodman (1997) studied how to create effective university-industry alliances (UI Alliance) in order to enhance the organization learning. They suggested strategies for such purpose as: selecting a motivation problems, selecting a generalizable problems, creating team-based work, creating monitoring and redesign mechanism, building multiple activities, creating personnel linkages, creating new organization arrangements, and using information technology (IT) for the dissemination and memory of knowledge.

b) <u>Transferor</u> (Donor, origin, source)

Considering the transferors, many factors affecting success or failure of transferring technology, such as global strategies of multinational corporations (MNC), which are flexible and responsive to markets. Moreover, these strategies also influence limitation of learning process. Furthermore, the transferor's policies also affect the levels, amount, or types of technology transfer. Japanese transferors, for example, have always been accused of not being sincere and never really transferring technical know-how to the target countries (Tiralap, 1992). If the law or regulation in the host countries is strict or host governments are strong, the Japanese transferors seem to transfer technology more than usual (Tiralap, 1992). According to Dymsza (1990), a joint venture in a developing country generally involves at least three parties : the transnational corporations, the national or local partner, and the host government. Furthermore, it can also involve the home country of the transnational corporations (TNC), external financial institutions, etc. The criteria for successful joint ventures that are the cooperation those survive over a reasonable period of time, generally over eight years, and related agents perceive sufficient benefits in relation to cost. Dymsza (1990) also proposed criteria for analysis of such key success factors in joint ventures : achievement of major common goals, complementary contributions by partners, Synergies of combining the contributions of partners, entry for small and medium-sized transnational corporations (TNC), conversion of a licensing arrangement into a successful joint venture, joint management responsibilities, different degrees of allocation of managerial responsibilities, transfer pricing and joint ventures, resolution of disputes in joint ventures, etc. Furthermore, the criteria for analysis of such key failure factors were also proposed : significant different in major goals of parties, TNC's global integration and local partner's national orientation, perception of unequal benefits and costs, joint venture agreement, conflicts over decision making, managerial process and style, differences between the partners concerning marketing, transfer-pricing conflict, royalties or management fees or headquarter charges, decline in resource contribution by the transnational corporations (TNC).

2.4. Weaknesses and Gaps of the Past Research in OL. and IT.

1. There have been many studies in organizational learning and IT separately. However, the relationship of 'organizational learning capabilities' and 'IT-based organizational learning tools' (OLT) in the context of technology transfer in global business has never been empirically studied. (ABI, 1971-1999; DAO, 1961-1999)

2. Up till now, none of the research has tested the potential relationship among organizational learning capabilities, 'IT-based organizational learning tools' (OLT), and 'organizational learning process' in the context of technology transfer in global business management (ABI, 1971-1999; DAO, 1961-1999).

3. There have been many studies of 'organizational learning' which treated 'organizational learning' as the independent variable. Nevertheless, 'organizational learning', studied as the dependent variables, has not so frequently been studied and operationalized. Moreover, not many clear and efficient measures of 'organizational learning' have been researched in-depth. The present research is planned to do so by multi-disciplinarily linking various fields together, such as human resource management, information technology, organization behavior, marketing, finance, pharmacy, and strategic management (ABI, 1971-1999; DAO, 1961-1999; Miller, 1991).

4. As accepted, IT is increasingly important in the global business. Many companies have implemented IT as one of the strategic tools to enhance organizational capabilities. However, no other researchers, even Hult and Ferrell (1997), studied organizational learning capability by using variable construct as 'IT-based organizational learning tools' (OLT) (ABI, 1971-1999; DAO, 1961-1999). Thus, the present study is planned to create and test this new variable of 'IT-based organizational learning tools' (OLT) in relationship with organizational learning capabilities.

5. Up till now, the organizational learning research, which is designed to combine quasi-experimental research with survey research, and used computerized data-collection via internet or CBT, has never been conducted as in this study (ABI, 1971-1999; DAO, 1961-1999).

Conclusion

This chapter reviewed the literature and relevant theories in organizational learning, information technology, and technology transfer. Furthermore, the chapter also concluded the weaknesses of the former research and presented the gaps for the present research. This chapter of literature review bridged the past fragmented theories and constructs to the integrated research models and proposed hypotheses in the next chapter.

CHAPTER 3

RESEARCH MODEL AND HYPOTHESIS

After reviewing the literature and gaps for research questions in the previous chapter, the research model and related hypothesis were proposed in this chapter. This chapter was separated into **two** sections to present the two different models and three hypotheses. The **first** section is the first research model and hypothesis aimed to test the potential impacts of 'organizational learning tools' (OLT) on 'organizational learning capabilities' (OLC). The **second** section is the second research model and hypotheses intended to assess the relationships of 'organizational learning tools' (OLT) and 'organizational learning process' (OLP) with 'organizational learning capabilities' (OLC).

3.1. Impacts of OLT on OLC

3.1.1. Research Model-1

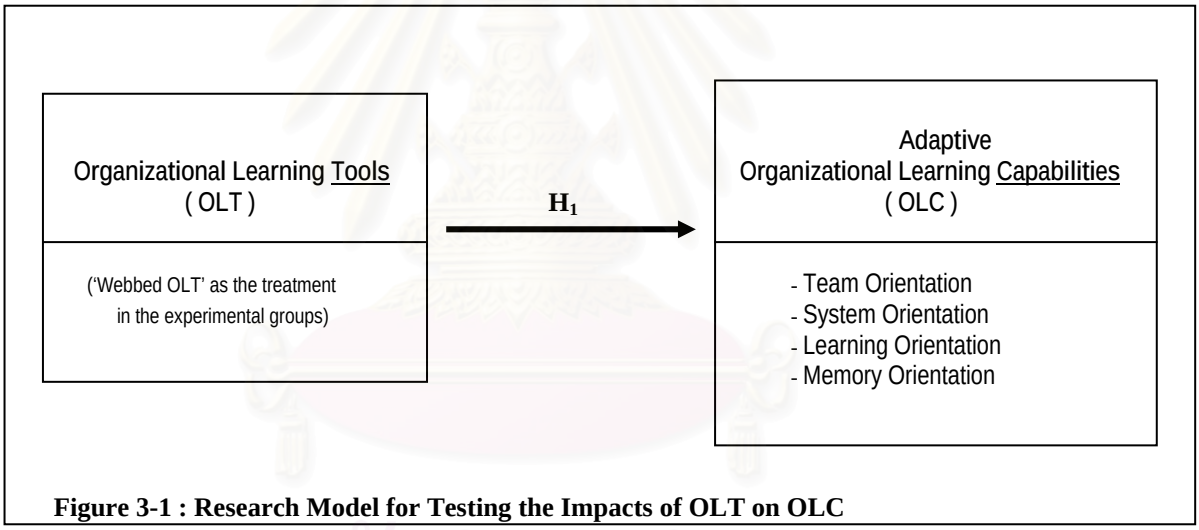

Figure 3-1 : Research Model for Testing the Impacts of OLT on OLC

3.1.2. Hypothesis

The research model to test the impacts of OLT on OLC consists of two constructs, OLT as the independent variable and OLC as the dependent variable. As mentioned in the literature review, Nanda (1996), Grant (1991), Teece, Pisano, and Shuen (1990), Prahalad and Hamel (1990), and Barney (1991) confirm that organizational resources, both tangible and intangible, if properly integrated and implemented, will potentially affect organizational capabilities and performance. In this era, IT-infrastructures are one of the important resources in any organizations. Laudon and Laudon (1998) propose the relationship of various kinds of IT-infrastructures, which help manage information and which influence organizational capabilities and performance.

Fichman and Moses (1999) also confirm that various types of information technology, specifically CBT, if properly used, will enhance the organizational learning capabilities. Thus, as shown in Figure 3-1, the research model of this thesis links the concepts of 'IT-based organizational learning tools (OLT) (Laudon and Laudon, 1998; Farrer, 1991; Christopher, 1993; Weber, 1999; Fichman and Moses, 1999; Turban, Mclean, and Wetherbe, 1998) with the concept of 'organizational learning capabilities' (Hult & Ferrell, 1997).

Organizational Learning Tools (OLT)

Information or information management is one of the important factors which influence the creation of 'organizational learning capabilities' (Slater and Narver, 1996; Sinkula, 1994; Senge, 1990; and Hult and Ferrell, 1997). Laudon and Laudon (1998) propose various kinds of information technology (IT) which directly or indirectly help facilitate efficient information management, knowledge management, and organizational performance. According to Laudon and Laudon (1998), IT-infrastructures can be classified into two groups, intra-organizational-IT-infrastructures and inter-organizational-IT-infrastructures. Both intra- and inter-organizational IT-infrastructures (hardware, software, database system, telecommunication and networking systems) can facilitate the organizations and individuals to cooperate better in working as a team, and storage of memory.

Farrer (1991) suggests various types of IT-facilities related to computer-based training to help manage organizational information and increase organizational training effectiveness. Some types of computer-based training (CBT) are computer-managed instruction, videodisc-based training, expert system and artificial intelligence, and, specifically in this research, IT-based organizational learning tools (**OLT**). Geber (1999) proposes the concepts of online learning, cyber-training, virtual classroom, and web-based training. He also suggests that web- and nonweb-based training (dynamic and static training) are both useful for organizational performance. He stresses that creating such tools is not an overnight process, but it takes some time to build and tailor these tools until they are appropriate to organizations.

Organizational Learning Capabilities (OLC.)

Organizational learning is the development of new knowledge that has the potential to influence significant behaviors of members in organizations (Sinkula, 1997; Slater and Narver, 1995). Organizations, with high organizational learning capabilities, tend to be skillful at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect new knowledge and insights (Garvin, 1993; Hult and Ferrell, 1997). Hult and Ferrell (1997) operationalize the measures of their concept of 'organizational learning capabilities' (OLC) by synthesizing the four orientations related to organizational learning. These orientations are team orientation, systems orientation, learning orientation, and memory orientation.

a). Team Orientation: Team orientation is the degree to which the corporate marketing center and the field officers or operators in the marketing unit stress collaboration and cooperation in performing their activities and in making significant decisions (Hult and Ferrell, 1997). The general principle is that the marketing unit should be able to produce better marketing result than the individual members of the marketing unit by stressing team orientation. However, often it seems that teams made up of highly intelligent employees do not 'live up to the expectations'. The reason is that they have not really learned to work together (Hult and Ferrell, 1997). In order for the marketing team to function effectively, a dialogue must exist among members focused on sharing assumptions, thinking together to solve problems, and charting the future operations of the organization (Senge, 1990). Thinking together fosters a climate focused on creating a genuine vision, subsequently leading to excellence and learning because the employees feel that they are pursuing their own goals (Sinkula, 1994). As such, each organizational member has an input in the process of creating, developing, and implementing a team orientation that leads to a commonality of direction and the harmonization of individuals' energy.

b). Systems Orientation: System orientation is the degree to which the corporate marketing center and the SBU field officers or operators in the marketing unit stress the broad 'picture' of the activities in the marketing process and thus a reason certain activities exist : 'system thinking is a discipline for seeing the wholes' (Hult and Ferrell, 1997; Senge, 1990). A systems orientation focuses on structuring and making sense of the multiple marketing inputs from the environment, the organization, the immediate work group, the task, relationships will colleagues, and outputs in terms of performance and satisfaction in relation to the broad 'picture' created by these multiple inputs. In addition, a systems orientation fuses the other three orientations into a coherent whole identified as the 'fifth discipline' by Senge(1990) (Slater and Narver, 1995; Hult and Ferrell, 1997).

c). Learning Orientation: Learning orientation is the degree to which the corporate marketing center and the SBU field officers or operators in the marketing unit stress the value of organizational learning for the long-term benefits of the marketing process and the specific marketing unit (Hult and Ferrell, 1997). Thus, an important component of organization learning is the set of fundamental axioms or truths that the organization hold regarding the value it places on learning orientation. Norman (1985) notes that every organization learns, and every organization has a set of dominating ideas. They may be more or less consciously formulated and visible, and they may represent good or bad interpretations of what has led to success or failure. Senge (1990) also states that this is due to the concept of mental model. Developing an organization's capacity to work within the environment of a high degree of learning orientation requires both learning new skills and implementing an institutional climate that helps bring these skills into a regular practice (Slater and Narver, 1995). Learning orientation relates to the subprocess of information dissemination. Thus, learning orientation builds on the notion that a learning organization improves its understanding of the environment over time, a prerequisite of which is 'a culture amenable to learning'. This includes the ability to think, to reason, to disseminate, to diffuse, and to transfer the subsequent thoughts to organizational members (Tobin, 1993).

. **d). Memory Orientation:** Memory orientation is the degree to which the corporate marketing center and the SBU field officers or operators in the marketing unit stress communication, distribution, or transfer of marketing knowledge (Hult and Ferrell, 1997). The means of achieving a climate where organizational memory is readily accessible vary. It is a natural tendency to trivialize routine learning activities because they arise so frequently, routines are a critical part of 'communicating learning beyond the individual who discovers it' (Slater and Narver, 1995). Related to this notion, Cohen (1991) explores organizations as 'processing information to learn and apply skilled routines'. However, once the routine is in place, substantial barriers to information could contradict it. In this regard, a memory orientation is identified largely with the subprocess of information acquisition (Sinkula, 1994). A memory orientation incorporates the idea that by repeatedly performing a set of activities, organizational members develop a knowledge base of those activities (e.g., routine) and a means for performing better the next time. The individual member's experience leads to the modification of organizational knowledge, and thus, to a better understanding of the interactions between the organizational systems and the environment (Hult and Ferrell, 1997). Thus, the proposed hypothesis related to impacts of OLT on OLC is as follows.

H_1 : Organizations, which are exposed to organizational learning tools, have higher adaptive organizational learning capabilities than organizations without such exposure.

3.2. Relationships of OLT and OLP with OLC

3.2.1. Research Model-2

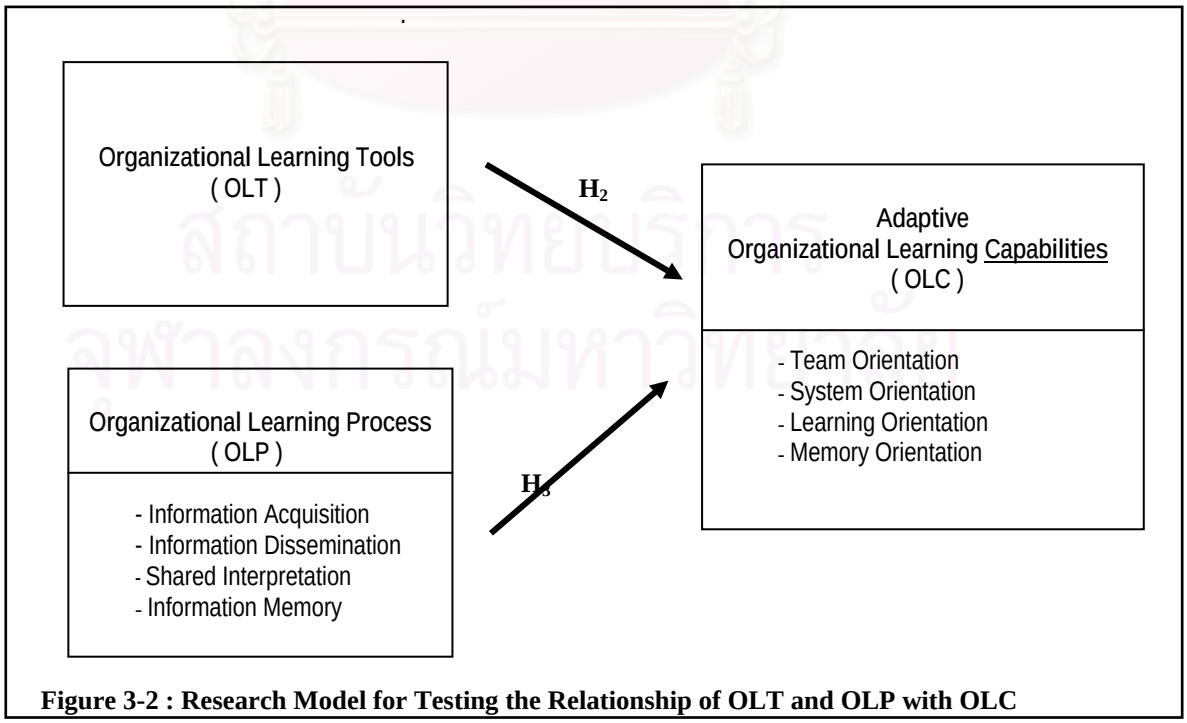

Figure 3-2 : Research Model for Testing the Relationship of OLT and OLP with OLC

3.2.2. Hypothesis

The research model to assess the relationships of OLT and OLP with OLC consists of three constructs, OLT and OLP as the independent variables and OLC as the dependent variable. As mentioned earlier, tangible or intangible organizational resources, potentially affect organizational capabilities and performance (Nanda, 1996; Grant, 1991, Teece, Pisano, and Shuen, 1990; Prahalad and Hamel, 1990; and Barney, 1991). OLT, or IT-infrastructures, are tangible resources while OLP, or organization process, is intangible resource.

Slater and Narver (1995) and Sinkula (1994) prove that their construct of OLP (organizational learning process) is mostly related to appropriate management of relevant information (information acquisition, information dissemination, information sharing, and memory of information). They also confirm that organizational learning process, if properly managed, will positively impact on organizational learning capabilities. So, the 'organizational learning process' is integrated in my research model as the independent variable, which potentially related to the dependent variable of 'organizational learning capabilities'. Moreover, the linkage of concept of OLT and OLC are reasoned in the last section (pp. 26-28). Thus, the potential relationship of OLT on OLC can be proposed as in the following hypotheses.

H_2 : Organizational learning tools have positive relationship with adaptive organizational learning capabilities.

Organizational Learning Process (OLP.)

'Organizational learning process' is the development process of new knowledge that has the potential to influence behavior (Sinkula, 1997; Slater and Narver, 1995). Adaptive organizational learning, which is the most fundamental form of learning occurs within a set of recognized and unrecognized constraints that reflect the organization's assumptions about its environment and itself (Senge, 1990). The learning boundaries constrains organizational learning, which is sequential, incremental, and focused on issues or opportunities that are within the traditional scope of the organization's activities (Slater and Narver, 1995). The process of organizational learning refers to the capability of an organization to transfer, integrate, and utilize information and expertise developed in various organization-networks to all other parts of organization (Hult and Ferrell, 1997). The process of organizational learning includes a) information acquisition, b) information dissemination, c) shared interpretation, and d) organizational memory (Slater and Narver, 1995; Sinkula, 1997).

a). Information Acquisition: Information may be acquired from direct experience, the experiences of others, or organizational memory. The learning curve, or experience curve, shows the clear illustration of acquiring knowledge from internally-focused experience (termed 'exploitation') and from externally focused experience (termed 'exploration').

Organizations must balance between learning from exploitation and exploration (March, 1991). Learning from others encompasses common practices, such as benchmarking, forming joint ventures, networking, making strategic alliances, and working with customers (Kanter, 1989). Learning from others also includes providing continuing education or training. Effective managers establish multiple credible internal and external sources to obtain objective information about their enterprise and environments. They search beyond their organization's formal information systems, fearing them to be too historical, tradition bound, or extrapolative to expose fundamental shifts in the market or organization. To avoid the adaptive learning trap, executives ensure that their networks include people with different perspectives from those who are dominant in the organization.

b). Information Dissemination: Organizational learning is closely related to personal learning by information dissemination and accomplishing a shared interpretation of the information (Sinkula, 1997). Effective disseminating or sharing information value when each piece of information can be seen in its broader context by all organizational players who might use or be affected by it and who are able to feedback questions, amplifications, or modifications that provide new insights to the sender (Glazer, 1991). When organizations remove the functional barriers that impede the flow of information from one unit to other units, they improve the organization's ability to make rapid decisions and execute them effectively. Increasingly, organizations encourage information sharing in the development process by sending people from multiple functions on customer visits. Not only does this stimulate real-time information sharing, but it also generally increases the quality of the information gathered (Mohr, 1994).

c). Shared Interpretation: For organizational learning to occur in any business units, there must be a consensus on the meaning of the information and its implications for that business (Day, 1994). High performing firms in dynamic and complex market strive for consensus to ensure effective strategy implementation. However, prior to achieving consensus, organizations may benefit from a high level of disagreement in assessing relative importance of company objectives and competitive methods. These requires balancing the need for rapid decision making with the need to consider carefully ramifications of alternative action plans through effective conflict resolution processes (Argyris and Schon, 1978). Effective conflict resolution may require the use of structured processes for surfacing disagreement, because allowing disagreement to surface informally may cause it to become emotional and adversarial and create long-term rifts among key members of the management team. By exposing new information to multiple interpretations using programmed techniques such as dialectical inquiry and devil' s advocacy, and developing alternative action plans for constructive discussion, new insights leading to generative learning may be developed in a positive atmosphere (Argyris and Schon, 1978). Conflict resolution is enhanced by the development of group norms that encourage open sharing of information and remove constraints on information and communication flows. To ensure that all information is considered, organizations must provide forums for information exchange and discussion.

This communication may occur through liaison positions, integrator roles, matrix organizations, face-to-face contact in meetings and on task forces, or utilization of information technology to create organization bulletin boards on topics such as competitive activity or technology development. The more uncertain the problem or opportunity, the more desirable it is to have higher frequency and informality in communication patterns (Argyris and Schon, 1978; Kanter, 1989).

d). Organizational memory: Organizational memory is any forms or methods of recording or keeping the knowledge, know-how, technology, etc created in organization. If there was no organizational memory, learning would have a relatively short half-life because of personnel turnover and the passage of time (Sinkula, 1994). Organizational memory is particularly important in this era of restructuring and reliance on temporary or contract workers. It is essential that important knowledge be codified or recorded in information systems, operating procedures, white papers, mission statements, organizational stories, or routines. The extent to which these memories are used will determine how long the memory should persist. However, these memories may constrain generative learning or even encourage ineffective learning if they focus on the organization inappropriately (March, 1991). Thus, the proposed hypothesis related to OLP and OLC will be as follows.

H_3 : Organizational learning process has positive relationship with adaptive organizational learning capabilities.

Conclusion

This chapter presented two separated models and proposed three hypotheses. One research model was aimed to test the impacts of OLT on OLC, while another was intended to assess the relationships of OLT and OLP with OLC. The research methodologies for testing the research models and proposed hypotheses will be described in the next chapter.

CHAPTER 4

RESEARCH METHODOLOGY

In the present study, the research process consists of research research and empirical research. The **research research** was studied in two approaches, doing the literature review and developing research framework and related hypothesis in the former chapters. In Chapter 2, related definitions, theories, and important aspects were elaborated in order to build the theoretical framework for the research. After that, the hypothesis linked with the research framework was presented in Chapter 3 and the research methodology (in this chapter) was prospected to complete the research process. This chapter focuses on the methodology for **empirical research**, which was performed after the research research. The chapter is organized into two sections, the operationalization of variable constructs (Section 4.1) and the research design (Section 4.2).

4.1 Construct Operationalization

From the research models in the previous chapter, there were three variables involved. One dependent variable of **OLC** (organizational learning capability) and two independent variables of **OLT** (organizational learning tools) and **OLP** (organizational learning process).

a). Dependent Variable : Measure of 'Organizational Learning Capability' (OLC.)

'Organizational learning capability' is defined as the ability, capability, competence, and resources to improve actions or performance through better knowledge and understanding. Organization learning capability is believed to occur through shared insights, knowledge, and mental models and builds on past knowledge and experience on memory (Fiol and Lyles, 1985; Stata, 1989; Hult and Ferrel, 1997). 'Organizational learning capability' is a multidimensional construct characterized by being composed of disciplines, orientations, foundations, skills, elements, or 'checklist' (Senge, 1990; Hult and Ferrell, 1997; Tobin, 1993; McKee, 1992; Slater and Narver, 1994; Galer and Heijden, 1992). Hult and Ferrell (1997) propose measures of 'organizational learning capability' including above qualifications. In their research, they have tested the reliability and validity of such measures statistically. So, following the measures of Hult and Ferrell (1997), the OLC measures were operationalized as follows.

Subjective Measurement of **OLC** (Hult and Ferrel, 1997) (Details are in Appendix II and III) The OLC was measured by five-point rating-scale of the four constructs (team orientation, systems orientation, learning orientation, and memory orientation). Based on the items of such four constructs, respondents rated the five-point scale (1 = strongly agree, 2 = somewhat agree, 3 = not sure, 4 = somewhat disagree, and 5 = strongly disagree).

Objective Measurement of **OLC** The OLC was measured by two different approaches related to orientations of team, system, learning, and organizational memory. One was measured by the test-scores in new product knowledge (this knowledge was transferred from transferor) (Bearden, 1995; ASTD, 1999), and another was measured by the rate of success in new product launching (which was not seasonal product) (Bearden, 1995).

b). Independent Variable: Measure of 'Organizational Learning Process' (OLP.)

Organizational learning process is a four-stage process that includes information acquisition, information dissemination, shared interpretation, and organization memory (Slater and Narver, 1995,1997; Sinkula, 1994). The organizational learning process is one important factor, which influence the organizational learning capability (Hult and Ferrell, 1997). The creation of such process depends on various organizational factors, both inside and outside organization (Slater and Narver, 1995; Hult and Ferrell, 1997).

Subjective Measurement of **OLP** (Slater and Narver, 1995; Hult and Ferrel, 1997) (Details are in Appendix III) The OLP was measured by five-point rating-scale of the four constructs (information acquisition, information dissemination, shared interpretation, and organizational memory). Based on the items of such four constructs, respondents rated the five-point scale (1 = strongly agree, 2 = somewhat agree, 3 = not sure, 4 = somewhat disagree, and 5 = strongly disagree).

c). Independent Variable: Measure of 'IT-based organizational learning tools' (OLT.)

The construct of OLT was measured subjectively and objectively, as follows.

Subjective Measurement of **OLT** (Laudon and Laudon, 1998) (Details are in Appendix III) The OLT was measured by five-point rating-scale of the perceptions and judgements related to IT-based organizational learning tools (OLT) in the subjects' organizations. Based on the items of such four constructs, respondents rated the five-point scale (1 = strongly agree, 2 = somewhat agree, 3 = not sure, 4 = somewhat disagree, and 5 = strongly disagree).

Objective Measurement of **OLT** The OLT was measured by organization assets (hardware/software/other related technologies; intra- and inter- or connected-organizations), spending on IT-based organizational learning tools (OLT), and number of personnel related IT or CBT. All data was collected by total volume, by growth, by month, by quarter, and by year) (Laudon and Laudon, 1998).

Practically, the operationalization of measures for all related variables and their relationships with question-items in the questionnaire were summarized in Table 4-1.

Variables	Operationalization	Description	Questionnaire
a.) Organizational Learning Capabilities (OLC) (Dependent variables) (The **OLC** is capabilities of organizations to learn via the contexts of technology transfer in subsidiaries of the pharmaceutical MNCs from the triads.)	• Subjective measures : Perceived values of 4 constructs. 1. Team orientation 2. System orientation 3. Learning orientation 4. Memory orientation • Objective measures : 5. Scores from new-product-knowledge tests 6. Rate of success in sales of new-product launching	The degree to which employees stress cooperation in performing some activities. The degree to which employees stress the broad 'picture' or seeing 'the whole' of significant activities. The degree to which employees stress the value of organizational learning for the long-term benefits. The degree to which employees stress distribution, transfer, restore the organizational knowledge. Percentage of scores of knowledge related to new launching products within one year. Percentage of success in sales of new launching products within one year.	Part A. Section 1 (11 items) Part A. Section 2 (5 items) Part A. Section 3 (5 items) Part A. Section 4 (4 items) Part A. Section 5 (2 items) Part A. Section 6 (2 items)
b.) Organizational Learning Process (OLP) (Independent variables) (The **OLP** is organizational processes, related to information management, potentially implemented to create OLC.)	• Subjective measures : Perceived values of 4 constructs. 1. Information acquisition 2. Information dissemination 3. Shared interpretation 4. Information memory	Process of collection / acquisition of organizational knowledge that influence performances. Process of distribution organizational knowledge within / among other units in the organization. Process of evaluation / assessment of organizational knowledge in the organization. Process of storage / keeping of organizational knowledge in the organization.	Part B. Section 1 (8 items) Part B. Section 2 (6 items) Part B. Section 3 (9 items) Part B. Section 4 (5 items)
c.) Organizational Learning Tools (OLT) (Independent variables) (The **OLT** is IT-based infrastructures or CBT (web or non-web) used in organizations to potentially facilitate the creation of OLC.)	• Objective measures : 1. Assets, spendings, personnel related to OLT. • Subjective measures : 2. Perception of development or increase in OLT.	Values of assets, spendings, personnel related to OLT infrastructures in organization within one year. Perceived values of development or increase in OLT infrastructures in organization within one year.	Part C. Section 1 (3 items) Part C. Section 2 (10 items)

Table 4-1: Summary of variables and related questionnaire-items used in the present research

(CBT: Computer-based training; IT: Information technology; OLC : Organizational learning capabilities; OLT: Organizational learning tools; OLP : Organizational learning process; OL : Organizational learning)

4.2. Research Design

4.2.1. Selection of Industry and Research Frame

Pharmaceutical Industry

Wortzel and Wortzel (1997) define 'knowledge-intensive industry' as groups of businesses (firms) which major costs of doing business do not depend on labor cost, but on specific or tacit technologies, know-how, knowledge, competency, capabilities. One of the main costs of such industry is expense on research and development (R&D) aimed to search for new knowledge or innovation. Examples of knowledge-intensive industries are pharmaceutical industry, biochemical industry, food-processing industry, genetically-modified food industry, electronic industry, computer hardware, software, and network industries, telecommunication industry, space and aircraft industries, business-consulting-service industry.

This research studied in the pharmaceutical industry, which is one of the knowledge-intensive industries. There were **pros** and **cons** of doing research in only a single industry. The **pros** were the ease of controlling some intervening variables or confounding factors, which are potentially caused by effects of different industries. If studied in many industries, the organizational learning capabilities, organizational learning process, IT-infrastructures, and technology transfer in different industries could be significantly varied because of the competitive characteristics of the different industries. If we could focus on only one industry, the research process will be less confounded and much easier. The potential results from the research were less-intervened, that is more valid and reliable. Comparing to other labor-intensive and knowledge-intensive industries, pharmaceutical industry is the knowledge-intensive industry, which is more practical to implement the concepts of organizational learning and technology transfer. Moreover, Nachmias and Nachmias (1997) suggested that researcher, if possible, should have experience or be specialized in research issues to create quality research. The researcher of this study had some experience in the pharmaceutical industry for about fifteen years, and this was potentially be the strength for this research as suggested. The **cons** of focusing on only one industry was the partially loss of power of generalization in research results. However, implementing the triangulation concept (Nachmias and Nachmias, 1997) could partly compensate such disadvantage. Though focusing on only one industry, it didn't mean that we would entirely lose all generalization power of the results to other industries. There are some hi-tech industries (knowledge-intensive industries) that have the same or common characteristics as pharmaceutical industry (Wortzel and Wortzel, 1997). Thus, we could partly generalize the results of the present research to such industries (e.g., biotechnology industry, chemical industry, food-processing industry, genetically-modified food industry, electronic industry, telecommunication industry, or computer hardware, software, network industries).

4.2.2. Triangulation Concept and Data Collection

Nachmias and Nachmias (1997) define the concept of '**triangulation**' as method, which relies on more than one form of data collection in testing the hypothesis. They confirm that using two or more methods of data collection (e.g., questionnaire survey, experimental research, or case study research) to test hypothesis will minimize the degree of specificity of certain methods to particular bodies of knowledge. This means that generalization of knowledge from research will not specifically depend on any methods of data collection. The present research implemented the concept of triangulation by combining two different types of data collection in order to test two different research models and two groups of corresponding hypothesis, as described in the next section.

4.2.3. *Data Collection*

To implement the triangulation concept, this research performed two methods of data collection, quasi-experimental research and survey (cross-sectional research) (Campbell and Stanley, 1969; Cook and Campbell, 1979; Nachmias and Nachmias, 1997; Burke and Baldwin, 1999; Leowarin, 1999). The **reason** for triangulation of quasi-experimentation and survey is to increase validity of the research results (Nachmias and Nachmias, 1997). According to Nachmias and Nachmias (1997), both methods have their strengths and weaknesses. Quasi-experimentation, though yields the research results with higher internal validity and more firmly causal-inference, it does not ensure higher external validity. On the other hand, survey research produces results with higher external validity, but it does not prove causal-inference and bears lower internal validity. Thus, triangulation of results of both methods helps compensate the weaknesses and enhance strengths of the two. In other words, the power of generalization of the research results is increased while maintained internal validity. In details, the data collection methods of this research were separated into three phases, as summarized in Table 4-2. Details of the three phases are also discussed as follows.

Phase	Study	Subjects	Number of Companies
I	**Preliminary study** Study unit **Pilot study / pre-testing questionnaires** Study units	**Middle managers** = 2 managers **Middle managers** = 5 managers	1 3
II	**Quasi-experimentation** Experimental units	**Middle managers** = 82 managers in exp. units. = 41 managers in cont. units	123 (82 + 41)
III	**Survey** Sampling units	**Top executives** = 123 top-executives	123

Table 4-2: Summary of the Three Phases of Data Collection Methods

Phase I: Preliminary Study and Pilot Study

Preliminary Study

This phase was started with doing the preliminary-study by interviewing middle managers in a pharmaceutical company (Astra Company, which the researcher used to work for). The marketing unit was interviewed in the context of OLC in marketing process of the corporation.

The observational method was also used, in visiting the worksite or fieldwork of the marketing staff. The major goals of this 'process' is to verify and validate the OLC constructs and search for some new constructs which specifically appropriate to Thai firms. Various organizational learning conceptualizations were then examined for similarities. In doing so, this preliminary study helped trim redundant elements, elements that are not viewed as meaningful in practice. This process leads to the construct of organizational learning capabilities that includes various 'orientations' which will be presented for learning to occur at the organizational level.

Pilot Study

The pretest was conducted to assess the quality, face validity, and content validity of the measurement items in the questionnaire. A questionnaire containing properties of measures was administered to some experts (scholars in universities or executives / managers in pharmaceutical companies) with knowledge of or working experience with organizational learning and marketing concepts. They were asked to complete the questionnaire and point out any item that was either ambiguous or otherwise difficult to answer. A stringent a priori decision rule was specified retaining an item only if all the judges consider the item to be easily understandable and capturing the specific OLC construct. Based on detailed comments, some items were modified and other were eliminated. This resulted in some items of pretested scale.

After completing the initial pretest, the experts were asked to critically evaluate each item relative to its assigned OLC orientation to provide a verification of the content validity (face validity and sampling validity) and construct validity of the scale items. Again, the respondents were also asked to identify any item that was ambiguous or difficult to answer in this evaluation. This resulted in the items ready to prepare the questionnaire for performing quasi-experimentation and survey, described in the next phases.

Phase II: Quasi-Experimentation

Quasi-experimental research is the research-design which compromise the limitations between cross-sectional research and classic (true) experimental research. Quasi-experimental research-design is superior to cross-sectional research because they usually involve the study of more than one sample over an extended period of time, and also ensure the causal inference and time-sequence of events (Nachmias and Nachmias, 1997). Quasi-experimental research is different from classic (true) experimental research, in that quasi-experimental research need no fully randomized assignment of individual cases to the comparison groups (Cook and Campbell, 1979). The Quasi-experimental research design is appropriate for social research because researcher can relax some strictly controllable criteria, e.g., sex, age, comparing to classic (true) experimental research (Cook and Campbell, 1979; Nachmias and Nachmias, 1997).

The specific design of quasi-experimental process conducted in this research was the non-equivalent control group design (pretest-posttest non-randomized, with repeated measurement) (Campbell and Stanley, 1969; Cook and Campbell, 1979; Nachmias and Nachmias, 1997; Burke and Baldwin, 1999; SPSS, Inc., 1999; Leowarin, 1999), as shown in Figure 4-1. The quasi-experimental design was separated into three periods, the pre-treatment period, the treatment period, and the post-treatment period, as in the following description (Cook and Campbell, 1979; Leowarin, 1999).

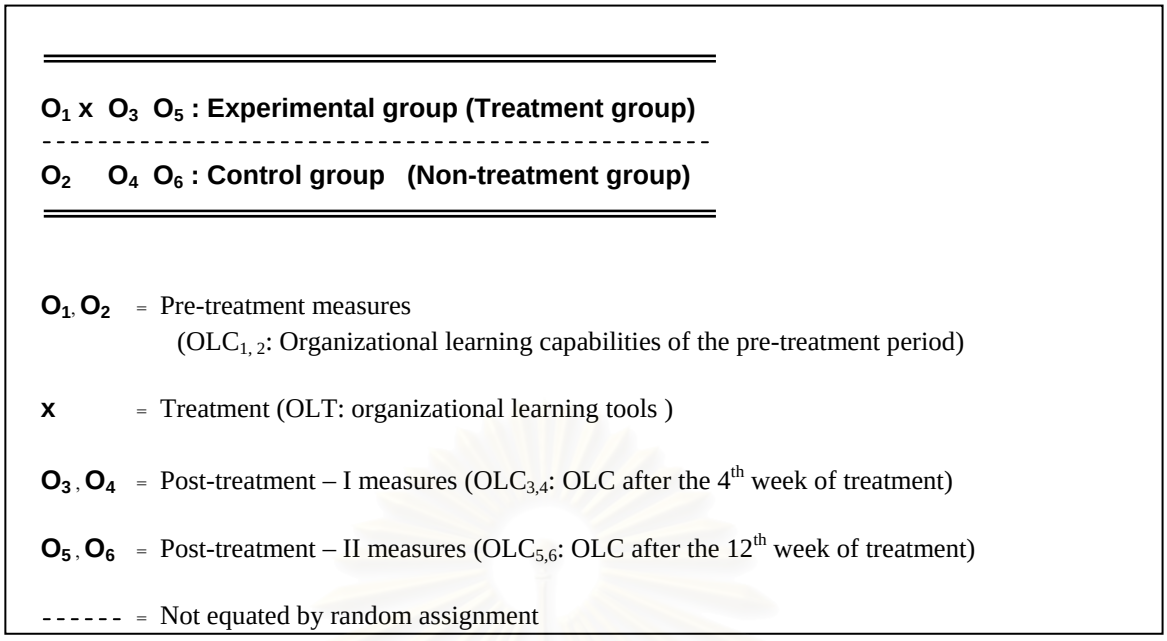

Figure 4-1: Pattern of quasi-experimentation implemented in this research

a.) Pre-Treatment Period

Following Leowarin (1999) and Cook and Campbell (1979), the quasi-experimental design in this study started with the pre-treatment period (the 1st week before treatment). The experimental units of this research were all Thai subsidiaries (= 127 companies) of US., European, and Japanese pharmaceutical multinational companies (Sources: Thai-FDA: Department in Ministry of Public Health, and TIMS, 1999). All companies had subsidiaries or distributor-offices, which were supported and transferred technology from their mother-companies. Furthermore, all companies had IT-infrastructures (web- or non-web-IT-infrastructures). Unit of analysis in this research was the company (firm) level. The quasi-experimental research was aimed at the middle managers in each company, and the average of responses from 2-3 middle managers from each team was analyzed. Four companies (1+3) of the experimental units were used for the preliminary study and pre-testing in the first phase. So, the numbers of experimental units left for the pre-treatment period were 123 companies.

All middle managers in the 123 companies were asked to complete the questionnaire. The questionnaire was designed to be filled electronically via the Internet (http://www.utcc.ac.th/itol) and all responses were directed to pose back to the server of the researcher (University of the Thai Chamber of Commerce). This data was saved as text-files in the server and sent from server managers to the researcher via the E-mail. Only the recruited subject companies were able to access this website of electronic questionnaire through pre-assigned password given by the researcher. The password was changed after the first pre-treatment period had finished. (Details of this questionnaire are shown in Appendix VII).

There were some tips for effectively convince target subjects to join this research project. These tips were their opportunity to create their team-organizational-learning-capabilities without cost, their chance to have free supervision of creating organizational learning capabilities from the researcher, and their right to receive incentives from the researcher (incentives consisted of a full set of CD-ROM titled 'Organizational Learning Development Program and Sales Management Productivity Development' after finishing the project at the end of 12th week).

Some data from the questionnaire (e.g., size of company, IT assets and spendings) was used as criteria for purposively dividing subject companies into two groups, control and experimental (Leowarin, 1999; Cook and Campbell, 1979; Nachmias and Nachmias, 1997). In order to achieve equivalent size of companies and to avoid the bias from assignment in both control and experimental groups, the 123 companies were randomly assigned to be experimental or control units by using criteria of their size of companies and size of IT-assets (Leowarin, 1999). The 123 units were randomly selected and separated into two groups by using 'Table of random number' as guided by Nachmias and Nachmias (1997) and Cook and Campbell (1979). The ratio of random selection from 123 companies was 2:1, that was experimental groups = 82 companies and control groups = 41 companies. The reason for choosing ratio of 2:1, instead of 1:1 or other ratios, was that the number of subjects were only 123 companies. Thus, increasing the number of companies in experimental groups would increase our power to study the prospected details of the experimental subjects.

The advantage of this random assignment before the treatment period was that we could ensure to have homogeneous subjects, thus reducing bias in both experimental and control groups (Cook and Campbell, 1979). Subjects in both experimental and control groups were middle managers (e.g., supervisors, product managers, sales managers). Moreover, all subjects in all companies were strictly directed not to contact, consult, or discuss any materials or methodologies among companies or inside their companies (Cook and Campbell, 1979). Data from this pre-treatment period was collected and analyzed in relation with the treatment period and post-treatment period described in the next sections.

b.) Treatment Period

After the pre-treatment, the companies in the experimental groups were given other different passwords to access to the **online-CBT (computer-based training)** program. This CBT-program **consisted** of modules of lessons, tests, workshop, and questionnaire designed to help motivate subject to create organizational learning capabilities.

Content in the CBT For the Experimental Groups (Treatment)		Content in the CBT For the Control Groups (Placebo)	
Questionnaire: Pre-treatment	(paper)	Questionnaire: Pre-treatment	(paper)
Instruction Manual	(electronic)	Instruction Manual	(electronic)
1. Chapter I: Theories & tests (OLC/OLP)	(electronic)	**1.** -	(no treatment)
2. Chapter II: Theories & tests (OLT)	(electronic)	**2.** -	(no treatment)
3. Chapter III: Implementation	(electronic)	**3.** -	(no treatment)
4. Chapter IV: Workshop-A	(electronic)	**4.** -	(no treatment)
5. Chapter V: Workshop-B	(electronic)	**5.** -	(no treatment)
Questionnaire: Post treatment	(electronic)	Questionnaire: Post treatment	(electronic)

Table 4-3: Comparison of Content in the CBT[1] for the Experimental and the Control Groups

('electronic' means computer program of CBT produced in a CD-ROM version or web version used as the treatment)

Along with the treated CBT used with the companies in the experimental groups, the companies in the control groups were told other different passwords to access the online "**placebo**" program which consisted of the same questionnaire as the experimental groups but no online-CBT program like the experimental groups (Table 4-3). All subject companies were strictly directed not to contact or consult other people in the same company or other companies. All subjects in both groups were left to study and follow the instructions, activities, and tests as directed in the OLT Development (online-CBT) Program. Subjects in the experimental groups were exposed to each section of theories and workshop at their speeds of learning. All subjects could pose their questions via the Internet to the researcher. If the answer could not be described via the Internet, the subjects were told to contact the researcher by phone. The responses of filled questionnaire from subjects were sent to the researcher (server at UTCC.) via the Internet as scheduled in the direction.

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1 At the period of preliminary study, the CBT in CD-ROM version was tried and tested with some companies. This CD-ROM worked very well, but it was costly and time-consuming to produce and send to all target subjects. The CD-ROM version was the static media and not easy to change the content inside. Moreover, complications in setting up the hardwares of target subjects appropriate for the CD-ROM version (e.g., monitor resolution, operating systems) took much time and care to complete the research project. So, the researcher decided to change the method of distribution but maintain the same contents unchanged. The researcher converted all contents in the CD-ROM version into the online (web) version (website in the Internet) without changing any contents inside. The online (web) version cost much less money and less time to reproduce than the CD-ROM version. Moreover, the online version is dynamic to change the contents by updating at the computer server while the CD-ROM version is not possible to change the contents inside after burning the CD. This conversion was operated by the computer programs of Authorware 4.0, FrontPage 2000, DreamWeaver 3.0, CourseBuilder 1.0, and PhotoImpact 5.0.

(CBT: Computer-Based Training; CD-ROM: Compact Disc-Read Only Memory)

The prospected periods of responses were four weeks and twelve weeks. The reason for choosing milestones of 4th week and 12th week is to standardize the duration of sales-performance evaluation in all companies (Miller, 1991). The personal e-mail from the researcher (by CC-Mail) to subjects was one of the effective tools to prevent them from being lazy or fading out from the project.

c.) Post-Treatment Period

At the end of 12th week, the subjects were asked to answer the questionnaire again in order to compare their organizational learning capabilities with the first two measures (from the pre-treatment and treatment periods). All the three sets of data from experimental subjects and control subjects were analyzed by statistical technique called MANOVA.

Phase III: Survey Research

After the quasi-experimental research (at the end of 12th week), the survey research was conducted by using the modified questionnaire administered to the top executives (the managing directors or the marketing directors of the subject companies). The researcher did this survey research himself. Some top executives were interviewed face-to-face but some were surveyed by telephone (because some of them were so busy to be appointed for face-to-face interview).

Sampling Frame, Sampling Methods, and Sample Size in Survey Research

Thai subsidiaries of pharmaceutical multinational companies were used as the population. The sampling frame for survey research was the Thai subsidiaries of the US, European, and Japanese pharmaceutical multinational companies situated in Thailand. This study used census by questionnaire survey of all pharmaceutical companies from the official lists of Thai-FDA. The total sample size in this study was 127 companies, which were equal to population. According to Hair (1998), canonical correlation technique requires 10 samples for each variable. There are nine variables in the model, so this exceeds the guideline of requirement for number of samples in canonical correlation analysis. The survey research was targeted at each of the only top-executive in the same companies as in the quasi-experimentation. (Four companies (1+3) of the experimental units were used for the preliminary study and pre-testing in the first phase. So, the number of experimental units left for the second phase was 123 companies).

Most top executives in this survey cooperated very well because of the personal relationship with the researcher (most of them are pharmacists and the researcher is also a pharmacist who used to work in the pharmaceutical industry for about 14 years). Moreover, all top executives (in experimental and control groups) were not be able to skipped this survey because the researcher set the agreement that top executives had to finish this survey before receiving the incentives.

The incentives consist of complete set of CBT in organizational learning development program and conclusive results of this research. Technically, all top executives were convinced that one key success factor of creating organizational learning capabilities in companies was 'leadership commitment and cooperation'.

4.2.4. Research Instruments

In the present study, the researcher used four different research instruments as follows.

a) Interviews in Preliminary Study

Personal depth-interviews (semi-structured) were performed as a preliminary study and pretest of the questionnaire. The target subjects were seven managers of selected companies and three specialists in universities. This helped create the content validity of related variables (Nachmias and Nachmias, 1997) and also helped improve the questionnaire.

b) Questionnaire

In the quasi-experimental phase, the electronically built-in questionnaire in the online-CBT (web-CBT) was used. But in the survey phase, the paper-printed questionnaire was used. The questionnaire consisted of two sections. The first section was designed to identify respondent's personal data (individual, team, and company data). The second section was aimed to retrieve data involved in variable constructs in the model and proposed hypothesis. The major contents in the questionnaires used in the three periods of quasi-experimentation (1^{st}, 4^{th} , and 12^{th} week) were the same, but were slightly modified in formats or wordings to prevent the subjects from memorize the questionnaire after repeating the tests for three times. This helped improve the threat to internal validity (Nachmias and Nachmias, 1997). The major contents in the paper-printed questionnaire, which was aimed to survey top executives at the end of 12^{th} week, were adjusted to test different model and hypothesis (as discussed in Chapter 3) and also to 'triangulate' the data from quasi-experimentation (Nachmias and Nachmias, 1997).

Most of the top executives were interviewed by telephone, except for a few were interviewed face-to-face. All subjects in quasi-experimentation or respondents in survey were managers, directors, or top-executives of the multinational companies who always use English language as the media of communication. So, the language used in the questionnaire was English only. This would help reduce potential error from English-Thai language translation or error from reversed-translation (Nachmias and Nachmias, 1997).

c) Computer-Based Training (CBT) Programs

The computer-based training (CBT) programs were used as the treatment in quasi-experimental research. This CBT were non-web-CBT (CD-ROM version) and web-CBT (online version), which were developed by the researcher. Such CBT program was aimed to be the treatment for subjects to expose the source of knowledge for creating organizational learning capabilities.

4.2.5. *Response Rate*

There were two groups of responses from two data collection methods, quasi-experimentation and survey. In the first group of quasi-experimentation, responses consisted of three subgroups of data, which were collected three times at the **1st** Week, **4th** Week, and **12th** Week (from middle managers). In the second of survey, responses were composed of data, which was collected once at the end of **12th** Week (from top executives in the same companies).

In the quasi-experimentation, at the **1st Week** of pretesting, 108 companies (73+35) out of expected 123 companies (82+41) were willing to join this research project and started to perform the pretesting. However, 15 companies (9+6) denied to participate in this project because they were quite busy in closing their quarter-sales and the researcher had no personal relationship to follow-up thoroughly. The computerized data were collected from the web-server (at the University of the Thai Chamber of Commerce). Thus, the response rate at the **1st** Week of pretreatment is 87.8%.

At the end of **4th Week** after the treatment, the data was also collected electronically from the web-server. Because of the close relationship with most managers in subject companies and continuously contacts by the web-facilities, the researcher could retrieve data from 104 companies (71+33), but 4 companies (2+2) refused to continue the project because of their time-constraint and internal reorganization. The response rate was 84.5%.

At the end of **12th Week** after the treatment, the data was collected from two different target groups. The **first** group, aimed for **quasi-experimentation**, was responses from the same target groups of the **1th** Week and the **4th** Week (middle managers). The data was collected electronically from the web-server. The response rate was 84.5% (104 companies). The **second** group, intended for **survey research**, was responses from top executives from the same companies as the experimentation research. The data was collected by survey (face-to-face interview or telephone survey), depending on the convenience of the top executives of subject companies. The response rate was 82.9% (102 companies) with 2 top-executives refusing to join the survey research.

To assess the non-response bias, 12 randomly selected non-respondents were contacted and asked several of the important descriptive questions contained in the original test instrument (Appendix III). A series of Chi-square tests indicated no significant difference between respondents and nonrespondents on any of the measures analyzed. These results suggest that the sample was representative of the overall population of the Thai subsidiaries of pharmaceutical multinational corporations (MNCs). Summarized details of response rate for both methods of data collection were shown in Table 4-4.

Pharmaceutical Industry	**Quasi-Experimentation**									**Survey**
	Pre-Treatment (**1st** Week)			**Treatment** (**4th** Week)			**Post-Treatment** (**12th** Week)			**Post-Treatment** (**12th** Week)
	Exp.	Con.	Cum	Exp.	Con.	Cum	Exp.	Con.	Cum	
No. of companies (ratio 2:1)	82	41	**123**							**123**
-Deduct (declined to join project)	9	6	15							
Subjects left (**1st week**)	73	35	**108**	73	35	**108**				
-Deduct (declined to continue)				2	2	4				
Subjects left (**4th week**)				71	33	**104**	71	33	**104**	
-Deduct (declined to continue)							-	-	-	
Subjects left (**12th week)**							71	33	**104**	**104**
-Deduct (declined to continue)										2
Subjects left (**12th week: Survey**)										**102**
Response rate	**87.8%**			**84.5%**			**84.5%**			**82.9%**

Table 4-4: Response Rate from Quasi-experimental Research and Survey Research

(**Exp.** = Number of companies as experimental units; **Con.** = Number of control units;
Cum = Total number of companies in the research)

4.2.6. *Ethical Research Practice*

1. Any data or information collected in this study was kept as secret as possible. In case of mentioning or referring to any company names, the acronyms were used to mask the real names. All questionnaires and related company-data were destroyed within six months after the research project had been finished.

2. The specific commercial secrets, defects, or success of sample companies in this study were not disclosed to public or any other companies, especially their competitors. Data or information in the dissertation was blinded and verified carefully to prevent any damage to the sample companies.

3. In all phases of this research, especially in the quasi-experimental phase, the subjects were informed about the objectives, details of processes, expected outcomes, or any other results which might affects the subjects positively or negatively. The subjects had their own right to withdraw from the study any time without any enforcement. However, the subjects were clearly explained about their benefits received from joining this program.

Conclusion

This chapter presented the operationalization of the related three variable constructs, OLT, OLP, and OLC. Moreover, the chapter also described the detailed research design and demonstrated the practical methods of triangulated data collection, which combined quasi-experimentation with survey. Finally, the response rate and ethical research practice were also concluded. To complete the research process, the research methodologies shown in this chapter are closely linked with the data analysis. There were two methods of data analysis used in this research, the MANOVA and canonical correlation analysis. The detailed methods of data analysis and their results will be demonstrated in the next chapter.

CHAPTER 5
DATA ANALYSIS AND RESULTS

This chapter presents the methods of data analysis and their results. Due to the 'triangulation' concept implemented in this research, the chapter is separated into three sections, as follows.

- **Section 5.1** is aimed to assess the impacts of OLT (organizational learning tools) on OLC (organizational learning capabilities) by using data from quasi-experimentation in middle managers (as shown in the first research model and H_1). The analytical technique involved was MANOVA.

- **Section 5.2** is intended to analyze the relationships of OLT and OLP (organizational learning process) with OLC by using data from survey research in top executives (as presented in the second research model and H_2 / H_3). The technique of data analysis used was canonical correlation.

- **Section 5.3** demonstrates the triangulation of results from both sections.

5.1. Impacts of OLT on OLC

This section includes methods of data analysis by MANOVA (Section 5.1.1), and statistical results and hypothesis testing (Section 5.1.2).

5.1.1. Analysis of Data from Quasi-Experimentation Using MANOVA

The technique of data analysis MANOVA was used to assess the impacts of OLT on OLC. The MANOVA is specifically powerful in experimental and quasi-experimental research, and is used to compare means of multiple dependent variables (variates), which are affected by the manipulated independent variable(s) (Hair, 1998, Kirk, 1982, Cook and Campbell, 1979, SPSS, 1999). The reason for choosing MANOVA is that the technique can be used to compare means differences of multiple criterion (dependent variate) between groups and within groups (Hair, 1998). Moreover, MANOVA can be used to gain some guidance as to how we should appropriately proceed to answer the important research questions (Johnson, 1998). If MANOVA shows there are significant differences between groups being compared, then we can probe more details in each variable which form composite of dependent variate (Johnson, 1998). In this study, the MANOVA technique was used to compare means differences of dependent variate-OLC, potentially affected by manipulated treatment-OLT in quasi-experimentation. Specifically, by using repeated-measures MANOVA, the impacts of OLT on OLC variates at varied periods of time (1^{st}, 4^{th}, and 12^{th} week) were analyzed. Means differences of OLC were compared between-groups (two groups of subject companies, experimental and control units) and within-groups (their own groups during varied periods of time at the 1^{st}, 4^{th}, and 12^{th} week). (Cook and Campbell, 1979, Hair, 1998, Anderson, 1958, Kirk, 1982, Tatsuoka, 1971, Nachmias and Nachmias, 1997, SPSS, 1999). The model of MANOVA analysis is as follows.

$$\sum_{i=1}^{4} a_i \, OLC_i = b_0 + b_1 (OLT) + e$$

OLC: Organizational learning capabilities

OLT: Organizational learning tools

There are two variables involved, the independent variable OLT (the treatment manipulated in this study), and the dependent variate OLC (multiple composite dependent variables). The OLC variate is measured objectively and subjectively. The objective measures of OLC variate were 'sales growth of new products' and 'percentage of new product test'. The subjective measures of OLC variate were the composite of dependent variables, which consists of four dependent variables (team orientation, system orientation, learning orientation, and memory orientation). These six measures of OLC were used for analysis in the process of MANOVA. There are **three** steps in the process of MANOVA analysis, data examination, verification of the assumptions for MANOVA, and estimation of the MANOVA model.

Step 1. Data Examination for MANOVA

Careful examination of data leads to better prediction and more accurate assessment of dimensionality (Hair, 1998). In this step, the examination of data includes analysis of outliers, validity and reliability tests, and bivariate correlation. Details of analyzing outliers are presented in Appendix III, while reliability test, validity test, and bivariate correlation are demonstrated in the following subsections, as follows.

Reliability Tests

According to Churchill (1995), multiple-item measures are subject to a purification process. The purification process eliminates items that seem to create confusion among respondents and items that do not discriminate between subjects with fundamentally different position on the construct. The purification of measures involves the assessment of validity and reliability of the relevant measures. Reliability concerns the tendency toward consistency of the results given by repeated measurements (Nachmias and Nachmias, 1997). In this research, multiple items were used to construct four variables (OLCTO, OLCSO, OLCLO, and OLCMO) and one variate (OLC variate). In Table 5-1-a, the values of Cronbach's alpha of the OLC variate and the four OLC variables exceeded 0.7, which meet the minimum acceptable level recommended by Nunnally (1978) and satisfy the reliability test.

Variable	Cronbach's alpha
OLC Variate	**0.7977**
OLCTO- Team orientation	**0.7732**
OLCSO- System orientation	**0.8229**
OLCLO- Learning orientation	**0.8989**
OLCMO- Memory orientation	**0.7134**

Table 5-1-a: Reliability of OLC Dependent Variate and Variables

Validity Tests

The purification of measures involves the assessment of validity and reliability of the relevant measures. The validity concerns the extent to which an indicator of some abstract concept measures what it intends to measure (Nachmias and Nachmias, 1997).

Content validity or face validity focuses on the adequacy with which the domain of the concept under study is captured by the measure (Nachmias and Nachmias, 1997). The key to content validity lies on the procedures that were used to develop the instrument. These procedures include examining the literature and testing the internal consistency. In MANOVA, multiple items were used to form the constructs of **OLC** dependent variate (consisted of OLCTO, OLCSO, OLCLO, and OLCMO dependent variables). Careful review of the literature and measures used in previous research, in-depth interviews with some top-executives from leading pharmaceutical companies and some academic professors in related disciplines, pilot study, and the pretest were conducted to help ensure the only relevant items were included in the final instrument.

Construct validity involves with the degree to which the scale represents and acts like the concept being measured (Nachmias and Nachmias, 1997). The statistical technique used to evaluate construct validity is discriminant validity. Discriminant validity is the degree to which the measurement scale may be differentiated from other scales meaning to measure different concepts (Nachmias and Nachmias, 1997). In order to evaluate the discriminant validity of measures, all the multiple-item measures used to measure the variables were assessed by subjecting the purified scale items to a principal component factor analysis with the varimax rotation.

Factors were rotated to obtain a clear interpretation of the loadings (Hair, 1998). The factor components and individual item loadings were assessed. Factor loadings are the correlations between the original variables and the factors, and the key to understand the nature of a particular factor (Hair, 1998). Factor loadings that were 0.5 or greater were considered practically significant whereas loadings greater than 0.3 were considered to meet the minimum level (Hair, 1998). Factor loadings that were less than 0.3 were considered as not valid and were eliminated (Hair, 1998). Factors emerged consistent with the priori operationalization. The item-to-item correlation between items in each of the proposed scale was examined. If the correlations between variables were small, it was unlikely that they shared common factors. Items with low correlation were eliminated. From Table 5-1-b, all factors extracted (OLCTO, OLCSO, OLCLO, OLCMO) have eigen values higher than 1. The factors were formed according to a predetermined model, which met the validity test.

	1. OLCTO	**2. OLCSO**	**3. OLCLO**	**4. OLCMO**
a11 (team orientation)	0.612			
a12 (team orientation)	0.766			
a16 (team orientation)	0.759			
a17 (team orientation)	0.708			
a18 (team orientation)	0.880			
a22 (system orientation)		0.618		
a24 (system orientation)		0.757		
a33 (learning orientation)			0.827	
a35 (learning orientation)			0.857	
a43 (memory orientation)				0.740
a44 (memory orientation)				0.714
Eigen Value	4.484	4.339	3.458	3.022
% of variance accounted for	17.936	17.357	13.833	12.089
Cum. percent of variance	17.936	35.293	49.126	61.215

Table 5-1-b: Factor Analysis of <u>OLC</u> Dependent Variate (Organizational Learning Capabilities)

	olcto1	olcto2	olcto3	olcso1	olcso2	olcso3	olclo1	olclo2	olclo3	olcmo1	olcmo2	olcmo3	oltx
olcto1	1.000												
olcto2	.347	1.000											
olcto3	.426**	.071	1.000										
olcso1	.022	.142	.267**	1.000									
olcso2	.451**	.245	.494**	.341	1.000								
olcso3	.357**	.054	.027	.528**	.037	1.000							
olclo1	.256	.374**	.395**	.274	.412**	.377**	1.000						
olclo2	.471	.056	.561**	.422**	.149	.667**	.284	1.000					
olclo3	.509**	.512**	.590**	.398**	.341	.017	.701**	.085	1.000				
olcmo1	.510**	.235**	.163	.391**	.329**	.222**	.071	.525**	.561	1.000**			
olcmo2	.307**	.244	.314**	.238**	.274	.398**	.297**	.407**	.218	.330**	1.000		
olcmo3	.124	.269	.425**	.343	.017	.357**	.471	.245	.419**	.287	.015**	1.000	
oltx	.395**	.602**	.507**	.035	.622**	.736**	.566**	.731**	.464**	.432**	.453**	0.578**	1.000

Table 5-2: Pearson Correlation Matrix of Variables Used in Quasi-Experimentation

(** = correlation is significant at the 0.01 level, two-tailed)

(* = correlation is significant at the 0.015level, two-tailed)

Bivariate Correlations

Bivariate correlations of related variables were computed to preliminarily assess the correlation of any pairs of independent and dependent variables (correlation coefficient above 0.8) (Hair, 1998). The bivariate correlation analysis was performed to check whether there was any pair of independent variables or dependent variables having high correlations (correlation coefficients above 0.8). This bivariate correlation test included new variables from factor analysis and transformed variables. Furthermore, bivariate correlation analyses were also used to preliminarily find the significant correlations among independent variables and dependent variables. The present research used **Pearson test** to assess such bivariate correlation. The independent variables that have significant correlations with dependent variables were selected to use in MANOVA. The results of bivariate correlation test were presented in Table 5-2.

Step 2. Testing the Assumptions for MANOVA

Before the MANOVA analysis, the dependent and independent variables were tested for meeting the essential assumption underlying multivariate analysis. Such assumptions were normality, linearity, multicollinearity, independence, and equality of variance-covariance matrices.

a. Normality

According to Hair (1998), the assumption for MANOVA is that all the variables are multivariate normal. Multivariate normality assumes that the joint effect of two variables is normally distributed. There is no direct test for multivariate normality but most analysts test for univariate normality (Hair, 1998). While univariate normality does not guarantee multivariate normality, if all variables meet this requirement, then any departures from multivariate normality are usually inconsequential (Hair, 1998). With moderate sample sizes, modest violations can be accommodated as long as the differences are due to skewness and not outliers (Hair, 1998). In this study, normality test is performed to test all related variables graphically and statistically, as details in Appendix III and IV.

b. Linearity and Multicollinearity among Dependent Variables

Linearity is the essential assumptions for most multivariate analysis (Hair, 1998). While MANOVA assesses the differences across combinations of dependent variables, it can construct a linear relationship only between the dependent measures (Hair, 1998). Moreover, in MANOVA, the dependent variables should not have high multicollinearity because this indicates only redundant dependent measures and decreases statistical efficiency (Hair, 1998). In this study, test of linearity and multicollinearity are conducted and detailed in Appendix III and IV.

c. Independence

The most basic, but serious, violation of an assumption for MANOVA occurs when there is a lack of independence among observations (Hair, 1998). Lack of independence may come from various confounding factors, e.g., time-ordered effect or serial correlation if measures are taken over time, extraneous and unmeasured effects, noisy room or confusing set of instructions, etc (Hair, 1998).

Although there are no tests with an absolute certainty of detecting all forms of dependence, the researcher should explore all possible effects and correct for them if found. If dependence is found among groups of respondents, then a possible solution is to combine those within the groups and analyze the group's average score instead of the scores of the separate respondents (Hair, 1998). Another approach is to employ blocking factors to account for the dependence. In either case, or when dependence is suspected, the researcher should use a lower level of significance depending on the issues (Hair, 1998).

d. Equality of Variance-Covariance Matrices

One essential assumption of MANOVA is the equivalence of covariance matrices across the groups (Hair, 1998). Here, as with the problem of heteroscedascity addressed in multiple regression, we are concerned with substantial differences in the amount of variance of one group versus another for the same variables. In MANOVA, however, the interest is in the variance-covariance matrices of the dependent measures for each group. The requirement of equivalence is a strict test because the MANOVA test examines all elements of the covariance matrix of the dependent variables (Hair, 1998). MANOVA programs provide the test for equality of covariance matrices and provide significance levels for the test statistic (Hair, 1998).

Step 3. Estimating the MANOVA Model and Assessing Overall Fit

After the data examination and tests for assumptions, the MANOVA model was estimated by using computer program SPSS 9.0: Advanced Model (MANOVA GLM- repeated measures). MANOVA (GLM- repeated measures) analyzes the means differences (sum square and means square) within-subjects (MSW) and between-subjects (MSB). The MSW was used to compare means differences among 1^{st} week and 4^{th} week, 4^{th} week and 12^{th} week, and 1^{st} and 12^{th} week, by using the 1^{st} week data of pre-treatment as covariate. The MSB was used to compare means differences between the treatment and control groups at the different pairs of time periods (1^{st} week and 4^{th} week, 4^{th} week and 12^{th} week, and 1^{st} and 12^{th} week).

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5.1.2. Statistical Results and Hypothesis Testing the Impacts of OLT on OLC

In the last section, the data analysis process of MANOVA aimed to test the impacts of OLT on OLC was presented. Data were collected from middle managers of 104 companies (84.5% of expected 123 companies). From Table 5-3, the averaged years of working experience of these middle managers were 7.8 years. The data of participated companies showed the details of countries of origin, status of organization, and groups of major product-groups. Moreover, the numbers of employees in related departments and details of IT-assets were also presented in Table 5-3.

The results of MANOVA testing the impacts of OLT on OLC will be presented in the following two sections. **Section 5.1.2.1** will show the results aimed to test the hypothesis related to the differences of OLC between treatment and control groups by assessing the **MSB** (means square between-subjects) and its significance of F-statistics. After testing the differences between treatment groups and control groups in **Section 5.1.2.1**, the differences within only the treatment groups will be presented in **Section 5.1.2.2**. The **MSW** (means square within-subjects) and its F-statistics will be demonstrated in order to deeply verify differences among the 1st, 4th week, and 12th week in the treatment groups. This will help evaluate any differences of impacts of OLT on OLC in the treatment groups during the twelve weeks.

Section 5.1.2.1. Differences between Treatment and Control Groups (MSB)

In this section, the MANOVA results of seven variables of OLC will be presented along with hypothesis testing in each of the seven subsections, as follows.

- **Subsection a**: 'OLC variate' (subjective measures of composite OLC)
- **Subsection b**: 'Team orientation' (subjective measures of OLC)
- **Subsection c**: 'System orientation' (subjective measures of OLC)
- **Subsection d**: 'Learning orientation' (subjective measures of OLC)
- **Subsection e**: 'Memory orientation' (subjective measures of OLC)
- **Subsection f**: 'Sales growth of new products' (objective measures of OLC)
- **Subsection g**: 'Percentage of new product test' (objective measures of OLC)

Firstly, means of each of the seven variables at the 1st week (pre-treatment) from the treatment groups and control groups will be compared. After that, the MANOVA results (repeated measures) will be presented to account for the initial means differences compared between the treatment and control groups at the 1st week. In the results of MANOVA (repeated measures), three pairs of comparisons of varied periods of time (1st / 4th week, 4th / 12th week, and 1st / 12th week) will be made along with the hypothesis testing of each of the seven variables.

a. OLC variate

At first, the means of 'OLC variate' from the treatment groups and control groups were calculated and compared. From Table 5-4-a, at the 1st week before treatment, means of 'OLC variate' for the treatment groups = 3.0463, and control groups = 2.8761. The results of t-test from Table 5-4-b prove that this pair of means is significantly different. So, we need to do further test by performing the repeated measures to get means of 'OLC variate' at the 4th week and 12th week. These tests by repeated measures take into account the initial differences of means between the treatment and control groups.

From Table 5-4-a, at the 4th week and 12th week after the treatment, means of 'OLC variate' from the treatment groups increased to 3.7742 and 3.6697. But the means of 'OLC variate' from the control groups seemed stable as 2.8693 and 2.8753. These changes of means can be statistically verified by the multivariate technique called MANOVA repeated measurers.

The purpose of the multivariate test is to assess differences collectively (with multivariate test) and singularly (with univariate test) (Johnson, 1998). Table 5-5 shows the results of MANOVA repeated measures conducted to statistically verify the above means differences and test the hypothesis. The differences of 'OLC variate' between the treated groups and control groups can be assessed by statistical values in the three row-sets (1st / 4th week, 4th / 12th week, 1st / 12th week) of the four multivariate tests (Pillai's trace, Wilk's lambda, Hotelling's trace, and Roy's root) in Table 5-5.

In the first row-set of 1st / 4th week, the four tests (Wilks' Lambda, Hotelling's Trace, Roy's Largest Root, and Pillai's Trace) show equal F statistics of **MSB** = 85.691. The Pillai's criterion has a significance level (<0.001) well below our prespecified level of 0.05 (Hair, 1998). The values of the Wilk's lambda, Hotelling's trace, and Roy's gcr (greatest characteristic root) , referring to the distribution with appropriate degrees of freedom and setting $\alpha = 0.05$, prove that the mean vectors of the compared groups are not equals (Hair, 1998). Using any measures of multivariate differences results the same conclusion that the dependent variable (OLC variate) varies across the independent variable (treatment of OLT).

In the same way, the second row-set of 4th / 12th week shows the significant F statistics of **MSB** = 85.821, which are equal from the four tests (Wilks' Lambda, Hotelling's Trace, Roy's Largest Root, and Pillai's Trace). The third row-set of 1st / 12th week also demonstrates the significant F statistics of **MSB** = 29.241, which are equal from the four tests (Wilks' Lambda, Hotelling's Trace, Roy's Largest Root, and Pillai's Trace). That is, the OLC variate of the treated groups is significantly different from the OLC variate of the control groups during the period of 12 weeks.

Consequently, the treated groups, which exposed to OLT, have higher 'OLC' variate than the controlled groups without such exposure. Moreover, in the treated groups exposed to OLT, the 'OLC' variate at the 4th week was significantly higher than that of the 1st week (Hair, 1998).

H_{1x} : Organizations, which are exposed to 'organizational learning tools', have higher 'OLC variate' than organizations without such exposure.

The statistical result supports hypothesis (**H_{1x}**) that the manipulated OLT causes the increase of OLT variate (which is the subjective measures of OLC).

In conclusion, the tests of hypothesis for subjective measures of OLC variate are summarized in Table 5-6. According to Hair (1998), the OLC variate, which is significant in multivariate tests of MANOVA, should be performed further analysis by univariate tests for each variable, which forms the composite of OLC variate. In this study, the team orientation, system orientation, learning orientation, and memory orientation are such variables, which form composite of OLC variate. Thus, the results of univariate tests and hypothesis testing of each individual variable will be presented in the next four sections.

OLC	Means of Treatment Groups	Means of Control Groups
OLC Variate: **1st Week** (Pre-Treatment)	**3.0463**	**2.8761**
: 4th Week (Post-Treatment)	3.7742	2.8693
: 12th Week (Post-Treatment)	3.6697	2.8759

Table 5-4-a: Comparison of Means of OLC Variate between the Treatment & Control Groups

Variables	Levene's Test of Equality of Variance		t-Test for Equality of Means		
	F	p-value	t	d.f.	p-value
OLC Variate (1st Week)	9.231	0.003	2.553	46.193	0.014**

Table 5-4-b: Comparison of Means of OLC Variate by t-Test

OLC	Tests of Between Subjects			
	Value	d.f.	F	p value
H_{1x} : OLC Variate				
1st / 4th wk.				
Pillai's Trace	0.776	4.000	85.691	< 0.001**
Wilks' Lambda	0.224	4.000	85.691	< 0.001**
Hotelling's Trace	3.462	4.000	85.691	< 0.001**
Roy's Largest Root	3.462	4.000	85.691	< 0.001**
4th / 12th wk.				
Pillai's Trace	0.783	4.000	85.821	< 0.001**
Wilks' Lambda	0.217	4.000	85.821	< 0.001**
Hotelling's Trace	3.614	4.000	85.821	< 0.001**
Roy's Largest Root	3.614	4.000	85.821	< 0.001**
1st / 12th wk.				
Pillai's Trace	0.542	4.000	29.241	< 0.001**
Wilks' Lambda	0.458	4.000	29.241	< 0.001**
Hotelling's Trace	1.181	4.000	29.241	< 0.001**
Roy's Largest Root	1.181	4.000	29.241	< 0.001**

Table 5-5: Statistical Results of MANOVA for OLC Variate During 12 Weeks

(Comparing between Treated/Control Group)
** significant at the 0.05 level, two-tailed

OLC	Between Subjects (Results of Hypothesis Testing)
H_{1x} : OLC variate	
1st / 4th wk.	Supported
4th / 12th wk	Supported
1st / 12th wk.	Supported

Table 5-6: Hypothesis Testing for the OLC Variate

d. Team orientation

Firstly, the means of 'team orientation' from the treatment groups and control groups were calculated and compared. From Table 5-7-a, at the 1st week before treatment, means of 'team orientation' for the treatment groups = 2.8399, and control groups = 2.6997. The results of t-test from Table 5-7-b prove that this pair of means is significantly different. So, we need to do further test by performing the repeated measures to yield means of 'team orientation' at the 4th week and 12th week. These tests by repeated measures take into account the initial differences of means between the treatment and control groups.

From Table 5-7-a, at the 4th week and 12th week after the treatment, means of 'team orientation' from the treatment groups increased to 3.4763 and 3.2983. But the means of 'team orientation' from the control groups seemed stable as 2.7273 and 2.6924. These changes of means can be statistically verified by the multivariate technique called MANOVA repeated measurers.

Table 5-8 shows the results of MANOVA repeated measures conducted to statistically verify the above means differences and test the hypothesis. The differences of 'team orientation' between the treated groups and control groups can be assessed by statistical values in the three row-sets (1st / 4th week, 4th / 12th week, 1st / 12th week) in Table 5-8. The significant F statistics of '1st / 4th week' = 13603.054, 4th / 12th week' = 119.387, and '1st / 12th week' = 52.274. That is, all statistical values demonstrate the significant differences of impacts of OLT on 'team orientation', in comparison with the treated groups and control groups during the 12 weeks. In other words, the treated groups of Thai pharmaceutical subsidiaries which exposed to OLT have higher 'team orientation' than the control groups of companies without such exposure.

H_{11} : Organizations, which are exposed to 'organizational learning tools', have higher 'team orientation' than organizations without such exposure.

The statistical result supports hypothesis (**H_{11}**) that manipulated OLT causes the increase of team orientation (which is the subjective composite measures of OLC variate).

e. System orientation

At the beginning, the means of 'system orientation' from the treatment groups and control groups were calculated and compared. From Table 5-7-a, at the 1st week before treatment, means of 'system orientation' for the treatment groups = 3.1155, and control groups = 2.9636. The results of t-test from Table 5-7-b prove that this pair of means is significantly different. So, we need to do further test by performing the repeated measures to yield means of 'system orientation' at the 4th week and 12th week. These tests by repeated measures take into account the initial differences of means between the treatment and control groups.

From Table 5-7-a, at the 4th week and 12th week after the treatment, means of ‘system orientation’ from the treatment groups increased to 3.7662 and 3.6676. But the means of ‘system orientation’ from the control groups seemed stable as 2.6363 and 2.6244. These changes of means can be statistically verified by the multivariate technique called MANOVA repeated measurers.

Table 5-8 shows the results of MANOVA repeated measures conducted to statistically verify the above means differences and test the hypothesis. The differences of ‘system orientation’ between the treated groups and control groups can be assessed by statistical values in the three row-sets (1st / 4th week, 4th / 12th week, 1st / 12th week) in Table 5-8. The significant F statistics of '1st / 4th week' = 12133.964, 4th / 12th week' = 186.378, and '1st / 12th week' = 63.838. That is, all statistical values demonstrate the significant differences of impacts of OLT on 'system orientation', in comparison with the treated groups and control groups during the 12 weeks. In other words, the treated groups of Thai pharmaceutical subsidiaries which exposed to OLT have higher 'system orientation' than the control groups of companies without such exposure.

H_{12} : Organizations, which are exposed to 'organizational learning tools', have higher ‘system orientation’ than organizations without such exposure.

The statistical result supports hypothesis (**H_{12}**) that manipulated OLT causes the increase of system orientation (which is the subjective composite measures of OLC variate).

f. Learning orientation

Originally, the means of ‘learning orientation’ from the treatment groups and control groups were calculated and compared. From Table 5-7-a, at the 1st week before treatment, means of ‘learning orientation’ for the treatment groups = 3.3070, and control groups = 3.0303. The results of t-test from Table 5-7-b prove that this pair of means is significantly different. So, we need to do further test by performing the repeated measures to yield means of ‘learning orientation’ at the 4th week and 12th week. These tests by repeated measures take into account the initial differences of means between the treatment and control groups.

From Table 5-7-a, at the 4th week and 12th week after the treatment, means of ‘learning orientation’ from the treatment groups increased to 3.9493 and 3.9380. But the means of ‘learning orientation’ from the control groups seemed stable as 2.9872 and 2.9923. These changes of means can be statistically verified by the multivariate technique called MANOVA repeated measurers. Table 5-8 shows the results of MANOVA repeated measures conducted to statistically verify the above means differences and test the hypothesis. The differences of ‘learning orientation’ between the treated groups and control groups can be assessed by statistical values in the three row-sets (1st / 4th week, 4th / 12th week, 1st / 12th week) in Table 5-8. The significant F statistics of '1st / 4th week' = 33.811, 4th / 12th week' = 166.325, and '1st / 12th week' = 34.539.

That is, all statistical values demonstrate the significant differences of impacts of OLT on 'learning orientation', in comparison with the treated groups and control groups during the 12 weeks. In other words, the treated groups of Thai pharmaceutical subsidiaries which exposed to OLT have higher 'learning orientation' than the control groups of companies without such exposure.

H_{13} : Organizations, which are exposed to 'organizational learning tools', have higher 'learning orientation' than organizations without such exposure.

The statistical result supports hypothesis (**H_{13}**)that manipulated OLT causes the increase of learning orientation (which is the subjective composite measures of OLC variate).

g. Memory orientation

Fundamentally, the means of 'memory orientation' from the treatment groups and control groups were calculated and compared. From Table 5-7-a at the 1st week before treatment, means of 'memory orientation' for the treatment groups = 2.9225, and control groups = 2.8106. The results of t-test from Table 5-7-b prove that this pair of means is significantly different. So, we need to do further test by performing the repeated measures to yield means of 'memory orientation' at the 4th week and 12th week. These tests by repeated measures take into account the initial differences of means between the treatment and control groups.

From Table 5-7-a, at the 4th week and 12th week after the treatment, means of 'memory orientation' from the treatment groups increased to 3.9049 and 3.7746. But the means of 'memory orientation' from the control groups seemed stable as 2.9541 and 2.9862. These changes of means can be statistically verified by the multivariate technique called MANOVA repeated measurers. Table 5-8 shows the results of MANOVA repeated measures conducted to statistically verify the above means differences and test the hypothesis. The differences of 'memory orientation' between the treated groups and control groups can be assessed by statistical values in the three row-sets (1st / 4th week, 4th / 12th week, 1st / 12th week) in Table 5-8. The significant F statistics of '1st / 4th week' = 21.200, 4th / 12th week' = 49.921, and '1st / 12th week' = 55.841. That is, all statistical values demonstrate the significant differences of impacts of OLT on 'memory orientation', in comparison with the treated groups and control groups during the 12 weeks. In other words, the treated groups of Thai pharmaceutical subsidiaries which exposed to OLT have higher 'memory orientation' than the control groups of companies without such exposure.

H_{14} : Organizations, which are exposed to 'organizational learning tools', have higher 'memory orientation' than organizations without such exposure.

The statistical result supports hypothesis (**H_{14}**) that manipulated OLT causes the increase of memory orientation (which is the subjective composite measures of OLC variate). In conclusion, the summary of hypothesis testing for all four OLC variables (team orientation, system orientation, learning orientation, and memory orientation), which form the composite OLC variate, are presented in Table 5-9.

OLC Variate	Means of Treatment Groups	Means of Control Groups
Team Orientation: **1st Week** (Pre-Treatment)	**2.8399**	**2.6997**
: 4th Week (Post-Treatment)	3.4763	2.7273
: 12th Week (Post-Treatment)	3.2983	2.6924
System Orientation: **1st Week** (Pre-Treatment)	**3.1155**	**2.9636**
: 4th Week (Post-Treatment)	3.7662	2.6363
: 12th Week (Post-Treatment)	3.6676	2.6244
Learning Orientation: **1st Week** (Pre-Treatment)	**3.3070**	**3.0303**
: 4th Week (Post-Treatment)	3.9493	2.9872
: 12th Week (Post-Treatment)	3.9380	2.9923
Memory Orientation: **1st Week** (Pre-Treatment)	**2.9225**	**2.8106**
: 4th Week (Post-Treatment)	3.9049	2.9541
: 12th Week (Post-Treatment)	3.7746	2.9862

Table 5-7-a: Comparison of Means of OLC Variables between the Treatment & Control Groups

Variables	Levene's Test of Equality of Variance		t-Test for Equality of Means		
	F	p-value	t	d.f.	p-value
Team Orientation (1st week)	0.192	0.662	2.827	102	0.006**
System Orientation (1st week)	4.908	0.029	2.382	49.518	0.021**
Learning Orientation (1st week)	10.057	0.002	2.367	46.450	0.022**
Memory Orientation (1st week)	0.357	0.542	1.443	102	0.032**

Table 5-7-b: Comparison of Means of OLC Variables by t-Test

OLC	Tests of Between Subjects				
	Sum Sq.	d.f.	Mean Sq.	F	p value
H_{11} : Team Orientation					
1^{st} / 4^{th} wk.	1546.13	1	1546.13	13603.054	< 0.001**
4^{th} / 12^{th} wk.	13.57	1	13.57	119.387	< 0.001**
1^{st} / 12^{th} wk.	6.15	1	6.15	52.274	< 0.001**
H_{12} : System Orientation					
1^{st} / 4^{th} wk.	1848.15	1	1848.15	12133.964	< 0.001**
4^{th} / 12^{th} wk.	16.26	1	16.26	186.378	< 0.001**
1^{st} / 12^{th} wk.	8.25	1	8.25	63.838	< 0.001**
H_{13} : Learning Orientation					
1^{st} / 4^{th} wk.	16.11	1	16.11	33.811	< 0.001**
4^{th} / 12^{th} wk.	17.53	1	17.53	166.325	< 0.001**
1^{st} / 12^{th} wk.	15.48	1	15.48	34.539	< 0.001**
H_{14} : Memory Orientation					
1^{st} / 4^{th} wk.	16.39	1	16.39	21.200	< 0.001**
4^{th} / 12^{th} wk.	32.75	1	32.75	49.921	< 0.001**
1^{st} / 12^{th} wk.	13.41	1	13.41	55.841	< 0.001**

Table 5-8: MSB for the Four OLC Variables During 12 Weeks

(Comparing between Treated/Control Group)

** significant at the 0.05 level, two-tailed

OLC	Between Subjects (Results of Hypothesis Testing)
H_{11} : Team Orientation	
1^{st} / 4^{th} wk.	Supported
4^{th} / 12^{th} wk	Supported
1^{st} / 12^{th} wk.	Supported
H_{12} : System Orientation	
1^{st} / 4^{th} wk.	Supported
4^{th} / 12^{th} wk	Supported
1^{st} / 12^{th} wk.	Supported
H_{13} : Learning Orientation	
1^{st} / 4^{th} wk.	Supported
4^{th} / 12^{th} wk	Supported
1^{st} / 12^{th} wk.	Supported
H_{14} : Memory Orientation	
1^{st} / 4^{th} wk.	Supported
4^{th} / 12^{th} wk	Supported
1^{st} / 12^{th} wk.	Supported

Table 5-9: Hypothesis Testing for the Four OLC Variables

a. Sales Growth of New Products

Initially, the means of 'sales growth' from the treatment groups and control groups were calculated and compared. From Table 5-10-a, at the 1st week before treatment, means of 'sales growth' for the treatment groups = 77.89, and control groups = 73.48. The results of t-test from Table 5-10-b prove that this pair of means is significantly different. So, we need to do further test by performing the repeated measures to yield means of 'sales growth' at the 4th week and 12th week. These tests by repeated measures take into account the initial differences of means between the treatment and control groups.

From Table 5-10-a, at the 4th week and 12th week after the treatment, means 'sales growth' from the treatment groups increased to 105.07 and 113.10. But the means of 'sales growth' from the control groups seemed stable as 76.97and 73.33. These changes of means can be statistically verified by the multivariate technique called MANOVA repeated measurers. Table 5-11 shows the results of MANOVA repeated measures conducted to statistically verify the above means differences and test the hypothesis. The differences of 'sales growth' between the treated groups and control groups can be assessed by statistical values in the three row-sets (1st / 4th week, 4th / 12th week, 1st / 12th week) in Table 5-11. The significant F statistics of '1st / 4th week' = 73.350, 4th / 12th week' = 324.850, and '1st / 12th week' = 161.998. That is, all statistical values demonstrate the significant differences of impacts of OLT on 'sales growth', in comparison with the treated groups and control groups during the 12 weeks. In other words, the treated groups of Thai pharmaceutical subsidiaries which exposed to OLT have higher 'sales growth of new products' than the control groups of companies without such exposure.

H_{15} : Organizations, which are exposed to 'organizational learning tools', have higher 'sales growth of new products' than organizations without such exposure.

The statistical results support hypothesis (**H_{15}**) that manipulated OLT causes the increase of sales growth of new product (which is the objective measures of OLC).

b. Percentage of new products test

Primarily, the means of 'percentage of new product test score' from the treatment groups and control groups were calculated and compared. From Table 5-10-a, at the 1st week before treatment, means of 'percentage of test score' for the treatment groups = 62.75, and control groups = 67.58. The results of t-test from Table 5-10-b prove that this pair of means is significantly different. So, we need to do further test by performing the repeated measures to yield means of 'percentage of test score' at the 4th week and 12th week. These tests by repeated measures take into account the initial differences of means between the treatment and control groups.

From Table 5-10-a, at the 4th week and 12th week after the treatment, means of ‘percentage of test score’ from the treatment groups increased to 75.42 and 78.59. But the means of ‘percentage of test score’ from the control groups seemed stable as 66.97 and 64.09. These changes of means can be statistically verified by the multivariate technique called MANOVA repeated measurers.

Table 5-11 shows the results of MANOVA repeated measures conducted to statistically verify the above means differences and test the hypothesis. The differences of ‘percentage of new product test score’ between the treated groups and control groups can be assessed by statistical values in the three row-sets (1st / 4th week, 4th / 12th week, 1st / 12th week) in Table 5-11. The significant F statistics of '1st / 4th week' = 44.976, 4th / 12th week' = 182.443, and '1st / 12th week' = 6.752. That is, all statistical values demonstrate the significant differences of impacts of OLT on 'percentage of new product test', in comparison with the treated groups and control groups during the 12 weeks. In other words, the treated groups of Thai pharmaceutical subsidiaries which exposed to OLT have higher ‘percentage of new product test’ than the control groups of companies without such exposure.

H_{16} : Organizations, which are exposed to 'organizational learning tools', have higher ‘percentage of new product test’ than organizations without such exposure.

The statistical results support hypothesis (**H_{16}**) that manipulated OLT causes the increase of percentage of new product test (which is the objective measures of OLC). In conclusion, the summary of hypothesis testing for ‘sales growth’ and ‘percentage of new product test score’ are presented in Table 5-12.

OLC	Means of Treatment Groups	Means of Control Groups
Sales Growth of New Products (%)		
: **1st Week** (Pre-Treatment)	**77.89**	**73.48**
: 4th Week (Post-Treatment)	105.07	76.97
: 12th Week (Post-Treatment)	113.10	73.33
Percentage of Test score (%)		
: 1st Week (Pre-Treatment)	**62.75**	**67.58**
: 4th Week (Post-Treatment)	75.42	66.97
: 12th Week (Post-Treatment)	78.59	64.09

Table 5-10-a: Comparison of Means between the Treatment & Control Groups

Variables	Levene's Test of Equality of Variance		t-Test for Equality of Means		
	F	p-value	t	d.f.	p-value
Sales Growth (1st week)	1.932	0.168	2.268	102	0.025**
Percentage of Score (1st week)	1.029	0.313	2.127	102	0.036**

Table 5-10-b: Comparison of Means of Objective Measures by t-Test

OLC	Tests of Between Subjects				
	Sum Sq.	d.f.	Mean Sq.	F	p value
H_{15} : Sales growth					
1st / 4th wk.	11900.4	1	11900.4	73.350	< 0.001**
4th / 12th wk.	42729.7	1	42729.7	324.850	< 0.001**
1st / 12th wk.	21974.5	1	21974.5	161.998	< 0.001**
H_{16} : Percentage of Score					
1st / 4th wk.	5934.8	1	5934.8	44.976	< 0.001**
4th / 12th wk.	6988.1	1	6988.1	182.443	< 0.001**
1st / 12th wk.	1053.6	1	1053.6	6.752	< 0.001**

Table 5-11: MSB for the 'Sales Growth' and 'Percentage of new product test' During 12 Weeks
(Comparing between Treated/Control Group) ** significant at the 0.05 level, two-tailed

OLC	Between Subjects (Results of Hypothesis Testing)
H_{15} : Sales growth of new products	
1st / 4th wk.	Supported
4th / 12th wk	Supported
1st / 12th wk	Supported
H_{16} : Percentage of new product test	
1st / 4th wk.	Supported
4th / 12th wk	Supported
1st / 12th wk	Supported

Table 5-12: Hypothesis Testing for 'Sales Growth' and 'Percentage of New Product Test'

Section 5.1.2.2. Differences among the 1st, 4th, and 12th week in Treated Groups (MSW)

a. Differences Between the 1st Week and 4th Week

The differences of OLC between the 1st week and 4th week can be assessed by statistical values in the first row-sets (1st / 4th week) of seven OLC variables in Table 5-13, 5-14, and 5-15. The seven OLC variables consist of 'OLC variate', 'team orientation', 'system orientation', 'learning orientation', 'memory orientation', 'sales growth of new products', and 'percentage of new product test'. The significant F statistics of 'team orientation' = 127.663, 'system orientation' = 134.067, 'learning orientation' = 150.141, 'memory orientation' = 20.385, 'sales growth' = 116.676, 'percentage of new product test' = 30.975. Moreover, the F statistics of Pillai's Trace, Wilks' Lambda, Roy's Largest Root, and Hotelling's Trace of OLC variate show the significant same value of 25.589. That is, all statistical values demonstrate the significant differences of OLC in the treatment groups between the 1st week and 4th week.

b. Differences Between the 4th Week and 12th Week

The differences of OLC between the 4th week and 12th week can be assessed by statistical values in the second row-sets (4th / 12th week) of seven OLC variables in Table 5-13, 5-14, and 5-15. The seven OLC variables consist of 'OLC variate', 'team orientation', 'system orientation', 'learning orientation', 'memory orientation', 'sales growth of new products', and 'percentage of new product test'. The insignificant F statistics of 'team orientation' = 4.494, 'system orientation' = 0.899, 'learning orientation' = 0.235, 'memory orientation' = 0.197, 'sales growth' = 78.716, and 'percentage of new product test' = 27.477. On the contrary, the F statistics of Pillai's Trace, Wilks' Lambda, Roy's Largest Root, and Hotelling's Trace show the significant same value of 1.419. In conclusion, not all statistical values demonstrate the significant differences of OLC in the treatment groups between the 4th week and 12th week. Only the OLC variate of the treatment groups is significantly different between the 4th week and 12th week, but the left (6 variables) are insignificantly different between the 4th week and 12th week.

c. Differences Between the 1st Week and 12th Week

The differences of OLC between the 1st week and 12th week can be assessed by statistical values in the third row-sets (1st / 12th week) of seven OLC variables in Table 5-13, 5-14, and 5-15. The seven OLC variables consist of 'OLC variate', 'team orientation', 'system orientation', 'learning orientation', 'memory orientation', 'sales growth of new products', and 'percentage of new product test'. The significant F statistics of 'team orientation' = 38.771, 'system orientation' = 83.023, 'learning orientation' = 56.247, 'memory orientation' = 99.823, 'sales growth' = 370.980, and 'percentage of new product test' = 155.447. Moreover, the F statistics of Pillai's Trace, Wilks' Lambda, Roy's Largest Root, and Hotelling's Trace of OLC variate show the significant same value of 37.123. That is, all statistical values demonstrate the significant differences of OLC in treatment groups between the 1st week and 12th week.

OLC	Tests of Within Subjects			
	Value	d.f.	F	p value
OLC Variate				
1st / 4th wk.				
Pillai's Trace	0.508	4.000	25.589	< 0.001**
Wilks' Lambda	0.492	4.000	25.589	< 0.001**
Hotelling's Trace	1.034	4.000	25.589	< 0.001**
Roy's Largest Root	1.034	4.000	25.589	< 0.001**
4th / 12th wk.				
Pillai's Trace	0.056	4.000	1.419	< 0.001**
Wilks' Lambda	0.944	4.000	1.419	< 0.001**
Hotelling's Trace	0.060	4.000	1.419	< 0.001**
Roy's Largest Root	0.060	4.000	1.419	< 0.001**
1st / 12th wk.				
Pillai's Trace	0.600	4.000	37.123	< 0.001**
Wilks' Lambda	0.400	4.000	37.123	< 0.001**
Hotelling's Trace	1.500	4.000	37.123	< 0.001**
Roy's Largest Root	1.500	4.000	37.123	< 0.001**

Table 5-13: Statistical Results of the Treatment Groups for the OLC Variate During 12 Weeks

** significant at the 0.05 level, two-tailed

OLC	Tests of Within Subjects				
	Sum Sq.	d.f.	Mean Sq.	F	p value
Team Orientation					
1st / 4th wk.	4.56	1	4.56	127.663	< 0.001**
4th / 12th wk.	0.26	1	0.26	4.494	0.057
1st / 12th wk.	2.37	1	2.37	38.771	< 0.001**
System Orientation					
1st / 4th wk.	4.77	1	4.77	134.067	< 0.001**
4th / 12th wk.	0.49	1	0.49	0.899	0.345
1st / 12th wk.	3.43	1	3.43	83.023	< 0.001**
Learning Orientation					
1st / 4th wk.	4.65	1	4.65	150.141	< 0.001**
4th / 12th wk.	0.427	1	0.427	0.235	0.629
1st / 12th wk.	4.31	1	4.31	56.247	< 0.001**
Memory Orientation					
1st / 4th wk.	10.87	1	10.87	20.385	< 0.001**
4th / 12th wk.	0.11	1	0.11	0.197	0.658
1st / 12th wk.	8.47	1	8.47	99.823	< 0.001**

Table 5-14: MSW of the Treatment Groups for the Four OLC Variables During 12 Weeks (Team Orientation, System Orientation, Learning Orientation, Memory Orientation)

** significant at the 0.05 level, two-tailed

OLC	Tests of Within Subjects				
	Sum Sq.	d.f.	Mean Sq.	F	p value
Sales growth					
1st / 4th wk.	6326.2	1	6326.2	116.676	< 0.001**
4th / 12th wk.	1492.3	1	1492.3	78.716	0.214
1st / 12th wk.	14086.5	1	14086.5	370.980	< 0.001**
Percentage of new product test					
1st / 4th wk.	412.0	1	412.0	30.975	< 0.001**
4th / 12th wk.	359.9	1	359.9	27.477	0.162
1st / 12th wk.	4208.9	1	4208.9	155.447	< 0.001**

Table 5-15: MSW of the Treatment Groups for the 'Sales Growth' and 'Percentage of new product test' During 12 Weeks

** significant at the 0.05 level, two-tailed

5.2. Relationships of OLT and OLP with OLC

This section includes methods of data analysis by canonical correlation (Section 5.2.1) and statistical results and hypothesis testing (Section 5.2.2).

5.2.1. Analysis of Data from Survey Research Using Canonical Correlation

After the analysis of data from experimentation by MANOVA, the technique of canonical correlation analysis (CanCor) was used to analyze the data from survey research. The reason for choosing this technique is that canonical correlation analysis is a multivariate statistical technique that facilitates the study of interrelationships among sets of multiple criterion (dependent) variables and sets of multiple predictor (independent) variables (Hair, 1998; Johnson, 1998; SPSS, 1999). Other reason is that canonical correlation technique is considered to be the general model on which many other multivariate techniques are based because it can simultaneously analyze both metric and non-metric data for either dependent or independent variables (Hair, 1998; Johnson, 1998). In this study, the canonical correlation technique was used to analyze the relationship of OLT (organizational learning tools) with OLC variate (organizational learning capabilities), and the multiple relationships of OLP variate (organizational learning process) with OLC variate. The data for CanCor analysis was collected from survey with top executives in the same companies as middle managers experimented in the previous section. The data was collected only once at the end of 12th week. The model of CanCor analysis for this section is as follows.

$$\sum_{i=1}^{4} a_i \, OLC_i = b_0 + \sum_{j=1}^{4} b_j \, OLP_j + b_5 \, (OLT) + e$$

OLC: Organizational learning capabilities

OLP: Organizational learning process

OLT: Organizational learning tools

From the model, nine variables (4 dependent and 5 independent variables) were used as input data. The measures of **OLC** variate (team orientation-OLCTO, system orientation-OLCSO, learning orientation-OLCLO, and memory orientation-OLCMO) were specified as the sets of dependent variables. The measures of **OLT** and **OLP** variates (information acquisition-OLPIA, information dissemination-OLPID, shared interpretation-OLPSI, and information memory-OLPIM) were specified as the sets of independent variables. Before testing the relationships of OLT and OLP with OLC by CanCor, the means of OLT, OLP, and OLC from the treatment groups and control groups were compared by using t-test. From Table 5-16, t-statistics shows that there is significant difference of means of OLT, OLC, and OLP between the treatment groups and control groups. So, the CanCor analysis by using data from the top-executives of the treatment groups and control groups will be proceeded.

Variables	Means		Levene's Test of Equality of Variance		t-Test for Equality of Means		
	Exp. Gr.	Cont. Gr.	F	p-value	t	d.f.	p-value
OLP: OLPIA	3.2500	2.7500	12.041	0.001	5.336	42.947	< 0.001**
: OLPID	3.5500	2.3854	0.695	0.406	13.532	100	< 0.001**
: OLPSI	3.6968	2.1701	2.304	0.132	12.310	100	< 0.001**
: OLPIM	3.7257	2.1813	4.348	0.04	12.557	47.505	< 0.001**
OLT	3.7114	2.1531	1.838	0.178	15.932	100	< 0.001**
OLC: OLCTO	3.3787	2.1861	5.216	0.024	16.884	95.902	< 0.001**
: OLCSO	3.2514	2.9875	1.545	0.217	2.373	100	0.020 *
: OLCLO	3.2143	2.7375	6.396	0.013	4.445	98.084	< 0.001**
: OLCMO	3.2821	2.9766	0.062	0.804	3.576	100	0.001 **

Table 5-16: Comparison of Means of OLT, OLP, and OLC by t-Test

* significant at the 0.05 level, two-tailed

** significant at the 0.01 level, two-tailed

In CanCor analysis, the statistical problem involves identifying any latent relationships (relationships among composites of variables and the separate variables). The theoretical and conceptual basis of both sets was well established, so there is no need for alternative model formulations testing different sets of variables (Hair, 1998). According to Hair (1998), there are **five** steps of CanCor analysis, examining data, testing the assumptions for CanCor analysis, deriving the canonical functions and assessing overall fit, interpreting CanCor variates, and validating the results, as detailed in the following subsections.

Step 1: Examination of Data

Descriptive Statistics

Descriptive statistics of all related variables were computed, including mean, standard errors of mean, modes, medians, standard deviations, variances, skewness, kurtosis, ranges, sum, minimums, and maximums. Furthermore, frequency of related variables were computed to assess errors in computerized data-input. The average of other data sets with more than one year (such as budgets in IT-tools, growth in sales, etc.) was also computed. Finally, the percentage of some relevant characteristics of subjects was also calculated and summarized. The missing values were coded as 999.

Outlier Analysis

Hair (1998) suggests to use **box plot** of all variables to check for outliers. From the result in the Appendix, the output shows that there is no serious outlier in this analysis. The effects of outliers are not strong because after trying in deleting outlier, the mean of each variable changes less than one standard error of mean.

Validity and Reliability Tests

The details of validity and reliability test before canonical correlation analysis were the same as that in the MANOVA section. From the output in Table 5-17-a and Table 5-17-b, both sets of factors extracted (Set 1: OLCTO, OLCSO, OLCLO, OLCMO and Set 2: OLPIA, OLPID, OLPSI, OLPIM) yield the eigen values higher than 1. The factors were formed according to a predetermined model, which met the validity test. Cronbach's alpha exceeded 0.6, which satisfied the reliability test.

Bivariate Correlations

Bivariate correlations of related variables were computed to preliminarily assess the correlation of any pairs of independent and dependent variables (correlation coefficient above 0.8) (Hair, 1998). The bivariate correlation analysis was performed to check whether there was any pair of independent variables or dependent variables having high correlations (correlation coefficients above 0.8). This bivariate correlation test included new variables from factor analysis and transformed variables. Furthermore, bivariate correlation analyses were also used to preliminarily find the significant correlations among independent variables and dependent variables. The present research used **Pearson test** to assess such bivariate correlation. The independent variables that have significant correlations with dependent variables were selected to use in canonical correlation analysis. The results of bivariate correlation test were presented in Table 5-18.

	1. OLCTO	2. OLCSO	3. OLCLO	4. OLCMO
a14 (team orientation)	0.995			
a15 (team orientation)	0.994			
a16 (team orientation)	0.984			
a17 (team orientation)	0.992			
a18 (team orientation)	0.995			
a22 (system orientation)		0.654		
a24 (system orientation)		0.714		
a33 (learning orientation)			0.846	
a35 (learning orientation)			0.622	
a43 (memory orientation)				0.728
Eigen Value	5.144	3.963	3.732	2.926
% of variance accounted for	20.574	15.852	14.929	11.703
Cum. percent of variance	20.574	36.426	51.356	63.069
Cronbach's alpha	0.8953	0.7218	0.6743	0.6289

Table 5-17-a: Factor Analysis of OLC Dependent Variate Used in CanCor Analysis

	1. OLPIA	2. OLPID	3. OLPSI	4. OLPIM
x14 (information acquisition)	0.801			
x16 (information acquisition)	0.743			
x18 (information acquisition)	0.567			
x21 (information dissemination)		0.747		
x22 (information dissemination)		0.828		
x31 (shared interpretation)			0.838	
x32 (shared interpretation)			0.788	
x35 (shared interpretation)			0.803	
x36 (shared interpretation)			0.750	
x37 (shared interpretation)			0.744	
x39 (shared interpretation)			0.538	
x43 (information memory)				0.839
x44 (information memory)				0.811
x45 (information memory)				0.794
Eigen Value	10.593	3.399	2.479	2.249
% of variance accounted for	39.234	8.885	8.514	8.329
Cum. percent of variance	39.234	48.119	56.632	64.961
Cronbach's alpha	0.6314	0.6021	0.7542	0.6211

Table 5-17-b: Factor Analysis of Independent Variates <u>OLP</u> (OL Process) Used in CanCor Analysis

	olcto	olcso	olclo	olcmo	olpia	olpid	olpsi	olpim	oltx
olcto	1.000								
olcso	.289*	1.000							
olclo	.409	.074	1.000						
olcmo	.339	.441*	.063	1.000					
olpia	.550**	.783**	.452**	.437*	1.000				
olpid	.787**	.613*	.314	.518	.239*	1.000			
olpsi	.777**	.290	.272	.366	.079	.305*	1.000		
olpim	.731**	.228	.230	.716*	.207	.256	.342*	1.000	
oltx	.771**	.860**	.789**	.526**	.147	.288	.318	.035	1.000

Table 5-18: Pearson Correlation Matrix of Variables Used in Survey Research

(** = correlation is significant at the 0.01 level, two-tailed)

(* = correlation is significant at the 0.015level, two-tailed)

Step 2: Testing the Assumptions for Canonical Correlation Analysis

Both dependent and independent variables were assessed for meeting the essential assumptions underlying multivariate analysis and passed all statistical tests. Such assumption testing were linearity, normality, and homoscedasticity.

a. Linearity

For canonical correlation analysis, assumption of linearity affects two aspects of results (Hair, 1998). First, the correlation coefficient between any two variables is based on a linear relationship. If the relationship is nonlinear, then one or both variables should be transformed (if possible). Second, the canonical correlation is the linear relationship between the variates. If the variates relate in a nonlinear manner, the relationship will not be captured by canonical correlation. According to Hair (1998), the most common way to assess linearity is to examine scatterplots of the variables and to identify any nonlinear patterns in the data. The linearity tests were done to verify sets of data shown in the Appendix.

b. Normality

Although canonical correlation analysis can accommodate any metric and non-metric variables without the strict assumption of normality, the normality is desirable because it standardizes a distribution to allow for a higher correlation among variables (Hair, 1998). But in the strictest sense, canonical correlation analysis can accommodate even non-normal variables if the distribution form (e.g., highly skewed) does not decrease the correlation with other variables. The tests of significance are less useful in small samples (fewer than 30) and quite sensitive in large samples (exceeding 1,000 observations). Both the graphical plots and any statistical tests should be used to assess the actual degree of departure from normality (Hair, 1998). In the present study, the tests for normality was performed graphically (Normal PP Plot and Histogram with normality plot) and statistically (Kolmogorov-Smirnov test). The variables which were not normal in distribution will have significance of Kolmogorov-Smirnov test lower than 0.05. The normality tests were performed to verify sets of data shown in the Appendix. According to Hair (1998), a simple test is a rule of thumb based on the skewness and kurtosis values (available as part of the basic descriptive statistics for a +/- 2.58 indicates we can reject the assumption about the normality of the distribution at the .01 probability level. Another commonly used critical value is +/- 1.96, which corresponds to a .05 error level.

c. Homoscedasticity

According to Hair (1998), homoscedasticity is an assumption related primarily to dependence relationships between variables. It refers to the assumption that dependent variable(s) exhibit equal levels of variance across the range of predictor variable(s). Homoscedasticity is desirable because the variance of the dependent variable being explained in the dependence relationship should not be concentrated in only a limited range of the independent values.

The test of homoscedasticity for two metric variables is best examined graphically (Hair, 1998). Boxplots work well to represent the degree of variation between groups formed by a categorical variable. The length of the box and the whiskers each portray the variation of data within that group (Hair, 1998). Moreover, the statistical tests for equal variance dispersion relate to the variances within groups formed by non-metric variables. The most common test, the Levene test, can be used to assess whether the variances of a single metric variable are equal across any number of groups. If more than one metric variable is being tested, so that the comparison involves the equality of variance / covariance matrices, the Box's M test is applicable.

In canonical correlation analysis, homoscedasticity should be tested and remedied because it may decreases the correlation between variables (Hair, 1998). In the present study, the tests for homoscedasticity was done by assessing from boxplots, Levene test, and equality of variance / covariance matrices as shown in the Appendix.

Step 3: Deriving the Canonical Functions and Assessing Overall Fit

According to Hair (1998), the canonical correlation analysis was restricted to deriving not more than number of canonical functions (depending on number of dependent or independent variables). To determine the number of significant canonical functions to include in the interpretation stage, the analysis focused on the level of statistical significance, the practical significance of the canonical correlation, and the redundancy indices for each variate. The first statistical significance test is for the canonical correlations of each of the four canonical functions. In this study, there were only two significant canonical functions (assessed from ‘canonical correlations’ values). In addition to tests of each canonical function separately, multivariate tests of both functions simultaneously were also performed. The test statistics implemented were Wilks' lambda, Pillai's criterion, Hotelling's trace, and Roy's gcr. In addition to statistical significance, the canonical correlations were both of sufficient size to be deemed practically significant.

Step 4: Interpreting the Canonical Variates

The researchers potentially proceeds to making additional interpretations of the results by assessing the canonical relationship deemed statistically significant and the magnitude of the canonical root and the 'redundancy index acceptable. The second function, which was practically non-significant because of the low redundancy value, was excluded from the next interpretation phase. Thus, only the first function was proceeds to additional interpretations. These interpretations involve examining the canonical functions to determine the relative importance of each of the original variables in deriving the canonical relationships. According to Hair (1998), the three methods for such interpretations are (1) canonical weights (standardized coefficients), (2) canonical loadings (structure of correlations), and (3) canonical cross-loadings. From the three, the canonical weights is the least stable and reliable and the methods of canonical loading and cross-loadings are considered more appropriate (Hair, 1998). So, in this study, only two methods, the canonical loadings and canonical cross-loadings, were performed.

Step 5: Validation and Diagnosis

The last stage involve a validation of the canonical correlation analyses through one of several procedures. Among the available approaches would be (1) splitting the sample into estimation and validation samples, and (2) sensitivity analysis of the independent variable set.

Characteristics	Number (n)	Percentage
Total number of organizations surveyed (Respondents were top executives with average years of experience = 9.2 years)	102	82.7%
Country of origin		
European	58	56.8%
USA.	32	31.4%
Japan	12	11.8%
Status of organization		
Importer	20	19.6%
Sole distributor / agent	22	21.6%
Joint venture	7	6.9%
Subsidiary without manufacturer	29	28.4%
Subsidiary with manufacturer	14	13.7%
MNC. affiliated with H/O	10	9.8%
Major product groups (Flagship products)		
Cardiovascular	11	10.8%
Respiratory	16	15.7%
Gastrointestinal	16	15.7%
Topical	13	12.7%
Pediatric	14	13.8%
Parenteral	13	12.7%
Food & nutrition	7	6.9%
Medical supplies	8	7.8%
Miscellaneous	4	3.9%
Total number of employees in organizations		
Less than 20	57	55.9%
20 or more	45	44.1%
Total sales turnover (yearly)		
Less than 100 million baht	40	39.2%
100 million baht or more	62	60.8%
Total budget of IT tools (excluded personnel)		
Less than 0.2 million baht	72	70.6%
0.2 million baht or more	30	29.4%
Total assets of IT tools (excluded personnel)		
Less than 0.5 million baht	64	62.7%
0.5 million baht or more	38	37.3%
Having Internet facilities	102	100%
Having company homepage (website)	55	53.9%

Table 5-19: Sample Profiles (Survey Research; Canonical Correlation Analysis)

5.2.2. Statistical Results and Hypothesis Testing Relationships of OLT & OLP with OLC

In the last section, the data analysis process of canonical correlation aimed to test the relationships of OLT and OLP with OLC were presented. Data were collected from top executives of 102 companies (82.7% of expected 123 companies). From Table 5-19, the averaged years of working experience of these top executives were 9.2 years. The data of participated companies also showed the details of countries of origin, status of organization, and groups of major product-groups. Moreover, the numbers of employees in related departments and IT-assets were also presented in Table 5-19.

Using canonical correlation analysis (CanCor), statistical results and tests of hypotheses for the relationships of OLT and OLP with OLC are presented in this section. Detailed process and results of all the five steps of canonical correlation analysis as mentioned in the previous section were presented in Appendix IV. However, the concluded results from such five steps were presented in Table 5-20, 5-21, 5-22, and 5-23. The results consisted of canonical correlation coefficient, canonical loading and cross loading, canonical weight, redundancy index, and sensitivity analysis of the canonical correlation. Firstly, the significant canonical functions were selected to proceed to other analysis of relationship and the insignificant functions were deleted. Secondly, the structures of relationship between independent and dependent variables were analyzed by canonical coefficient, loading, cross loading, canonical weight, and redundancy index. Finally, the stability or sensitivity analysis of canonical correlation was analyzed by removing each independent variable.

From Table 5-20, there are only two significant canonical functions to be assessed, the first and the second function (F = 8.918 and 1.795). In addition to tests of each canonical function separately, multivariate tests of both functions simultaneously were also performed. The test statistics implemented were Wilks' lambda, Pillai's criterion, Hotelling's trace, and Roy's gcr. Table 5-21 also shows the multivariate test statistics, which all indicate that the canonical functions, taken collectively, are statistically significant at the 0.05 level. In addition to statistical significance, the canonical correlations were both of sufficient size (0.848 and 0.419) to be deemed practically significant (Hair, 1998).

Canonical Function	**Canonical Correlation**	**Canonical R^2**	**F Statistics**	**Significance** (Probability)
1	**0.848**	0.719	**8.918**	**< 0.001****
2	**0.419**	0.175	**1.795**	**0.043****
3	0.138	0.019	0.365	0.901
4	0.057	0.003	0.157	0.855

Table 5-20: Measures of Overall Model Fit for Canonical Correlation Analysis

Statistics	**Value**	**Approximate F Statistics**	**Significance** (Probability)
Wilks' lambda	0.227	8.918	**< 0.001****
Pillai's trace	0.916	5.825	**< 0.001****
Hotelling's trace	2.793	13.055	**< 0.001****
Roy's GCR	0.719	-	-

Table 5-21: Multivariate Test of Significance for Canonical Function

By the reasons and tests presented in Appendix IV, only the first function with canonical correlation = 0.848 was selected to proceed to other analyses of relationships. The strength of the association among sets of the predictor (independent) variables and criterion (dependent) variables was assessed by inspecting the magnitudes of both canonical correlation coefficients and the redundancy index for each pair of linear composites derived from the data (Hair, 1998). By inspecting the canonical correlation coefficients, a rough estimation of the strength of relationship among each set of variables was derived. Specifically, the canonical coefficient indicates the correlation between canonical scores for each linear combination of variables (Johnson, 1998). An analysis of the canonical correlation coefficient does not reveal the amount of variance shared by the two sets of variables. Consequently, it necessitates inspection of the magnitude of the redundancy index, an asymmetric index measuring how much variance in one set of variables is shared by the variability in the other set. Hair (1998) recommends that the redundancy index is the indicative measure of the explanatory capability of canonical analysis in accounting for criterion variance.

The relative importance of a variable in each of variables was indicated by the canonical weights extracted for the variable, their canonical loadings (within set, variable-variate correlation) and canonical cross-loadings (between set, variable-variate correlations) (Hair, 1998). These statistics computed for the most significant linear composite provided a basis for the subset interpretation. The canonical loading reflects the variance that an observed variable in one set of variables shares with the canonical score for that set. Conversely, the cross-loading value reflects the variable's correlation with the canonical score for the other set of variables. The results of separate canonical correlation analysis of relationship among each of the predictor sets (OLT and OLP) and the criterion set (OLC) appear in Table 5-22.

Table 5-22 shows the result of correlating the OLT variable with the OLC variate. The canonical correlation is 0.848, which is significantly different than zero (at the p value < 0.001) by the chi-square test (Hair, 1998). The canonical weights are also presented. According to Hair (1998), canonical weights are an approach to interpreting canonical functions by examining the sign of the magnitude of the canonical weight assigned to each variable in its canonical variate. Variables with larger weights contribute more to the variate, and vice versa (Hair, 1998). From Table 5-22, canonical weight of OLT = 0.212, which means that OLT contributes to the canonical function = 21.2%.

The redundancy index for the canonical function indicates that 29.80% of the variance in the OLC dimensions is accounted for by the variability in the OLT. Conversely, 54.90% of the variation in the OLT is accounted for by the variability in the OLC dimensions. An examination of the structural coefficients for the canonical function indicated that the composite score for the OLT is significantly related to all the four dimension of OLC. The cross-loading values for all four dimensions of OLC exceed 0.30 level suggested by Lambert and Durand (1975) and Hair (1998) as an acceptable minimum loading value. Thus, OLT and OLC are significantly related.

H_2 : Organizational learning tools have significant positive relationship with adaptive organizational learning capabilities.

The statistical result supports hypothesis-2 that OLT have significant positive relationship with OLC. In other words, manipulated organizational learning tools are positively related with the creation of adaptive organizational learning capabilities.

Table 5-22: OLT and OLP Correlated with OLC

	Canonical Weights	Canonical Loadings	Canonical Cross-Loadings
Predictor Set: OLT			
OLT	0.212	0.900	0.763
Predictor Set: OLP			
Information Acquisition	0.343	0.746	0.631
Information Dissemination	0.387	0.946	0.802
Shared Interpretation	0.204	0.916	0.777
Information Memory	0.001	0.849	0.720
Redundancy Index = 0.549			
Criterion Set: OLC			
Team Orientation	0.812	0.964	0.817
System Orientation	0.094	0.447	0.379
Learning Orientation	0.113	0.472	0.400
Memory Orientation	0.220	0.552	0.468
Redundancy Index = 0.298			

Canonical correlation coefficient = 0.848
Canonical root (eigenvalue) = 2.557
Chi-squaure = 145.45
d.f. = 20; p value < 0.001

Table 5-22 also shows the result of canonical correlating the four dimensions of OLP with the four dimensions of OLC. The **canonical correlation** is 0.848, which is significantly different than zero (at the p value < 0.001) by the chi-square test (Hair, 1998). The **canonical weights** of OLPIA, OLPID, OLPSI, and OLPIM = 0.343, 0.387, 0.204, and 0.001, which means that OLPIA, OLPID, OLPSI, and OLPIM contribute to the canonical function = 34.3%, 38.7%, 20.4%, and 1%. The **redundancy index** for the canonical function indicates that 29.80% of the variance in the OLC dimensions is accounted for by the variability in the OLP dimensions. On the contrary, 54.90% of the variation in the OLP dimensions is accounted for by the variability in the OLC dimensions (Hair, 1998). The examination of the structural coefficients for the canonical function indicated that the composite score for the OLT is significantly related to all the four dimension of OLC. The **cross-loading** values for all four dimensions of OLC exceed 0.30 level suggested by Lambert and Durand (1975) and Hair (1998) as an acceptable minimum loading value.

The multicollinearity between **OLT** variable and **OLP** variate (OLPIA, OLPID, OLPSI, and OLPIM) was tested by withdrawal of each variable and reprocessing the data. The results of stable share variance (R^2) and consistent redundancy index confirmed that there was no significant multicollinearity among those variables (Appendix IV: Table V-7) (Hair, 1998). However, in the real life practice, it is unavoidable that the various process of OLP is sometimes related to OLT. Thus, we should be aware of this interaction effect in generalizing the results to some other situations. Thus, OLP is significantly related with OLC.

H_3 : Organizational learning process has significant positive relationship with adaptive organizational learning capabilities.

The statistical result supports hypothesis-3 that OLP have significant positive relationship with OLC. In other words, organizational learning process is positively related with the creation of adaptive OLC. In conclusion, Table 5-23 summarizes the conclusive results of testing of the three hypotheses from the two models. The triangulation of results from both models will be discussed in the next section.

Independent Variables	OL. Capabilities	Hypothesis Testing Results
H_1: OL. tools	Sales growth of new product	Supported
	Percentage of new product test	Supported
	OLC variate - Team orientation	Supported
	- System orientation	Supported
	- Learning orientation	Supported
	- Memory orientation	Supported
H_2: OL. tools	OLC variate	Supported
H_3: OL. process	OLC variate	Supported

Table 5-23: Conclusive Results of Hypothesis Testing from Both Data Collection Methods

5.3. Triangulation of Results from Both Data Collection Methods

According to Nachmias and Nachmias (1997), all data collection methods have certain advantages as well as some inherent limitations. To a certain degree, research findings concluded from each data collection method are affected by the nature of data collection methods and varied research environment (Nachmias and Nachmias, 1997). They suggest that **'triangulation'** can partially help solving these problems because **'triangulation'** relies on more than one forms of data collection which yield different results. Such 'triangulation' concept was implemented in this research by combining two methods of data collection (survey and quasi-experimentation) and also evaluating by two different statistical methods (canonical correlation and MANOVA). The separate statistical results from each statistical method was presented in the former sections, and finally 'triangulated' in this section. According to Nachmias and Nachmias (1997), implementing 'triangulation' concept will minimize the degree of specificity of certain methods to particular bodies of knowledge. This means that generalization of knowledge from research will not specifically depend on any methods of data collection. If the findings yielded by the different data collection methods are consistent, the validity of those findings is increased (Nachmias and Nachmias, 1997).

From the results of MANOVA testing (Section 5.1.2) and canonical correlation analysis (Section 5.2.2), both conclusive hypothesis $\mathbf{H_1}$ (Section 5.1.3) and $\mathbf{H_2}$ (Section 5.2.3) confirmed that **OLT** (organizational learning tools) have significantly impacts on **OLC** (adaptive organizational learning capabilities) in positive directions (Table 5-23). The greater the extents of 'organizational learning tools' made available by the organizations, the greater degree of 'adaptive organizational learning capabilities' the organizations acquire. The concept of 'triangulation' used in this research helped us making conclusions of results with increased validity that 'organizational learning tools' positively affects 'adaptive organizational learning capabilities'. Thus, making generalization from such research results is more confidently.

Conclusion

Due to the triangulation concept implemented, this chapter demonstrated two methods of data analysis, results, and tests of hypotheses. One was the MANOVA (repeated measures), which was aimed to test the impacts of OLT on OLC and was conducted in quasi-experimentation with middle managers. Another was the canonical correlation, which was intended to assess the relationships of OLT and OLP with OLC and was surveyed in the top executives. Finally, triangulation of both results was also presented and discussed. The detailed discussion of results, implications, suggestions for future research, and overall conclusion will be elaborated in the next chapter.

CHAPTER 6
DISCUSSION AND CONCLUSION

This chapter discusses the research results and concludes the overall research findings. The chapter is organized into six sections. The first section discusses the results from the first model, which related to the impacts of organizational learning tools (OLT) on organizational learning capabilities (OLC). The second section discusses the results from the second model, which examines the relationship of OLT and organizational learning process (OLP) with OLC. The third section presents the implications of this research. The limitations and suggestions for future research are shown in the fourth and the fifth sections. Finally, the sixth section concludes with overall summary.

6.1. The Impacts of 'OLT' on 'OLC'

The OLC, as being measured by subjective measures of OLC variate and OLC variables. The OLC of the treated groups are higher than the controlled groups in all three period of times ($1^{st}/4^{th}$, $4^{th}/12^{th}$, $1^{st}/12^{th}$ weeks) (Table 5-4, 5-5, and 5-6). However, if analyzing only within the treated groups, the increase in OLC shows the significant changes only at the $1^{st}/4^{th}$ and the $1^{st}/12^{th}$ week, but the OLC of $4^{th}/12^{th}$ week has no significant increase (Table 5-13 and Table 5-14).

In the same way, similar results pertain to the objective measures (the sales growth and percentage of percentage of new product test) appears to be affected by the introduction of OLT in the manipulated environment. The OLC of the treated groups are higher than the controlled groups in all three period of times ($1^{st}/4^{th}$, $4^{th}/12^{th}$, $1^{st}/12^{th}$ weeks) (Table 5-10, 5-11, and 5-12). Yet, if analyzing only within the treated groups, the increase in OLC shows the jumps only at the $1^{st}/4^{th}$ and the $1^{st}/12^{th}$ week. The OLC of $4^{th}/12^{th}$ week has no significant improvement (Table 5-15).

These findings confirm Laudon and Laudon (1998) and Andreu and Ciborra (1996) that one of the most obvious roles of information technology and information systems (IT/IS) in organization is the components to create organizational learning capabilities. However, both of them do not elaborate on the organizational activities leading to organizational learning capabilities (OLC). This study provided some evidences that the sales growth of new products and percentage of new products, which were used as the proxy of OLC, can be affected by the appropriate organizational learning tools (OLT). However, except for OLT, there are many confounding factors in organizations, which possibly impact the changes of sales growth and percentage of new products. This is one of the reasons why this research used both objective and subjective measures. In doing future research like this, alternative measures (both subjective and objective) should be considered in order to add to OLC-measure validity.

Note that OLC (subjective and objective) in the treated groups at the $4^{th}/ 12^{th}$ week do not significantly improved (Table 5-13, 5-14, and 5-15).

One possible reason for the insignificance of the MSW at the 4th/ 12th week, found from interviewing with some top executives at the end of the 12th week, is that the subjects received no new motivation after the introduction of treatment at the 1st week. Most of the subjects paid less attention or stopped using the CBT after the 2nd till 4th week. After the 2nd to 4th week., the subjects had already learned everything in the CBT (computer-based training) and seen the prospected results from implementing the materials learnt from the CBT.

Moreover, the periods during the 4th week to the 12th week were the period of closing their third-quarter sales (August-September 2000). So, most of the subjects (middle managers) had to concentrate on their sales performance by their conventional approaches of working and paid little attention on implementing new concepts learnt from the computer-based training (CBT). This phenomenon of reduced motivation of the target subjects should be one important point for designing future research.

Laudon and Laudon (1998) and Turban, Rainer, and Potter (2001) suggest various kinds of information technology (IT), which may facilitate the efficient management of organizational information and knowledge (e.g., database systems, computerized telecommunication systems, computer-based training and sharing knowledge systems, artificial intelligence, expert systems). The OLT in this study was the computer-based training (CBT), which taught and recommended subjects to implement the knowledge learnt from the CBT to their organizational IT-infrastructures. However, the industry selected for this research is only one industry, pharmaceutical industry, which is not much competitive in implementing some high-cost OLT. According to Hult and Ferrell (1997), creating organizational learning capabilities is closely related to the process of organizational change and organizational development, which require some investment in relevant resources and are not overnight implementation. Thus, the OLC variate may or may not be significant in some period of time because of the variation of management of change and organizational development.

The subjective measures of OLC variate were composed of four variables (OLCTO: Team orientation, OLCSO: System orientation, OLCLO: Learning orientation, and OLCMO: memory orientation) (Hult and Ferrell, 1997). The MANOVA univariate results of the four variables were separately presented in relationship with the multivariate results of OLC variate. Thus, evaluating and applying the results of this research related to the four OLC variables and OLC variate should be done with care.

Hult and Ferrell (1997) prove the composite of OLC variate from four OLC variables. They also suggest that 'team orientation' is the degree of collaboration and cooperation in performing significant activities to enhance organizational performance. However, in some organizations and some activities, staffs did not really learn to work together within the limited time, existing routines, and organizational structures. The present study confirms what Laudon and Laudon (1998) posits that IT or OLT, if properly managed, can enhance and speed up this team orientation.

After interviewing with the middle managers and top executives participated in this research, the researcher agreed with what Senge (1990) posits. Senge (1990) suggests that in order for the team orientation to function effectively, a dialogue must exist among members focused on sharing assumptions, thinking together to solve problems, and charting the future operations of the organization. Argyris & Schon (1978) also recommend that thinking together fosters a climate focused on creating a genuine vision, subsequently leading to excellence and learning because the employees feel that they are pursuing their own goals. As such, each organizational member has an input in the process of creating, developing, and implementing a team orientation that leads to a commonality of direction and the harmonization of individuals' energy.

According to Hult and Ferrell (1997), 'system orientation', which is the focus of the broad 'picture' or discipline for seeing the 'whole' or systematic approach of the significant activities to enhance organizational performance is other important component of OLC variate. Systems orientation focuses on structuring and making sense of the multiple inputs from the organizational environments.

After interviewing with the middle managers and top executives participated in this research, the researcher found that 'system orientation' is the most difficult orientation for staffs to implement in organizations. In their views, Asian staffs perceived the significance and implemented 'system orientation' less than Western staffs in the same companies (both in the same countries or other country-branches). Moreover, they also commented that the 'system orientation' was difficult to standardize for all the periods of time and for all staffs in different departments. Senge (1990) recommends that system orientation guides the organization's cognitive levels of learning, by that helping to identify market patterns and the reinforcement or changing of these patterns at the adaptive to generative learning.

The middle managers and top executives participated in this research also suggested that the 'learning orientation' in each industry is not the same in patterns, degrees or amounts, types, and quality. Knowledge-intensive industries (e.g., pharmaceutical) require much more different 'learning orientation' from labor-intensive industries. The conventional 'learning orientation' is mostly focused on group-teaching, personal training, or seminar. However, the speedy development of IT or OLT has changed the pattern of 'learning orientation', like Senge (1990) suggest in his 'mental model' in the organization. The web-based learning and development of Internet is one of the challenging trends of advanced IT development in creating organizational learning capabilities.

Finally, 'memory orientation', the focus of communication, distribution, or transfer of knowledge of activities to enhance organizational performance (Hult & Ferrell, 1997), shows interesting results in this research. According to Slater & Narver (1995), 'memory orientation' incorporates ideas that repeatedly performing a set of activities, organizational members develop a knowledge base of those activities and a mean for performing better the next time. The individual member's experience leads to the modification of organizational knowledge, and thus, to a better understanding of the interactions between the organizational systems and the environment (Hult & Ferrell, 1997).

After interviewing with the middle managers and top executives participated in this research, the 'memory orientation' in Thai subsidiaries of pharmaceutical multinational corporations is not much focused. The OLT or IT facilities have not been applied in full functions to enhance the 'memory orientation' in creating OLC. Most of the OLT used are the database systems of customers, products, or company information. However, the OLT facilities related to knowledge-based systems or computer-based training have not been implemented so much. Nevertheless, after participating in this research project, most of them perceived the potentials of these OLT and put them into the company plans for the next year.

Specifically related to its research context, the results of this research partially support Grosse (1996), Contractor (1989), Laudon and Laudon (1998), and Davidson and Mcfetridge (1984) that technology transfer, knowledge transfer, or information diffusion may take place through market transactions, and may be facilitated to happen within a firm through its network of affiliates by some kinds of information technology / information system (IT/IS). According to Laudon and Laudon (1998), CBT is one of the tools for knowledge (information) management, which potentially creates organizational learning. The present research specified that the type of information technology is online- or web-computer-based training (CBT). The web CBT is closely related to the creation of information networks via the Internet.

6.2. The Relationships of 'OLT' and 'OLP' with 'OLC'

The organizational learning capabilities (OLC), which were tested to be impacted by organizational learning tools (OLT) in the first research model, was confirmed to have positive relationship with OLT again in the second research model of this study (Table 5-22). Nevertheless, the different data collection methods used in both models yield slightly different conclusions due to the strengths of each method. One of the strengths of quasi-experimental research is gaining the causal inference from the results (Cook and Campbell, 1979; Nachmias and Nachmias, 1997). Quasi-experimentation yields results with higher internal validity but less external validity, and vice versa for the survey research (Nachmias and Nachmias, 1997). Thus, the causal inference of OLT and OLC was confirmed in the first model and the relationship of OLT and OLC was proved in the second model.

Furthermore, the OLC were also tested to have positive relationship with organizational learning process (OLP) in the second model (Table 5-22). The findings from this research support Sinkula (1994) and Slater and Narver (1995) that some organizational processes related to information (information acquisition, information dissemination, shared interpretation, and information memory)may potentially create organizational learning. However, both studies do not specifically identify the types, characteristics, and details of organizational learning like this study. This research clarified the type of organizational learning capabilities (adaptive OLC) and identified the detailed relationship of OLC and OLP variates and their composite variables.

This opens up the opportunity for theorists and practitioners to specifically study and implement the organizational learning theories in details appropriate for their situations.

Daft and Huber (1987) and Huber (1989) suggest the systems-structural framework, which consists of four learning-related axes (information acquisition, information distribution, information interpretation, and organizational memory). This study confirmed the theses of such authors with some differences that the organizational learning process (information acquisition, information dissemination, shared interpretation, and information memory) and organizational learning tools are positively related to the creation of organizational learning capabilities.

Daft and Huber (1987) posit that information acquisition (OLPIA) consists of five processes by which information leading to learning is obtained (inherited knowledge, experiential learning, imitation related to intelligence, grafting new members or the whole organization possessing the knowledge, and searching information from the internal or external environment). However, Sinkula (1994) suggests that information acquisition is from direct experience, the experiences of others, or organizational memory. In this research, after interviewing with the middle managers and top executives, the information acquisition in the Thai subsidiaries of pharmaceutical multinational corporations is the same process as what Daft and Huber (1987) and Sinkula (1994) propose. Nonetheless, in their viewpoint, advanced information technologies play an important role in creating this subprocess of information acquisition, especially the Internet or the World Wide Web.

Information dissemination (OLPID), the process and extent of distribution of relevant information among, staffs, units, SBU, or companies to enhance the organizational performance (Kohli, 1993, Sinkula (1994), is also supported to be a major component of OLP in creating OLC in this study. However, middle managers and top executives joined in this research viewed that information technologies, if appropriately used and managed, facilitate the efficiency and efficacy of information dissemination.

Shared interpretation (OLPSI) in this research was concluded with different callings but the same connotation as shared visions and interpretation (Simonin, 1991, Sinkula, 1994), closeness in planning and action (GalerandVan Der Heijden, 1992), shared vision (Senge, 1995), transfer of knowledge throughout organization (Garvin, 1993), sharing of information (Wick and Leon, 1993), internal networks (Gephart and Marsick , 1996). That is, shared interpretation involves development of shared meaning, evaluating, and understanding relative to new information within or across units to enhance organizational performance.

However, after interviewing with the middle managers and top executives participated in this research, shared interpretation in the Thai subsidiaries of pharmaceutical multinational corporations is less than the Western staffs or branches. They viewed that shared interpretation is closely linked with the teamworks and system thinkings, which Thai staffs implemented less than Western staffs.

In addition, they also proposed that advanced information technologies (e.g., networking facilities, the Internet) become the potential facilitator for shared interpretation in the global businesses. From this research and interviews with middle managers / top executives participated, information memory (OLPIM) is the subprocess of organizational learning process which creates organizational learning capabilities. This confirms with the suggestions of Kohli (1993) Sinkula (1994) that organizational memory is the extent of storage or retrieval of relevant information among, staffs, units, SBU, or companies to enhance the organizational performance. Levitt and March (1988) posit that organizations learn by encoding inferences from history into routines that guide behavior and organizational learning can be created through direct experience or through the experience of others. Top executives and middle managers joined in this research also viewed that information technologies facilitated the creation of organizational learning capabilities by help the efficiency and efficacy of information memory in organizations, especially the knowledge-intensive industry which related to lots of complex information.

According to Daft (1998), the management shift has been prompted by two accelerating trends. The first is the increasing rate of change brought by global competition. Organizations must adapt faster and be able to do more things well. The second trend is a fundamental change in organizational technologies. Traditional organizations were designed to manage machine-based technologies, with a primary need for stable and efficient use of physical resources, such as in mass production.

However, new organizations are knowledge-based, which means they are designed to handle ideas and information, with each employee becoming an expert in one or several conceptual tasks. Rather than striving for efficiency, each employee in knowledge-based companies must continuously learn and be able to identify and solve problems in his or her domain of activity. In this new world order, the responsibility of management is to create organizational learning capability.

The findings from this research extends the theory of Daft (1998) that OLT, which is one of the advanced organizational infrastructures, and OLP, which is one of the organizational process, enhance the organizational ability to learn and change faster than competitors. Thus, these two factors help sustain competitive advantage. Slater and Narver (1995) and Sinkula (1994) propose the concepts of organizational learning process (OLP) while Hult and Ferrell (1997) prove their theory and measures of organizational learning capabilities (OLC). The findings from this research confirm the relationships between these two theories. Senge (1995) describes the kinds of changes managers need to undergo to help their organizations adapt to an increasingly chaotic world. His original concepts about how managers build learning capability have evolved to include characteristics of the organization itself.

The results of this research take side with what Laudon and Laudon (1998) posit that information management process are one of the tools for knowledge management, which potentially creates organizational learning. The present research specified that information management process or organizational learning process (OLPIA, OLPID, OLPSI, OLPIM) and proved the relationship with specific organizational learning capabilities (adaptive OLC variate which consists of OLCTO, OLCSO, OLCLO, OLCMO). By the quasi-experimentation performed in

this research, the static CBT (CD-ROM version) and dynamic CBT (online- or web-version) were experimented. The qualitative finding accidentally found from this research is that online- or web-technology (dynamic media) can speed up the information transfer or knowledge transfer, comparing to the fixed media (static media). This finding should be proved quantitatively in relation with OLT, OLP and OLC in future research.

There is no single model of the learning organization. The organizational learning is the attitude or philosophy about what an organization is and the role of employees, and the organizational learning is a paradigm shift to a new way of thinking about organizations. In the **learning organization,** everyone is engaged in identifying and solving problems, enabling the organization to continuously experiment, improve, and increase its capability (Garvin, 1993). The essential value of the organizational learning is problem solving, in contrast to the traditional organization that was designed for efficiency. In the learning organization, employees engage in problem identification, which means understanding customer needs. Employees also solve problems, which means putting things together in unique ways to meet customer needs. The organization in this way adds value by defining new needs and solving them, which is accomplished more often with ideas and information than with physical products. The results of this research refute what Senge (1995) and Garvin (1993) posit and also extend their theories that using modern information technologies (OLT) and appropriate organizational learning process (OLP) will potentially increase the organizational learning capabilities (OLC).

Various researchers termed the concepts of 'organizational learning' (OL) for some decades, and Hult and Ferrell (1997) extend the term 'global organizational learning capabilities (GOLC) to specified the details of 'organizational learning' concept. Thus, the present research would potentially expand the concept of 'organizational learning' and coin the term 'national organizational learning capabilities' (NOLC) because its results are ralated to the organizational learning capabilities of Thai firms and its global affiliates.

6.3. Implications

The findings obtained in this study provide evidence showing that the **OLT** (Organizational learning tools) affect the **OLC** (Organizational learning capabilities). The implications of results from this research for were two folds, the theoretical implications and practical implications. The practical implications, which were major focus of this study, were classified into three groups of interconnected agencies, the businesses , the academics, and the governments.

6.3.1. Theoretical Implications

There are two theoretical implications from this research.

Firstly, the theoretical framework of organizational learning (OLT-OLP-OLC) developed in this research provides the essential guide for creating organizational learning capabilities.

The triangulated results (in Chapter 5) was consistent with the theoretical model, that is the **OLT** (organizational learning tools) create the **OLC** (organizational learning capabilities), and the appropriate **OLP** (organizational learning process) help build the **OLC** (organizational learning capabilities). Consequently, the findings from this research indicate that future work has to be continued on such three factors.

Secondly, the results from this study extend the theory by showing that, except for the OLP (organizational learning process), OLT (organizational learning tools) is one of the major infrastructures in this era which can be optimally managed to produce OLC (organizational learning capabilities). So far, there have been lots of proven theories related to relationships between OLP and OLC. However, the theory of relationship between OLT and OLC has never been clearly proved, especially in the casaulity pattern from quasi-experimentation like this study. The OLT are mostly related to organizational infrastructures or 'hardware' while the OLP are mostly related to people in the organizational process or 'peopleware'. The combined model of such two components of OLT and OLP in relationships with OLC is the complete set of modern organizational learning theory. Thus, the findings from this research extend some new understanding related to organizational learning theories.

6.3.2. Practical Implications

a. Implications for businesses

In this era of borderless business world, the increased degrees of competition are unavoidable. The survival is preserved only for the most dynamic to change and continuous to learn. Organizational learning capabilities (OLC) have been accepted by many researchers and practitioners to be one major factor facilitating competitive edge. The results from this research indicate business managers to implement **OLT** (organizational learning tools) and **OLP** (organizational learning process) to create **OLC** (Organizational learning capabilities) with confidence. Moreover, the research results confirms the first-mover-managers to apply the networked IT systems (web-based OLT) to build the more advanced **OLC** (Organizational learning capabilities) than their competitors.

In the aspects of international business, global businesses can enhance their productivity in doing business with their global networks and their global affiliates by applying the concepts of IT-facilitated organizational learning concluded from this research results. By manipulating **OLT** (webbed and non-webbed formats) and implementing **OLP**, the head-office and their affiliates can create their **OLC** (organizational learning capabilities) and transfer their technologies back and forth, thus increasing competitive advantage. Most knowledge-intensive industries (e.g., computer software, pharmaceutical, biotechnological, etc.), which mostly rely on their employees' **OLC** in building competitive edge, can also implement the results of this research to create **OLC** over their competitors. Based on the contexts of this research, the technology transfer in international businesses, results from this research can also be applied in international business management to achieve better performance and competitive advantage.

Roles of OLT (organizational learning tools or information technology) are mostly recognized as positive enabler of OLC (organizational learning capabilities). However, Sveiby (1999) suggests that information technology may be the enabler or disabler tools, which accelerate or decelerate the speed of organizational development, if not properly implemented or not dynamic to changing environment. For organizational learning, information technology may disable organizational learning capabilities by supporting rigid systems that are not dynamic (or adaptable) to changing conditions of use. So, managers of any organizations have to be aware of appropriately implementing information technology in their organizations.

b. Implications for Academics

Academic institutions are one of the main sources of producing, modifying, distributing, and memorizing knowledge. Individual learning and organizational learning are one of the major research issues affecting the efficacy and efficiency of academic institutions and academicians. So far, various streams of research related to organizational learning have been finding the factors affecting OLC.

The results of this research help academic agencies and personnel to apply two important factors (OLT and OLP) to create organizational learning capabilities (OLC), thus enhancing the efficiency and efficacy of their own management and also for their students. Moreover, there are two implications in research methodology from this research, which can be extended and modified in the future. One is the IT-tools experimented in this research, another is the triangulation concept implemented in the present research. The electronic tools developed in this research are the static CBT (CD-ROM) and the dynamic CBT (web CBT), which can be applied and developed for doing research efficiently in the future. Other advanced cyber-techniques in doing research effectively and efficiently can be experimented by using this research as a guideline.

Furthermore, triangulation concept used in this research should be considered as the standard alternative in increasing validity of research. Though causing more time, labor, and budgets than doing normal single approach, the ‘triangulation’ approach is worth investing. Proper management of research projects, good connection with the target subjects and industries, and applying appropriate and advanced IT tools will absolutely help alleviate these problems.

c. Implications for Governmental Agencies

National competitiveness is one of the major issues that most policy-makers of any countries try to achieve. Organizational learning capabilities, though their title is ‘organizational’, are not confined only to the organizational level because any countries consist of many organizations in different forms and functions. Government policy makers (in Ministry of Communications) can apply the results from this research to enhance their national competitiveness by various approaches and different dimensions.

For example, policy of creating efficient national information superhighway and effective global networks (**OLT**) to support the **OLC** (organizational learning capabilities) of their national organizations will help increase their competitive advantage (e.g., the USA., Singapore, Japan, etc.)

Moreover, the policy makers (in Ministry of Education and University Affairs) can setup the targets of creating their educational infrastructures related to OLT to support the OLC in the national levels by apply the results of this research. The policy makers (in Ministry of Industry) can propose the policy of 'upgrading the national productivity' and the policy of 'industrial restructuring from labor-intensive to knowledge-intensive industries' by applying the concepts of 'IT-facilitated organizational learning' concluded from the results of this research.

So far, most industry in the less-developed countries have been transferred various technologies from the developed countries without applying or developing their own R&D. The policy of creating national OLC (organizational learning capabilities) will certainly help the less-developed countries to be self-reliant and remain competitive in the fast-changing business world (Singapore, Japan, and South Korea are the best examples for this point). The regulation of the WTO and many regional groups of countries, especially the freely-opened boarder regulation, will be more effective in the near future (WTO: World Trade Organization). If the less-developed countries have not prepared themselves properly, it will be difficult for them to survive in the fierce-competition world.

6.4. Limitations

There are some limitations in the present study as follows.

1. The present research was conducted in only one industry (pharmaceutical industry) and data was gathered from only Thai subsidiaries of MNCs. Consequently, the results of the research may not be comparable to results of other studies in different industries. Studying in only single industry may lose some power of generalization in research result. However, implementing the triangulation concept (the combination of data collection methods: depth-interview, questionnaire survey and quasi-experimental research) helped compensate such limitation. In the positive view, focusing on only single industry facilitated the control of intervening variables emerging from different industries, but maintained some generalization powers to other knowledge-intensive industries, e.g. software industry, electronic industry, chemical industry, business consulting industry, financial-service industry etc. To conclude, the variance among industries may limit the generalizability of the results. So, generalization of some specific results from this research should be made with caution.

2. Because of the controlled settings of subjects and environment in quasi-experiment implemented in the present study, the generalization power of the results was reduced (reduced internal validity). However, this can be compensated by 'triangulation' concept, which surveyed other groups of subjects in the same organizations.

3. Comparing to other large global markets, e.g., USA. or Japan, Thailand is such a small market that the Triads MNCs conserve in transferring their technologies. In other words, the transfer of technologies in some sample companies were comparably less and superficial to be evaluated. Thus, we have to be careful in generalizing some specific results of this research to other kinds of technologies.

4. Some technologies are commercially secrets and are difficult to assess explicitly. However, the experience of the researcher, fifteen years of working in the pharmaceutical company, helped alleviate such limitation by assessing the secondary data from insiders, journals, and textbooks.

5. The sample size was 120 companies, therefore some variables were not normally distributed and had to be excluded from the canonical relation and MANOVA. Moreover, it may be the nature of variables in the Thai-pharmaceutical-subsidiary context, which is highly right skewed and high kurtosis.

6.5. Suggestions for Future Research

Because of the sophistication and high speed of technological development, future research could be conducted by extending the detailed indicators of **OLT** (IT-based organizational learning tools) which affect **OLC** (Organizational learning capabilities). The 'computer-based training' techniques and instrument could be studied more deeply to find better or efficient tools. Both static media (CD-ROM) and dynamic media (web-based medias) could be researched more to integrate both of them for efficacy and efficiency. Furthermore, the research model from this research could be quantitatively and qualitatively tested in other industries or other countries (international or global dimensions) to compare the results with this study. Thus, the results will be more useful and generalizable.

In the side of organizational theories, the **OLP** (Organizational learning process) could be researched more deeply to find other OLP components, besides the existing four components – OLPIA (Information acquisition), OLPID (Information dissemination), OLPSI (Shared interpretation), and OLPIM (Information memory). Other related factors and some connections with other theories could be investigated. Moreover, research related to the **OLC** (Organizational learning capabilities) should be extended to other advanced level (generative OLC or 2nd loop OLC), instead of focusing on only adaptive level (1st loop OLC) like this research.

The methodology of quasi-experimentation research, though difficult and complicated to conduct but robust in conclusion and causal inference, could be extended to factorial design, which is related to two or more independent variables and is more complicated in manipulation and evaluation. Moreover, the concept of 'triangulation', implemented in this research, could be profoundly studied to find more efficient approaches and to confirm their efficacy with reduced risks. This triangulation concept, though resource-consuming, could potentially be promoted as routine practice in most quality research works for more robust conclusion and generalization.

6.6. Conclusion

The **objectives** of this research were twofold, to test the impact of OLT (organizational learning tools) on OLC (organizational learning capabilities), and to investigate the relationship of OLP (organizational learning process) and OLT on OLC in the context of technology transfer in Thai pharmaceutical subsidiaries of the MNCs.

This study integrated and extended the theoretical foundations of Hult and Ferrell (1997), Senge (1990), Sinkula (1994), and Laudon and Laudon (1998) related to organizational learning and information technology. The two research models were developed based on the integration of theory of information technology (Laudon and Laudon, 1998), the theory of organizational learning process (Sinkula, 1994) and the theory of organizational learning capabilities (Hult and Ferrell, 1997). One model was the impact of OLT on OLC (as shown in Figure 3-1, pp.33) and another model was the relationship of OLT and OLP with OLC (as presented in Figure 3-2, pp.36).

In this study, the research **methodology** was conduct by 'triangulation' of the two different data collection methods (quasi-experimentation and survey) from two different groups of subjects (middle managers and top executives). The quasi-experimentation was conducted to examine the impact of **OLT** (treatment) on **OLC** by using MANOVA (with repeated measures) as the data analysis method. Moreover, the survey research was performed to investigate the relationships of **OLT** and **OLP** on **OLC** by using canonical correlation as the method of data analysis. Both data analysis methods were conducted by computer program of SPSS for Windows Version 9.01 (Base and Advance Model). Finally, the **results** from both data analysis methods were triangulated and concluded with increased validity and better confidence.

This research has contributed to theoretical and practical knowledge related to 'organizational learning' and 'information technology'. None of the previous research has yet linked these two constructs in such the contexts and methodology like this research. Positive impacts of 'organizational learning tools' and 'organizational learning process' on 'adaptive organizational learning capabilities' has been partially proved. This study extended prior research and theories on 'organizational learning' and created new relationship with 'information technology'.

So far, not many pieces of organizational research have been performed quantitatively (empirically), especially in the true- or quasi-experimentation approach. This study paves the ways for future research in other new related issues by efficient and effective methodologies.

In practice, this research developed both static and dynamic medias of CBT (computer-based training in the CD-ROM version and webbed version) which can be really used to build the organizational-IT-infrastructures which facilitate the creation of 'organizational learning capabilities'.

This research also motivate and guides the international business practitioners, academics, and governmental agencies to apply IT (information technology) and organizational learning to their organizations. OLT (organizational learning tools or information technology) and OLP (organizational learning process) can be the important ingredients in the design of 'learning organizations' by providing infrastructures for OLC (organizational learning capabilities which consists of team orientation, system orientation, learning orientation, and memory orientation), thus, improving their competitive advantage and their performance.

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Appendices

APPENDIX-I: OPERATIONAL DEFINITIONS

Definitions Related to Organizational Learning, Information Technology, and Technology Transfer

Adaptive organizational learning capabilities (OLC.) is defined as the capabilities which occurs within a set of recognized and unrecognized fundamental constraints (1st loop learning) that reflect the organization's assumptions about its environment and itself. (Hult and Ferrell, 1997).

IT-based organizational learning tools (OLT.) is defined as a computer-based training which may include various types of IT-components, webbed-hardware, non-webbed-hardware, software, and peopleware, inside and outside the organization which are used integratedly or separately to increase the ability to record, store, analyze, and transmit information in training and development of personnel in target organization.(Zuboff, 1997; Laudon and Laudon, 1998). OLT in the present study will include two levels of IT-infrastructures, as intra-organizational- and inter-organizational IT-infrastructures. **Intra-organizational IT-infrastructures** is the IT-components which are installed or used within the organization and valued (in accounting aspect) as assets of the organization. **Inter-organizational IT-infrastructures** is the IT-components which are installed or used outside the organization and not valued (in accounting aspect) as the sole assets of the organization. The inter-organizational IT-infrastructures may be the shared assets with other related companies or may be the public assets with no owner.

Organizational learning process (OLP.) is defined as the process of creating or promoting organizational learning, which involved in information acquisition, information dissemination, shared interpretation, and information memory (Sinkula, 1994).

Adaptive organizational learning is defined as the learning which occurs within a set of recognized and unrecognized constraints that reflect the organization's assumptions about its environment and itself. Adaptive learning is the most basic forms of learning which can be developed to the higher level of learning- generative learning- if organization is well-prepared as the conditions (Senge, 1990).

Team orientation is defined as the degree to which the corporate marketing center and the SBU field officer/operator in the marketing unit stress collaboration and cooperation in performing marketing activities and in making marketing decisions (Hult and Ferrell, 1997)

System orientation is defined as the degree to which the corporate marketing center and the SBU field officer/operator in the marketing unit stress the broad 'picture' of the activities in the marketing process and thus a reason certain activities exist : 'system thinking is a discipline for seeing the wholes' (Hult and Ferrell, 1997; Senge, 1990).

Learning orientation is defined as the degree to which the corporate marketing center and the SBU field officer/operator in the marketing unit stress the value of organizational learning for the long-term benefits of the marketing process and the specific marketing unit (Hult and Ferrell, 1997).

Memory orientation is defined as the degree to which the corporate marketing center & the SBU field officer/operator in the marketing unit stress communication, distribution, or transfer of marketing knowledge (Hult and Ferrell, 1997)

Information acquisition refers to the collection and assessment of both the SBU's marketing preferences and the forces (e.g., the development skills, insights, and relationships) that influence the development and refinement of those need s in the focal marketing unit. (Kohli, 1993).

Information dissemination refers to the process and extent of dissemination of marketing information between the SBU and the other units in the focal marketing unit (Kohli, 1993).

Information system (IS) is defined as the interrelated components working together to collect, process, store, and disseminate information to support decision making, coordination, control, analysis, and visualization in an organization (Laudon and Laudon, 1998)

Information technology (IT) is defined as the convergence of technical developments that increase the ability to record, store, analyze, and transmit information in ways that permit flexibility, accuracy, immediacy, geographic independence, volume, and complexity. IT has the potential to change the ways of doing jobs and interaction among personnel inside/ outside the organizations (Zuboff, 1997).

The Triads is defined as the three leading countries or groups of countries, which mainly influence the world economy. The first country is the USA., the second is Japan, and the last groups of countries are countries in the European Union (EU) (Wortzel and Wortzel, 1997).

Triads MNCs is defined as the multinational corporations which originated or primarily founded from the Triads Countries (Wortzel and Wortzel, 1997).

Technology has long been studied and defined in many ways, depending on its context. Considered by various disciplines to which "technology" related, it may be defined in various ways, both single-disciplinary or interdisciplinary approaches. In general 'technology' mean skill or craft needed to make or produce something. ('Technology' comes from two Greek words : techne = skill or craft needed to make something ; logos = discussion or knowledge of something) (Dorland's Medical Dictionary, Asian Edition. W.B. Saunders. 1976).

Technology transfer is defined as learning process wherein technological knowledge is being continually accumulated into human resources engaging in production or operation activities. Technology transfer involves transformation process, during which a newly introduced technology is absorbed and mastered by its transferees. In many developing countries, during the last few years, many practitioners and scholars have focused their attention on technology transfer, because this technology strategy has come to be believed as the key factor influencing the national development (Shiowattana, 1990).

NB: Yoshihara (1990) defined technology transfer as both a product and process. If considered as process, technology transfer is a transformation process, which a newly introduced technology is absorbed and mastered by its recipients. Furthermore, Yoshihara (1990) also viewed technology transfer as a learning process wherein technological knowledge is being continually accumulated into human resources engaging in production activities.

Detailing is defined as the process that medical detailer (medical representative) communicating the pharmaceutical information or details to the target groups (practitioners, nurses, pharmacists, or medical-related professions).

Statistical Definitions for MANOVA (Hair, 1998 and SPSS Inc., 1999.)

Alpha is significance level associated with the statistical testing of the differences between two or more groups. Typically, small values, such as .05 or .01, are specified to minimize the possibility of making a Type I error.
A priori test See planned comparison.

Blocking factor is characteristic of respondents in the ANOVA or MANOVA that is used to reduce within-group variability. This characteristic becomes an additional treatment in the analysis. In doing so, additional groups are formed that are more homogeneous. As an example, assume that customers were asked buying intentions for a product and the independent measure used was age. Examination of the data found that substantial variation was due to gender. Then gender could be added as a further treatment so that each age category was split into male and female groups with greater within-group homogeneity.

Box test is statistical test for the equality of the variance/covariance matrices of the dependent variables across the groups. It is very sensitive, especially to the presence of abnormal variables. A significance level of .01 or less is used as an adjustment for the sensitivity of the statistic.

Effect size is standardized measure of group differences used in the calculation of statistical power. Calculated as the difference in group means divided by the standard deviation, it is then comparable across research studies as a generalized measure of effect (i.e., differences in group means).

Experimental design is research plan in which the researcher directly manipulates or controls one or more predictor variables (see treatment) and assesses their effect on the dependent variables. Common in the physical sciences, it is gaining in popularity in business and the social sciences. For example, respondents are shown separate advertisements that vary systematically on a characteristic, such as different appeals (emotional versus rational) or types of presentation (color versus black-and-white), and are then asked their attitudes, evaluations, or feelings toward the different advertisements.

Factor is nonmetric independent variable, also referred to as a treatment or experimental variable.

Greatest characteristic root (gcr) is statistics for testing the null hypothesis in MANOVA. It tests the first discriminant function of the dependent variables for its ability to discern group differences.
Ordinal interaction is acceptable type of interaction effect in which the magnitudes of differences between groups vary but the groups' relative positions remain constant. It is graphically represented by plotting mean values and observing nonparallel lines that do not intersect.

Power is probability of identifying a treatment effect when it actually exists in the sample. Power is defined as 1 - 6 (see beta). Power is determined as a function of (1) the statistical significance level (a) set by the researcher for a Type 1 error, (2) the sample size used in the analysis, and (3) the effect size being examined.

Repeated measures is use of two or more responses from a single individual in an ANOVA or MANOVA analysis. The purpose of a repeated measures design is to control for individual-level differences that may affect the within-group variance. Repeated measures are a form of respondent's lack of independence.

Replication is readministration of an experiment with the intent of validating the results in another sample of respondents.

Significance level is standard error Measure of the dispersion of the means or mean differences expected due to sampling variation. The standard error is used in the calculation of the t statistic.

t statistic is test statistic that assesses the statistical significance between two groups on a single dependent variable.

t test is test to assess the statistical significance of the difference between two sample means for a single dependent variable. The t test is a special case of ANOVA for two groups or levels of a treatment variable.

Treatment is independent variable that a researcher manipulates to see the effect (if any) on the dependent variables. The treatment variable can have several levels. For example, different intensifies of advertising appeals might be manipulated to see the effect on consumer believability.

Variate is linear combination of variables. In MANOVA, the dependent variables are formed into variates in the discriminant functions).

Wilk's lambda is one of the four principal statistics for testing the null hypothesis in MANOVA. Also referred to as the maximum likelihood criterion or U statistic.

Statistical Definitions for Canonical Correlation Analysis (Hair, 1998 and SPSS Inc., 1999.)

Canonical correlation is measure of the strength of the overall relationships between the linear composites (canonical variates) for the independent and dependent variables. In effect, it represents the bivariate correlation between the two canonical variates.

Canonical cross-loadings is correlation of each observed independent or dependent variable with the opposite canonical variate. For example, the independent variables are correlated with the dependent canonical variate. They can be interpreted like canonical loadings, but with the opposite canonical variate.

Canonical function is relationship (correlational) between two linear composites (canonical variates). Each canonical function has two canonical variates, one for the set of dependent variables and one for the set of independent variables. The strength of the relationship is given by the canonical correlation.

Canonical loadings is measure of the simple linear correlation between the independent variables and their respective canonical variates. These can be interpreted like factor loadings, and are also known as canonical structure correlations.

Canonical roots is squared canonical correlations, which provide an estimate of the amount of shared variance between the respective optimally weighted canonical variates of dependent and independent variables. Also known as eigenvalues.

Canonical variates is linear combinations that represent the weighted sum of two or more variables and can be defined for either dependent or independent variables. Also referred to as linear composites, linear compounds, and linear combinations.

Canonical weights is an approach to interpreting canonical functions involves examining the sign of the magnitude of the canonical weight assigned to each variable in its canonical variate. Variables with larger weights contribute more to the variate, and vice versa. Similarly, variables whose weights have opposite signs exhibit an inverse relationship with each other. Some problem with the use of canonical weights is that these weights are subject to considerable instability (variability) from one sample to another. This instability occurs because the computation procedure for canonical analysis yields weights that maximize the canonical correlations for a particular sample of observed dependent and independent variable sets.

Eigenvalues is squared canonical correlations . Also known as canonical roots.

Linear composites is linear combinations that represent the weighted sum of two or more variables. See canonical variates.

Orthogonal is mathematical constraint specifying that the canonical functions are independent of each other. In other words, the canonical functions are derived so that each is at a right angle. to all other functions when plotted in multivariate space, thus ensuring statistical independence between the canonical functions.

Redundancy index is amount of variance in a canonical variate (dependent or independent) explained by the other canonical variate in the canonical function. It can be computed for both the dependent and the independent canonical variates

APPENDIX-II: MEASURES OF OLC
(Hult & Ferrell, 1997)

Organizational learning capabilities (OLC) : Construct development and measurement

Hult & Ferrell (1997) operationalize their concepts of organizational learning capabilities (OLC) by synthesizing the four orientations related to organizational learning, which are team orientation, systems orientation, learning orientation, and memory orientation. These 'orientations' synthesize the means for operationalizing the OLC constructs, incorporating the encompassed subprocess of learning (information acquisition, information dissemination, shared interpretation) and cognitive levels of learning (adaptive & generative).

Synthesizing the Orientations

The idea of organization learning was popularized by Senge (1990), who argued that organizational learning incorporates the five 'disciplines' of system thinking, personal mastery, mental model, shared vision, and team learning. within the marketing literature, Day (1994) introduced four learning capabilities (i.e., open-minded inquiry, synergistic information distribution, mutually informed interpretations, and accessible memory) as the basis for organizational learning. Moreover, Sinkula (1994, 1997) argues that organizational learning is composed of a set of learning 'foundations' (i.e., shared vision, learning axioms, cross-functional teamwork, open-mindedness, and experience sharing). Similarly, Tobin (1993) proposed a set of different 'foundations' as the criteria for organizational learning (i.e., visible leadership, thinking literacy, functional myopia, learning teams, and managers as enablers). Other scholars have conceptualized the organizational learning construct similarly, introducing different yet related elements that compose some broader organizational learning constructs. While the terms vary, the common thread is that organizational learning is multifarious and involves mechanisms in a number of unique yet related areas.

According to Hult & Ferrell, (1997), the orientation synthesis will start with careful examination of the conceptualization of organization learning in conjunction with the subprocess of learning and the cognitive levels of learning which characterize it as a multidimensional construct. The principle goal of the 'synthesis process' was to corroborate theory with practice and further validate the OLC construct. The various organizational learning conceptualizations were then examined for similarities. In specifying and synthesizing the organizational learning orientations, this study will trimmed the redundant elements. This process led to an organizational learning capacity construct that includes

In synthesizing the orientations of OLC, the approach in this study will use the model of organizational learning capacity (Hult & Ferrell, 1997), but add some orientations related to IT/IS of the organization, organizational cultures, and organizational climate, and also expand from studying only purchasing unit to marketing unit . The model of organizational learning capacity (Hult & Ferrell, 1997) consists of four conceptual components - team orientation, systems orientation, learning orientation, and memory orientation. Details of the four components are review in the next four parts.

1. Team Orientation

In operationalization, team orientation is defined as the degree to which the corporate marketing center and the SBU field officer/operator in the marketing unit stress collaboration and cooperation in performing marketing activities and in making marketing decisions (Hult & Ferrell, 1997) . From a long-term perspective, the general principle is that the marketing unit should be able to produce better marketing result than the individual members of the marketing unit by stressing team orientation However, often it seems that teams made up of highly intelligent employees do not 'live up to the expectations' . The reason is that they have not really learned to work together. In order for the marketing team to function effectively, a dialogue must exist among members focused on sharing assumptions, thinking together to solve problems, and charting the future operations of the organization (Senge, 1990). Thinking together fosters a climate focused on creating a genuine vision, subsequently leading to excellence and learning because the employees feel that they are pursuing their own goals (Argyris & Schon, 1978; Sinkula, 1994).

As such, each organizational member has an input in the process of creating, developing, and implementing a team orientation that leads to a commonality of direction and the harmonization of individuals' energy. Team orientation builds on the idea of the subprocess of shared interpretation (Sinkula, 1994; Slater & Narver, 1995). The focus of team orientation in this study is on the marketing unit composed of SBU users and corporate buying center representatives.

2. Systems Orientation

In operationalization, system orientation is defined as the degree to which the corporate marketing center and the SBU field officer/operator in the marketing unit stress the broad 'picture' of the activities in the marketing process and thus a reason certain activities exist : 'system thinking is a discipline for seeing the wholes' (Hult & Ferrell, 1997; Senge, 1990). For example individuals who can predict the consequences of an action arguably make the best problem- solvers, leading to an increase in the individual's effectiveness. A systems orientation focuses on structuring and making sense of the multiple marketing inputs from the environment, the organization, the immediate work group, the task, relationships will colleagues, and outputs in terms of performance and satisfaction in relation to the broad 'picture' created by these multiple inputs. In addition, a systems orientation fuses the other three orientations into a coherent whole identified as the 'fifth discipline' by Senge(1990) that keep them from turning into 'fads' or 'gimmicks'. This means that system orientation is a crucial component of organizational learning because it guides the organization's cognitive levels of learning, by that helping to identify market patterns and the reinforcement or changing of these patterns at the adaptive to generative learning levels (Senge, 1990; Slater & Narver, 1995; Hult & Ferrell, 1997).

3. Learning Orientation

In operationalization, learning orientation is defined as the degree to which the corporate marketing center and the SBU field officer/operator in the marketing unit stress the value of organizational learning for the long-term benefits of the marketing process and the specific marketing unit (Hult & Ferrell, 1997). Thus, an important component of organization learning is the set of fundamental axioms or truths that the organization hold regarding the value it places on learning (i.e. learning orientation). Norman (1985) notes that "every organization learns, and every organization has a set of dominating ideas. They may be more or less consciously formulated and more or less visible, and they may represent good or bad interpretations of what has led to success or failure, but they are always there". Senge (1990) also states that this is due to the concept of mental model. Developing an organization's capacity to work within the environment of a high degree of learning orientation requires both learning new skills and implementing an institutional climate that helps bring these skills into a regular practice (Slater&Narver, 1995).As such, learning orientation relates to the subprocess of information dissemination (Sinkula, 1994; Slater & Narver, 1995). Thus, learning orientation builds on the notion that a learning organization improves its understanding of the environment over time, a prerequisite of which is 'a culture amenable to learning' (Galer & Heijden, 1992). This includes the ability to think and reason and to disseminate, diffusion, or transfer the subsequent thoughts to the organizational members (Tobin, 1993).

4. Memory Orientation

In operationalization, memory orientation is defined as the degree to which the corporate marketing center and the SBU field officer/operator in the marketing unit stress communication, distribution, or transfer of marketing knowledge (Hult & Ferrell, 1997). The means of achieving a climate where organizational memory is readily accessible vary. For example, through it is a natural tendency to trivialize routine learning activities because they arise so frequently, routines are a critical part of ' communicating learning beyond the individual who discovers it' (Slater & Narver, 1995). Related to this notion, Cohen (1991) explores organizations as 'processing information to learn and apply skilled routines'. However, once the routine is in place, substantial barriers to information could contradict it. In this regard, a memory orientation is identified largely with the subprocess of information acquisition (Sinkula, 1994). A memory orientation incorporates the idea that by repeatedly performing a set of activities, organizational members develop a knowledge base of those activities and a means for performing better the next time. The individual member's experience leads to the modification of organizational knowledge, and thus, to a better understanding of the interactions between the organizational systems and the environment (Hult & Ferrell, 1997).

Purification Analysis

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The synthesis of prior conceptualizations of the OLC construct proposed in this study suggest that OLC should encompass the four conceptually distinct but related components of team orientation, systems orientation, learning orientation, and memory orientation. From a measurement standpoint, the theoretical construct of OLC dictates a measurement model composed of four distinct but correlated dimensions. Stated formally :

h_a : The Covariation among the organizational learning items can be accounted for by a correlated four-factor model where each factor represent a specific conceptual orientation of organizational learning
and each item is reflective of only one single component (MOD1).

Similar to Hult & Ferrell (1997), several potentially plausible competing measurement models will also be tested following the evaluation and elimination of items based on model MOD1. The following a priori hypotheses are made regarding the competing models :

h_b : The covariation among the set of organizational learning items can be accounted for by a general organizational learning factors even though the construct is conceptualized as consisting of four distinct orientations (MOD2)

h_c : The covariation among the set of organizational learning items can be accounted for by a correlated three-factor model where each factor represents a specific conceptual orientation of organizational learning
and each item is reflective of only one single component (MOD3-MOD8).

h_1 : Each organizational learning item is reflective of team orientation .

h_2 : Each organizational learning item is reflective of system orientation .

h_3 : Each organizational learning item is reflective of learning orientation .

h_4 : Each organizational learning item is reflective of memory orientation .

In h_c , six different models were tested to assess h_c . Each of the models (MOD3-MOD8) will combine two of the orientations of the theoretically developed measurement model. The null model (MOD9) is included for comparison purposes.

The model fits will be evaluated using the DELTA2 index (Bollen, 1989) and the relative noncentrality index (RN1), which have been shown to be the two most stable fit indices (Gerbing & Anderson, 1992). The chi-square goodness-of-fit statistic and the goodness-of-fit index (Joreskog & Sorbom, 1993) are included for comparison purpose. Several criteria will be used to evaluate OLC items, including the items error variance, modification index, and residual covariation (Hult & Ferrell, 1997). To construct a practical OLC scale with managerial implications, a scale consisting of single-components items will be chosen. Thus, an item will only be allowed to load on one factor and will not be able to cross-load on any other factors. As such, the diagnosis of MOD1 - MOD8, in conjunction with theory and content considerations will lead to eliminate the redundant items, and leave some items for subsequent analysis (Gerbing & Anderson, 1992; Hult & Ferrel, 1997).

Reliability and Validity Analysis

Validaton Analysis (Hult and Ferrel, 1997; Anderson and Gerbing, 1988; Joreskog and Sorbom, 1993)

The validation analysis for the OLC scale will follow the format used by Kohli (1993) and Hult&Ferrell (1997) in their development and testing of MARKOR scale (a scale used to assess a SBU's degree of market orientation) and provides an initial test of the criterion validity and the construct validity of the OLC scale. The validation analysis builds on the notion that 'organizations learn only through individuals who learn. Individual learning does not guarantee organizational learning. But without individual organizational learning, no organizational learning occurs' (Senge, 1990). Thus organizational learning is a process that evolves through individual learning. As such, organizational learning is mediated by the collaborative inquiry of individual actors (Argyris, 1978). The primary difference between individual and organizational learning is the social requirement of organizational learning.

Thus, learning organizations conduct continuous evaluation on development programs to capture learning before the team disbands. This creates a public forum where employees' thoughts regarding what works and what does not work are exposed and possibly contested and criticized. A distinguishing feature of this organizational learning orientation is that it provides a forum that makes publicly discussing mistakes legitimate. The fact that all employees recognize mistakes is a part of the operating policies of the organization and the basis for learning (Hult & Ferrel, 1997).

The formal means for providing and enhancing OLC within an organization is to conduct seminars and workshops deal with the components, activities, and relationships involved in the OLC orientations. The logical deduction of this reasoning is that each of the OLC orientation should be positively correlated with the number of times a respondent has attended learning seminars and workshops. Therefore, to validate and provide an initial assessment of criterion validity of the OLC scale, Hult & Ferrel (1997) asked the respondents to list the number of organizational learning seminars that they had attended during the last two years. The following question will be asked : "How many learning seminars dealing with the marketing process have you as a representative of your SBU attended? When was the last time you attended?" The qualifier of 'when was the last time you attended?' was used to limit the sample to those respondents that had participated in organizational learning seminars or workshops during the last two years. The cutoff date was chosen because they believe that the effect of the learning seminars and workshops is minimized after a two-year period.

The four OLC orientations were correlated with an open-ended measure assessing the cycle time of the marketing process (cycle time : the time it takes from initiation to completion of the marketing process) (Hult & Ferrel, 1997). The unit of measure for the marketing cycle item is number of weeks. The average cycle time for the marketing process may depend on each dominant marketing activities in the companies and calculate the average value. The logic for using cycle time as a correlate with organizational learning stems for Meyer (1993), who argues that organizational learning is the foundation for 'fast cycle time.' Furthermore, Garvin (1993), also propose the concept related with 'learning curve' and 'half-life curve', which explains the same logic. Thus, to provide an initial assessment of construct validity, each component of the organizational learning scale should be negatively correlated with the marketing process cycle time measure. The following question will be asked : "Based on the experiences of your SBU, the average length of the dominant marketing activities from initiation to completion is ?"

Measurement of 'Organizational Learning Structure' : Openness and Localness

For this study, the complete scale of organizational learning structure, information processing, and performance are provided in the appendix (participative openness, reflective openness, centralization, formalization, information acquisition, information dissemination, success in technology transfer). The psychometric properties of the constructs were evaluated by conducting one overall confirmatory factor analysis (CFA) on all the scale properties of the seven sub-scales simultaneously via the use of LISREL (Joreskog & Sorbom, 1993). The model fit will be evaluated using DELTA2 index (Bollen, 1989) and the relative noncentrality index (RNI) (McDonald & Marsh, 1990), which have been shown to be the most stable fit indices (Gerbing & Anderson, 1992). The specific items will be evaluated based on the item's error variance, modification index, and residual covariation. Utilizing these criteria, both DELTA2 and RNI value will be evaluated, indicating the degree of measurement model fit (Gerbing & Anderson, 1992 ; Joreskog & Sorbom, 1993).

To provide for addition assessment of psychometric properties, four additional CFA(Confirmatory Factor Analysis) will be examined, including 1) openness, 2) localness, 3) information processing, and 4) success of technology transfer in marketing management. Within the CFA analysis, construct reliability will be calculated and examining the parameter estimates and their associated t-values and assessing the construct's average variance extracted (Anderson & Gerbing, 1988). Discriminant validity will be established by verifying that the average variance extracted for a dimension is higher than the shared variance between that dimension and any other dimension scale (Hult & Ferrell, 1997).

Openness

No literature reveals existing measurement scale of openness incorporating the two dimensions of participative and reflective openness. However, participative openness corresponds to the five items of the 'interdepartmental connectedness' scale developed by Kohli (1993). As in this study, the scale items tap the extent to which the SBUs have the freedom to participate in marketing-related decision making and 'speak their own mind' regarding marketing phenomena. Furthermore, reflective openness will use the five items developed by Hult & Ferrell (1997) to measure construct. The reflective openness items measure the degree to which the SBUs and the marketing center exercise a willingness to collectively challenge their own thinking regarding marketing phenomena (Senge, 1990). A four-point Likert-type scale ranging from 'strongly disagree' to 'strongly agree' will be used. DELTA2 and RNI for the measurement model of openness will be both evaluated.

Localness

Localness is essential a structural measure (Senge, 1990) composed of a centralization measure (the extent to which authority is concentrated in the marketing center regarding decision making in the marketing unit) and a formalization measure (the existence of formal rules and procedures in the marketing units). As such, the scale developed by Hult & Ferrell (1997) will be adapted to assess localness. The scale will use five items for each of the two dimensions and a four-point Likert-type response format ranging from 'strongly disagree' to 'strongly agree' . DELTA2 and RNI for localness measurement model will also be both evaluated.

APPENDIX-III: DETAILED METHODS OF MANOVA ANALYSIS

Table III-1: Comparison of Responses Across Respondent and Nonrespondent Groups

	Respondents		Non-Respondents				
Variable	**n**	**Percentage**	**n**	**Percentage**	χ^2	**d.f.**	**p-value**
Status of organization					2.74	2	0.243
Importer	20	19.2	2	16.7			
Sole distributor	22	21.2	3	24.9			
Joint ventures	9	8.7	1	8.4			
Subsidiaries	43	41.3	5	41.6			
MNC affiliated with H/O	10	9.6	1	8.4			
No. of employees (total)					2.86	2	0.315
Less than 20	58	55.8	7	58.3			
20 or more	46	44.2	5	41.7			
No. of marketing-staffs					3.17	2	0.225
Less than 5	23	22.1	3	24.9			
5 or more	81	77.9	9	75.1			
No. of training staffs					2.37	2	0.481
0	36	34.6	3	24.9			
1	57	54.8	7	58.4			
2 or more	11	10.6	2	16.7			
No. of IT-staffs					3.42	2	0.346
0	24	23.1	2	16.7			
1	69	66.3	8	66.6			
2 or more	11	10.6	2	16.7			
Having Internet facilities	104	100	12	100	4.75	2	0.774
Having company homepage	58	55.7	7	58.3	3.78	2	0.682

Process of MANOVA Analysis (Following Hair, 1998 and SPSS Advanced Model V.9.0, 1999)

Step 1. Data Examination for MANOVA

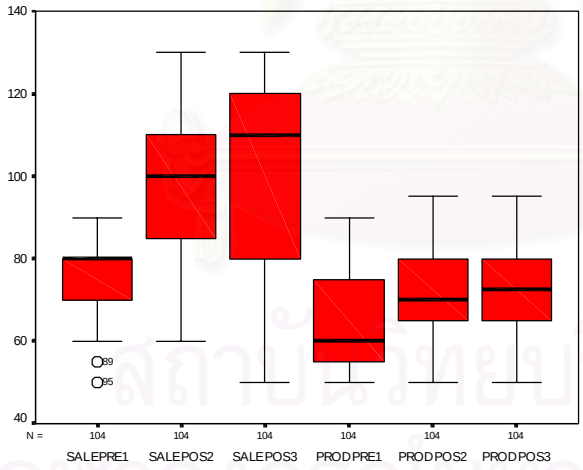
The examination of data in this step includes descriptive statistics, analysis of outliers, validity and reliability tests, and bivariate correlation (validity & reliability tests and bivariate correlation were presented in Chapter 5).

Descriptive Statistics

Descriptive statistics was used to analyze the nature of data and also to report demographic data of some related variables descriptively (Nachmias and Nachmias, 1997). Descriptive statistics of all related variables were computed, including means, standard errors of means, medians, standard deviations, variances, skewness, kurtosis, ranges, sum, minimums, and maximums. In some companies, the responses were collected from more than one middle manager, so the average of data was computed (the unit of analysis is the company level). The missing values were coded as 999. The average of other data sets with more than one year (such as budgets in IT-tools, growth in sales, etc.) were also computed. Finally, the percentage of some relevant characteristics of subjects was also calculated and summarized.

Outlier analysis

Hair (1998) suggests to use **box plot** of all variables to check for outliers. From the result in Appendix IV, the output shows that there is no serious outlier in this analysis (only one outlier of case number 66- OLCMO1 was the significant outlier, which was deleted from the analysis). The outliers of OLCTO1, OLCSO1, OLCMO1 were not serious outliers, but should be cautious in evaluating results from these groups of data. The effects of outliers are not strong because after trying in deleting outlier, the mean of each variable changes less than one standard error of mean.



Step 2. Testing the Assumptions for MANOVA

Before the MANOVA analysis, the dependent and independent variables were tested for meeting the essential assumption underlying multivariate analysis. Such assumptions were normality, linearity, multicollinearity, independence, and equality of variance-covariance matrices.

a. Normality

According to Hair (1998), the assumption for MANOVA is that all the variables are multivariate normal. Multivariate normality assumes that the joint effect of two variables is normally distributed. There is no direct test for multivariate normality but most analysts test for univariate normality (Hair, 1998). While univariate normality does not guarantee multivariate normality, if all variables meet this requirement, then any departures from multivariate normality are usually inconsequential (Hair, 1998). With moderate sample sizes, modest violations can be accommodated as long as the differences are due to skewness and not outliers (Hair, 1998). In this study, normality test is performed to test all related variables graphically and statistically. The graphical tests for normality were histogram with normal plot and normal P-P plot as shown in the Appendix. The statistical test for normality were Kolmogorov-Smirnov test (Hair, 1998). The variables which were not normal in distribution will have significance of Kolmogorov-Smirnov test lower than 0.05.

b. Linearity and Multicollinearity among Dependent Variables

Linearity is the essential assumptions for most multivariate analysis (Hair, 1998). While MANOVA assesses the differences across combinations of dependent variables, it can construct a linear relationship only between the dependent measures (Hair, 1998). According to Hair (1998), the most common way to assess linearity is to examine scatterplots of the variables and to identify any nonlinear patterns in the data as shown in the Appendix. Moreover, in MANOVA, the dependent variables should not have high multicollinearity because this indicates only redundant dependent measures and decreases statistical efficiency (Hair, 1998). Tests for multicollinearity of OLC shown in the Appendix indicated that there was no multicollinearity among dependent variables.

c. Independence

The most basic, but serious, violation of an assumption for MANOVA occurs when there is a lack of independence among observations (Hair, 1998). Lack of independence may come from various confounding factors, e.g., time-ordered effect or serial correlation if measures are taken over time, extraneous and unmeasured effects, noisy room or confusing set of instructions, etc (Hair, 1998). Although there are no tests with an absolute certainty of detecting all forms of dependence, the researcher should explore all possible effects and correct for them if found. If dependence is found among groups of respondents, then a possible solution is to combine those within the groups and analyze the group's average score instead of the scores of the separate respondents (Hair, 1998). Another approach is to employ a blocking factors or some form of covariate analysis to account for the dependence. In either case, or when dependence is suspected, the researcher should use a lower level of significance depending on the issues (Hair, 1998).

d. Equality of Variance-Covariance Matrices

One essential assumption of MANOVA is the equivalence of covariance matrices across the groups (Hair, 1998). Here, as with the problem of heteroscedascity addressed in multiple regression, we are concerned with substantial differences in the amount of variance of one group versus another for the same variables. In MANOVA, however, the interest is in the variance-covariance matrices of the dependent measures for each group. The requirement of equivalence is a strict test because the MANOVA test examines all elements of the covariance matrix of the dependent variables (Hair, 1998). MANOVA programs provide the test for equality of covariance matrices - typically the Box test and provide significance levels for the test statistic (Hair, 1998).

Step 3. Estimating the MANOVA Model and Assessing Overall Fit

After passed the data examination and tests for assumptions, the MANOVA model was estimated by using computer program SPSS 9.01: MANOVA (general linear model: GLM- repeated measures). MANOVA (GLM-repeated measures) helped compare the means differences within-subjects (MSW) and between subjects (MSB).

APPENDIX-IV: DETAILED METHODS / SYNTAX OF CANCOR ANALYSIS

Process of Canonical Correlation Analysis (Hair, 1998 and SPSS: Advanced Model 9.0, 1999)

Step 1: Testing the assumptions for canonical correlation analysis

Both dependent and independent variables were assessed for meeting the essential assumptions underlying multivariate analysis. Such assumption testing were linearity, normality, and homoscedasticity (as shown in the Appendix of statistical outputs).

Step 2: Deriving the Canonical Functions and Assessing Overall Fit

The canonical correlation analysis focused on the level of statistical significance, the practical significance, and the redundancy indices for each variate were evaluated to determine the number of significant canonical functions to include in the interpretation stage. The results are as follows.

Statistical and Practical Significance

Assessed from data output (in Table V-1 and the Appendix), there were only two significant canonical functions to be assessed, the first and the second function (F = 8.918 and 1.795; Sig = 0.000 and 0.043). In addition to tests of each canonical function separately, multivariate tests of both functions simultaneously were also performed. The test statistics implemented were Wilks' lambda, Pillai's criterion, Hotelling's trace, and Roy's gcr. Table V-2 also shows the multivariate test statistics, which all indicate that the canonical functions, taken collectively, are statistically significant at the 0.05 level. In addition to statistical significance, the canonical correlations were both of sufficient size (0.848 and 0.419) to be deemed practically significant (Hair, 1998).

Measures of overall model fit for canonical correlation analysis

Canonical Function	**Canonical Correlation**	**Canonical R^2**	**F Statistics**	**Significance** (Probability)
1	**0.848**	0.719	**8.918**	**< 0.001****
2	**0.419**	0.175	**1.795**	**0.043**
3	0.138	0.019	0.365	0.901
4	0.057	0.003	0.157	0.855

Table V-1: Canonical correlation analysis relating dependent OLC variate with independent OLP variate and independent OLT ($\alpha = 0.05$)

Multivariate test of significance

Statistics	**Value**	**Approximate F Statistics**	**Significance** (Probability)
Wilks' lambda	0.227	8.918	**< 0.001****
Pillai's trace	0.916	5.825	**< 0.001****
Hotelling's trace	2.793	13.055	**< 0.001****
Roy's GCR	0.719	-	-

Table V-2: Canonical correlation analysis by various tests ($\alpha = 0.05$)

Redundancy Analysis

The redundancy index for the independent and dependent variates of the first function was shown in Table V-3. In Table V-3, the redundancy index for the dependent variate is not high but acceptable (0.398) and the independent variate, has a higher redundancy index (0.549) (Hair, 1998). This means that there is not so clear delineation between dependent and independent variables (Hair, 1998). From the redundancy analysis and the statistical significance tests, the first function should be accepted. The redundancy analysis for the second function produces quite lower results (Table V-1, V-4, and V-5). First, the canonical R^2 is substantially lower (0.175). Moreover, both variable-sets have low shared variance in the second function (0.169 for the dependent variate and 0.170 for the independent variate). Their combination with the canonical root in the redundancy index produces values of 0.0295 for the dependent variate and 0.0298 for the independent variate (redundancy index' is calculated as the average loading squared times the canonical R^2) (Hair, 1998).

Variate / Variables	Canonical Loading	Canonical Loading Squared	Average Loading Squared	Canonical R^2	Redundancy Index
Dependent Variables					
OLCTO	0.964	0.929	-	-	-
OLCSO	0.447	0.19			
OLCLO	0.472	0.223			
OLCMO	0.552	0.305			
Dependent Variate	-	1.657	0.414	0.719	0.298
Independent Variables					
OLPIA	0.745	0.555	-	-	-
OLPID	0.946	0.895			
OLPSI	0.916	0.839			
OLPIM	0.849	0.721			
OLT	0.900	0.810			
Independent Variate	-	3.820	0.764	0.719	0.549

Table V-3: Calculation of Redundancy Indices for the first canonical function
(The 'redundancy index' is calculated as the average loading squared times the canonical R^2) (Hair, 1998)

Although the second function is statistically significant, it has little practical significance because it does not explain a large proportion of the dependent variables' variance (Hair, 1998). According to Hair (1998), canonical correlation is in some ways a form of scale development, as the dependent and independent variates represent dimensions of the variable sets similar to the scales developed with factor analysis. The primary difference is that these dimensions are developed to maximize the relationship between them, whereas factor analysis maximizes the explanation (shared variance) of the variable set(s) (Hair, 1998).

	Their Own Canonical Variate (Shared Variance)			The Opposite Canonical Variate (Redundancy)	
Canonical Function	**Percentage**	**Cumulative Percentage**	**Canonical R^2**	**Percentage**	**Cumulative Percentage**
Function 1	0.638	0.638	0.719	0.458	0.298
Function 2	0.169	0.583	0.175	0.030	0.328
Function 3	0.242	0.825	0.019	0.005	0.333
Function 4	0.175	1.000	0.003	0.001	0.334

Table V-4: Standardized variances of dependent variables explained by their canonical variate and their opposite variate.

	Their Own Canonical Variate (Shared Variance)			The Opposite Canonical Variate (Redundancy)	
Canonical Function	**Percentage**	**Cumulative Percentage**	**Canonical R^2**	**Percentage**	**Cumulative Percentage**
Function 1	0.764	0.764	0.719	0.549	0.549
Function 2	0.170	0.934	0.175	0.030	0.579
Function 3	0.020	0.954	0.019	0.000	0.579
Function 4	0.016	1.000	0.003	0.000	0.579

Table V-5: Standardized variance of independent variables explained by their canonical variate and their opposite variate.

Step 3: Interpreting the Canonical Variates

The results of canonical loadings and canonical cross-loadings were shown and evaluated, as follows.

Canonical Loadings

Table V-6 shows the canonical loadings for the dependent and independent variates for both canonical functions. The objective of maximizing the variates for the correlation between them results in variates "optimized" not for interpretation, but instead for prediction (Hair, 1998). Although the second function is statistically significant, it has little practical significance because it does not explain a large proportion of the dependent variables' variance (Hair, 1998). So, after this, the canonical correlation analysis would be focused on only function-1. The second function's poor redundancy values were exhibited in the substantially lower loadings for both variates on the second function. Thus, the poorer interpretability as reflected in the lower loadings, coupled with the low redundancy values, reinforce the low practical significance of the second function (Hair, 1998).

In the first-function column, the canonical loadings for independent variables were averagely quite high (0.746 – 0.946), resulting in the high shared-variance. The canonical loadings for dependent variables were averagely not so high as independent variables (0.447 – 0.964). This indicates a moderate degree of intercorrelation among the two variables and suggests that both, or either, measures are representative of the effects (Hair, 1998).

The four independent variables with the highest loadings on the independent variate were **OLPID** (Information Dissemination), **OLPSI** (Shared interpretation), **OLT** (Organization learning tools), **OLPIA** (Information acquisition). Only one independent variables with the moderate loadings on the independent variate was **OLPIM** (Information memory). This variate does not correspond to the dimensions extracted in factor analysis, but it would not be expected to because the variates in canonical correlation are extracted only to maximize predictive objectives.
As such, it should correspond more to the results from other dependence techniques, like multiple regression (Hair, 1998). Thus, the first canonical function closely corresponds to the multiple regression results, with the independent variate representing the set of variables best predicting the two dependent measures (Hair, 1998).

Canonical Cross-Loadings

Table V-6 also included the cross-loadings for the two canonical functions. With the same reason as the canonical loadings in the former section, function-2 would be discarded and only function-1 would be evaluated. In assessing the canonical function (of function-1), **OLPID** (Information dissemination), **OLPSI** (Shared interpretation), **OLT** (Organizational learning tools), and **OLPIM** (Information memory) exhibited moderate correlations with the independent canonical variate (function 1): 0.802, 0.777, 0.763, and 0.720 respectively. This reflected the moderate shared variance among these four variables (Hair, 1998).

This meant that most independent variables had moderate correlations with the opposite dependent canonical variate (Hair, 1998). However, **OLPIA** (Information acquisition) had the moderately lower canonical cross-loadings (0.631). This meant that only one independent variable, OLPIA, had the lowest correlations with the opposite dependent canonical variate, but still acceptable (Hair, 1998).

The final issue of interpretation is examining the mathematical signs of the cross-loadings. All independent variables had a positive, direct relationship. The three highest cross-loadings of the first independent variate correspond to the variables with the highest canonical loadings as well. Thus all the relationships are direct (Hair, 1998).

	Canonical Loadings	
	Function 1	**Function 2**
Correlations between **independent variables** and - their canonical **variates**		
OLPIA	0.746	0.628
OLPID	0.946	-0.185
OLPSI	0.916	-0.334
OLPIM	0.849	-0.436
OLT	0.900	-0.354
Correlations between **dependent variables** and - their canonical **variates**		
OLCTO	0.964	-0.228
OLCSO	0.447	0.396
OLCLO	0.472	0.566
OLCMO	0.552	0.381

	Canonical Cross-Loadings	
	Function 1	**Function 2**
Correlations between **independent variables** and - **dependent** canonical **variates**		
OLPIA	0.631	0.263
OLPID	0.802	-0.078
OLPSI	0.777	-0.140
OLPIM	0.720	-0.183
OLT	0.763	-0.148
Correlations between **dependent variables** and - **independent** canonical **variates**		
OLCTO	0.817	0.095
OLCSO	0.379	-0.166
OLCLO	0.400	-0.237
OLCMO	0.468	-0.160

Table V-6: Canonical structure for the two canonical functions

Step 4: Validation and Diagnosis

The final stage is a validation of the canonical correlation analyses through one of several procedures. Among the available approaches would be (1) splitting the sample into estimation and validation samples, or (2) sensitivity analysis of the independent variable set (Hair, 1998). Table V-7 contains the results of such a sensitivity analysis in which the canonical loadings are examined for stability when individual independent variables are deleted from the analysis. As seen in the table, the canonical loadings are remarkably stable and consistent when each independent variable (**OLPIA**, **OLPID**, **OLPSI**, **OLPIM**, **OLT**) is deleted (withdrew each of the five variables for five times of data processing, detailed output data are shown in the Appendix IV). The overall canonical correlations (R) also remain stable.

		Results after Deletion of ..				
	Complete Variate	**OLCIA**	**OLCID**	**OLCSI**	**OLCIM**	**OLT**
Canonical Correlation (R)	0.848	0.819	0.839	0.846	0.848	0.846
Canonical Root (R^2)	0.719	0.671	0.704	0.716	0.719	0.715
Independent Variate ***						
Canonical Loadings						
OLPIA	0.746	omitted	0.749	0.748	0.745	0.747
OLPID	0.946	0.984	omitted	0.948	0.946	0.949
OLPSI	0.916	0.963	0.927	omitted	0.916	0.918
OLPIM	0.849	0.900	0.860	0.847	omitted	0.850
OLT	0.900	0.947	0.912	0.901	0.900	omitted
Shared Variance	0.764	0.900	0.748	0.748	0.775	0.756
Redundancy Index	0.549	0.604	0.527	0.535	0.557	0.541
Dependent Variate ***						
Canonical Loadings						
OLCTO	0.964	0.984	0.969	0.963	0.964	0.962
OLCSO	0.447	0.393	0.443	0.445	0.447	0.451
OLCLO	0.472	0.386	0.474	0.478	0.472	0.467
OLCMO	0.468	0.505	0.536	0.553	0.552	0.561
Shared Variance	0.414	0.382	0.412	0.415	0.414	0.416
Redundancy Index	0.298	0.256	0.290	0.297	0.298	0.297

Table V-7: Sensitivity analysis (of the canonical correlation results) to removal of each independent variable (OLCIA, OLCID, OLCSI, OLCIM, OLT)

Syntax for CanCor (SPSS: Based and Syntax Guide in Advanced Model, V.9.0, 1999; Hair, 1998)

```
INCLUDE "Canonical Correlation.sps"
CANCORR SET1 = olpiax olpidx olpsix olpomx oltx/
            SET2 = olctoex olcsoex olcloex olcmoex/.
```

Canonical Correlation.sps

```
preserve.
set printback=off.
define cancorr (set1  =!charend('/')
        /set2  =!charend('/')
        /debug =!charend('/') !DEFAULT ('N')
        /KEEPSC=!charend('/') !DEFAULT ('Y')
        /PRCOR =!charend('/') !DEFAULT (25 ) ).
preserve.
!IF ( !DEBUG !EQ 'N') !THEN
set printback=off mprint off.
!ELSE
set printback on mprint on.
!IFEND .
* Save the original file for later retrieval.

!IF (!DEBUG !EQ 'N') !THEN
SET RESULTS ON.
DO IF $CASENUM=1.
PRINT / "NOTE: ALL OUTPUT INCLUDING ERROR MESSAGES HAVE BEEN TEMPORARILY"
    / "SUPPRESSED. IF YOU EXPERIENCE UNUSUAL BEHAVIOR THEN RERUN THIS"
    / "MACRO WITH AN ADDITIONAL ARGUMENT /DEBUG='Y'."
    / "BEFORE DOING THIS YOU SHOULD RESTORE YOUR DATA FILE."
    / "THIS WILL FACILITATE FURTHER DIAGNOSTICS OF ANY PROBLEMS".
END IF.
!IFEND .
save outfile='cc__tmp1.sav'.
* Compute the correlation matrix and pass information to MATRIX.

* DEFAULT:  SET RESULTS AND ERRORS OFF TO SUPPRESS CORRELATION PIVOT TABLE *.
!IF (!DEBUG='N') !THEN
set results off errors off.
!IFEND
corr variables=!set1 !set2 /missing=listwise/matrix out(*).
set errors on results listing.
* Get correlations and compute basic quantities needed for analysis.
* SET command placed to prevent exceeding MXLOOPS 40 default * .

SET MXLOOPS=199 MITERATE 199.
matrix.
get r /variables=!set1/file=*.
compute p1=ncol(r).
get r /file=* /names=varname/variables=!set1 !set2.
compute p2=ncol(r)-p1.
compute nx1=varname(1:p1).
compute nv=p1+p2.
compute nx2=varname((p1+1):nv).
```

```
compute rr=r(4:(nv+3),1:nv).
compute ns=r(3,1).
compute r11=rr(1:p1,1:p1).
compute r22=rr((p1+1):nv,(p1+1):nv).
compute r12=rr(1:p1,(p1+1):nv).
compute d1=r(2,1:p1).
compute d2=r(2,(p1+1):nv).
compute d1=mdiag(d1).
compute d2=mdiag(d2).
compute s1=d1*r11*d1.
compute s12=d1*r12*d2.
compute s2=d2*r22*d2.
compute d1=inv(d1).
compute d2=inv(d2).
compute r1=chol(r11).
compute r2=chol(r22).
* R1_inv and r2_inv are inverse of r1 and r2.
compute r1_inv=inv(r1).
compute r2_inv=inv(r2).
* compute omega matrix.
do if (p1 le p2).
compute omega=t(r1_inv)*r12*r2_inv.
else.
compute omega=t(r2_inv)*t(r12)*r1_inv.
end if.
* SVD computes the singular value decomposition of omega.
call svd(omega,u,lambda,v).
* Create a list of names for use later in labels .
!LET !@=!NULL !LET !@1=!NULL !LET !@2=!NULL
 !DO !N= 1 !TO 199
    !LET !@=!CONCAT(!@,!QUOTE(!N),",")
    !LET !@1=!CONCAT(!@1,!QUOTE(!CONCAT('CV1-',!N)),",")
    !LET !@2=!CONCAT(!@2,!QUOTE(!CONCAT('CV2-',!N)),",")
 !DOEND
 !LET !@=!CONCAT(!@,!QUOTE(@@))
 !LET !@1=!CONCAT(!@1,!QUOTE(@@))
 !LET !@2=!CONCAT(!@2,!QUOTE(@@)).
Compute num={!@}.
* Lambda stores the canonical correlations. Print them now.
print diag(lambda)/format "f8.3"/title 'Canonical Correlations'
        /space 2/rnames=num.
compute dlam=diag(lambda).
* Compute the eigenvalues and test of remaining canonical correlations.
compute eign=(1 &/ (1-dlam &**2)) - 1.
compute wlam=1 &/ (1+eign).
compute n=nrow(wlam).
compute wilk=wlam.
compute df=wlam.
compute sig=wlam.
compute bart2=wlam.
compute tem=1.
loop  #l=1 to n.
+  compute tem=tem*wlam(n-#l+1).
+  compute df(n-#l+1)=(p1-n+#l)*(p2-n+#l).
+  compute dof=df(n-#l+1).
```

```
+  compute bart2(n-#l+1)=-(ns-0.5*(p1+p2+3))*ln(tem).
+  compute chi=bart2(n-#l+1).
+  compute sig(n-#l+1)=1-chicdf(chi,dof).
+  compute wilk(n-#l+1)=tem.
end loop.
compute test={wilk,bart2,df,sig}.
print test /format "f8.3"/title 'Test that remaining correlations are zero:'
  /space 2/rnames=num
  /cnames={"Wilk's ","Chi-SQ","  DF  ","  Sig."}.
* Compute and print the standardized canonical coefficients for set-1.
do if (p1 le p2).
compute a=r1_inv*u.
else.
compute a=r1_inv*v.
end if.
do if (p2 lt p1).
compute a=a(:,1:p2).
end if.
print tem /format "f8.3"/title 'Canonical Loadings for Set-1'
   /space 2/rnames=nx1/cnames=num.
* Compute the redundancy index as the proportion of variance in set-1
* explained by its own canonical variates.
compute f1=cssq(tem)/p1.
compute f1=t(f1).
* Compute and print cross loadings for set-1.
compute tem=d1*s12*b1.
print tem /format "f8.3"/title 'Cross Loadings for Set-1'
   /space 2/rnames=nx1/cnames=num.
* Compute the redundancy index as the proportion of variance in set-1
* explained by the set-2 canonical variates.
compute cs3=cssq(tem)/p1.
compute cs3=t(cs3).
* Compute and print cross loadings for set-2.
compute tem=d2*s2*b1.
print tem /format "f8.3"/title 'Canonical Loadings for Set-2'
   /space 2/rnames=nx2/cnames=num.
* Compute the redundancy index as the proportion of variance in set-2
* explained by its own canonical variates.
compute f2=cssq(tem)/p2.
compute f2=t(f2).
* Compute and print cross loadings for set-2.
compute tem=d2*t(s12)*a1.
print tem /format "f8.3"/title 'Cross Loadings for Set-2'
   /space 2/rnames=nx2/cnames=num.
* Compute the redundancy index as the proportion of variance in set-2
* explained by the set-1 canonical variates.
compute cs4=cssq(tem)/p2.
compute cs4=t(cs4).

* Print redundancy analysis results.
compute c1={!@1}.
compute c2={!@2}.
print /title '           Redundancy Analysis:' /space 2.
print f1/format "f15.3"
  /title 'Proportion of Variance of Set-1 Explained by Its Own Can. Var.'
```

```
    /space 2/rnames=c1/cnames= {"Prop Var"}.
print cs3/format "f15.3"
  /title 'Proportion of Variance of Set-1 Explained by Opposite Can.Var.'
    /space 2/rnames=c2/cnames= {"Prop Var"}.
print f2/format "f15.3"
  /title 'Proportion of Variance of Set-2 Explained by Its Own Can. Var.'
    /space 2/rnames=c2/cnames= {"Prop Var"}.
print cs4/format "f15.3"
  /title 'Proportion of Variance of Set-2 Explained by Opposite Can. Var.'
    /space 2/rnames=c1/cnames= {"Prop Var"}.
* Create files for use in calculation of canonical scores.
SAVE {P1,P2} / OUTFILE 'CC__SIZE.SAV'.
SAVE {T(A1),T(B)} / OUTFILE 'CC__AB.SAV' .
END MATRIX.
* Create a file with variable names and set number variable
SET MESSAGES OFF RESULTS OFF.
SELECT IF $CASENUM=1.
DO REPEAT V=!SET1.
COMPUTE V=1.
END REPEAT.
DO REPEAT V=!SET2.
COMPUTE V=2.
END REPEAT.
STRING VARNAME (A8).
COMPUTE VARNAME='SET_NUM'.
FLIP VARIABLES !SET1 !SET2 / NEWNAMES=VARNAME .
COMPUTE VARSEQ=1.
SPLIT FILE BY SET_NUM.
CREATE VARSEQ=CSUM(VARSEQ).
SAVE OUTFILE 'CC_NAMES.SAV'.
GET FILE 'CC__SIZE.SAV' .
* Set up required information to create compute statements for scoring.
WRITE OUTFILE 'CC__AB.INC'
  /'STRING @NMA001 TO @NMA',COL1 (N3), ' (A8)'
  /'       @NMB001 TO @NMB',COL2 (N3), ' (A8)'
  /'VECTOR @NMA= @NMA001 TO @NMA',COL1 (N3)
  /'       @NMB= @NMB001 TO @NMB',COL2 (N3)
  /'COMPUTE N_A='COL1 (N3)
  /'COMPUTE N_B='COL2 (N3)
  /'IF (SET_NUM=1) @NMA(VARSEQ)=CASE_LBL'
  /'IF (SET_NUM=2) @NMB(VARSEQ)=CASE_LBL'
  /'COMPUTE @=1'
  /'AGGREGATE OUTFILE "CC__SPRD.SAV" / BREAK @'
  / ' / N_A=MAX(N_A) / N_B=MAX(N_B)'
  / ' / @NMA001 TO @NMA',COL1 (N3) '=MAX (@NMA001 TO @NMA',COL1 (N3),')'
  / ' / @NMB001 TO @NMB',COL2 (N3) '=MAX (@NMB001 TO @NMB',COL2 (N3),')'
  / 'GET FILE "CC__AB.SAV"'
  / 'COMPUTE @=1'
  / 'MATCH FILES FILE * / TABLE "CC__SPRD.SAV"/BY @'
  / 'VECTOR @NMA= @NMA001 TO @NMA',COL1 (N3)
  / '       @NMB= @NMB001 TO @NMB',COL2 (N3)
  / '       COEF= COL1 TO @'.
EXECUTE.
GET FILE 'CC_NAMES.SAV'.
INCLUDE FILE 'CC__AB.INC'.
```

```
SET PRINTBACK OFF.
* Write out the compute statements for scoring.
STRING @SCNM@ (A8).
STRING @OLDNM@ (A8).
COMPUTE @SCNM@=CONCAT('S1_CV',STRING($CASENUM,N3)).
WRITE OUTFILE 'CC__.INC' /'COMPUTE ',@SCNM@ ,'= 0'.
LOOP CC@@@ = 1 TO N_A.
COMPUTE @OLDNM@=@NMA(CC@@@).
COMPUTE @COEF@ =COEF(CC@@@).
WRITE OUTFILE 'CC__.INC' / ' +',@COEF@ (F20.16),' * ',@OLDNM@ .
END LOOP.
COMPUTE @SCNM@=CONCAT('S2_CV',STRING($CASENUM,N3)).
WRITE OUTFILE 'CC__.INC' /'COMPUTE ',@SCNM@ ,'= 0'.
LOOP CC@@@=1 TO N_B.
COMPUTE @OLDNM@=@NMB(CC@@@).
COMPUTE @COEF@ =COEF(CC@@@+N_A).
WRITE OUTFILE 'CC__.INC' / ' +',@COEF@ (F20.16),' * ',@OLDNM@ .
END LOOP.
EXECUTE.
* Get the original data and run the scoring program.
GET FILE 'cc__tmp1.sav'.
INCLUDE FILE 'CC__.INC' .
ERASE FILE 'CC__SIZE.SAV' .
ERASE FILE 'CC__AB.INC'.
ERASE FILE 'CC_NAMES.SAV'.
ERASE FILE 'CC__AB.SAV'.
ERASE FILE "CC__SPRD.SAV"
!IF (!KEEPSC ='N') !THEN
ERASE FILE 'CC__.INC'.
!ELSE
DO IF ($CASENUM=1).
SET RESULTS ON.
PRINT /'The canonical scores have been written to the active file.'
    /'Also, a file containing an SPSS Scoring program has been written'
    /'To use this file GET a system file with the SAME variables'
    /'Which were used in the present analysis.  Then use an INCLUDE command'
    /'to run the scoring program.'
    /'For example :' /
    /'GET FILE anotherfilename'
    /'INCLUDE FILE "CC__.INC".'
    /'EXECUTE.'.
END IF.
EXECUTE.

!IFEND.
RESTORE.
!enddefine.
RESTORE.
```

APPENDIX-V: QUESTIONNAIRE AND COVER LETTER

May ….., 2000.
Subject : Questionnaire survey
Dear : Managing Directors, Managers, Detailing Supervisors, Medical Detailers, Officers
Attachment : 1. One set of CD-ROM titled 'Organizational Learning Development Program'
2. One set of questionnaire and envelop

I, Mr. Prasert Sirisereewan, the doctoral student in the Joint Doctoral Program in Business Administration (JDBA) of the Faculty of Commerce and Accountancy, Chulalongkorn University, am working on my dissertation entitled ***'IT-Facilitated Adaptive-Organizational-Learning in Global Corporations'.***

This research attempts to study the role of 'IT-facilities related to CBT (computer-based training)' towards 'organizational learning' and 'medical-detailing-technology-transfer' of Thai subsidiaries of MNCs. The result of this research will develop a better understanding of the relationship and guide Thai companies and other international companies, whether in pharmaceutical industry or not, in improving their performance.

As the executives or personnel with skills and experience in marketing and medical detailing in pharmaceutical industry, your contribution to this questionnaire will result in the development of this dissertation, which is expected to create knowledge and understanding about organizational learning, information technology, and technology transfer. So, please answer all the questions fully and send it back to the notified address.

As the appreciation for your response, the certificate from the JDBA program will be sent to you after the results are presented. A summary of results will also be provided to you if you would like. Please fill in your information or attach your business card with the response. I would like to thank you very much for your cooperation in the preparation of this dissertation.

Please be assured that individual responses are anonymous and will remain strictly confidential. All related data will be destroyed within 6 months after finishing the research project.

Sincerely Yours,

Mr. Prasert Sirisereewan

Contact number : Tel. 4638538, 4633650 Fax 4638099
Mobile phone 01-3123499 E-mail: sertjdba@hotmail.com

Respondent :

Name _____ Position _____
Company _____ Tel. _____
E-mail _____
Address _____

Would you like to receive the conclusive result of this research ? [ ] Yes [ ] No

….. พฤษภาคม พ.ศ. 2543

เรื่อง ขอความกรุณาในการตอบแบบสอบถาม

เรียน ท่านกรรมการผู้จัดการ, ผู้จัดการฝ่ายการตลาด, ฝ่ายบริหาร, พนักงานแนะนำผลิตภัณฑ์ยา, ผู้ที่เกี่ยวข้อง

สิ่งที่แนบมาด้วย 1. ซีดี-รอม เรื่อง “Organizational Learning Development Program”

2. แบบสอบถามพร้อมซองจำนวน 1 ชุด

ด้วยกระผม นายประเสริฐ ศิริเสรีวรรณ ปัจจุบันเป็นนิสิตปริญญาเอก ในโครงการร่วมผลิตบัณฑิตระดับปริญญาเอกด้านบริหารธุรกิจ(JDBA) สังกัดคณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย ขณะนี้กระผมกำลังทำวิทยานิพนธ์ เรื่อง “"การใช้เทคโนโลยีสารสนเทศเพื่อเสริมสร้างความสามารถการเรียนรู้แบบปรับตัวขององค์กร ของบริษัทข้ามชาติในประเทศไทย"" (IT-Facilitated Adaptive-Organizational-Learning in Global Corporations).

การวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาถึงบทบาทของเทคโนโลยีสารสนเทศที่มีผลต่อความสามารถการเรียนรู้ขององค์กรและต่อการถ่ายทอดเทคโนโลยีในบริษัทยาข้ามชาติในประเทศไทย ผลของการวิจัยนี้สามารถทำให้เข้าใจถึงความสัมพันธ์ระหว่างเรื่องดังกล่าวได้ดียิ่งขึ้น พร้อมทั้งนำเสนอแนวทางในการปรับปรุงและพัฒนาความสามารถการเรียนรู้ของพนักงานและขององค์กรให้แก่ผู้บริหารทุกระดับ เพื่อความสามารถในการแข่งขันในธุรกิจระหว่างประเทศ

ในฐานะที่ท่านเป็นผู้บริหารที่มีความรู้ ความชำนาญและมีประสบการณ์ในอุตสาหกรรมยาของธุรกิจระหว่างประเทศและในประเทศไทย การให้ความร่วมมือเสียสละเวลาตอบแบบสอบถามของท่านจะส่งผลต่อความสำเร็จของงานวิจัยนี้ อันจะเป็นประโยชน์อย่างยิ่งในการสร้างความรู้ความเข้าใจเกี่ยวกับองค์ความรู้ดังกล่าว ขอความกรุณาท่านตอบแบบสอบถามนี้โดยครบถ้วนและส่งกลับมาที่ผู้วิจัยตามที่อยู่ที่กำหนดไว้ด้วย

ทางโครงการร่วมผลิตบัณฑิตระดับปริญญาเอก(JDBA) ขอมอบกิตติบัตรขอบคุณแด่ท่าน โดยจะส่งมอบให้ท่านพร้อมกับผลสรุปจากการวิจัยครั้งนี้ โปรดกรอกข้อมูลเกี่ยวกับตัวท่านในแบบฟอร์มข้างล่างนี้ หรือแนบนามบัตรมากับแบบสอบถามนี้ด้วย กระผมขอขอบพระคุณล่วงหน้าเป็นอย่างสูง ในความร่วมมือตอบแบบสอบถามของท่าน

กระผมขอรับรองว่าจะเก็บข้อมูลของท่านในการตอบแบบสอบถามนี้เป็นความลับ และข้อมูลทั้งหมดจะถูกทำลายภายใน 6 เดือน หลังจากโครงการวิจัยนี้สิ้นสุดลง

ขอแสดงความนับถืออย่างสูง

(นายประเสริฐ ศิริเสรีวรรณ)

ติดต่อผู้วิจัย : โทรศัพท์ 4638538, 4633650, 01-3123499 แฟกซ์ 4638099 E-mail: sertjdba@hotmail.com

ผู้ตอบแบบสอบถาม :

ชื่อ_____ตำแหน่ง_____

บริษัท_____ โทรศัพท์_____

ที่อยู่_____

ท่านต้องการผลสรุปจากการวิจัยนี้หรือไม่ [ ] ต้องการ [ ] ไม่ต้องการ

Questionnaire

For Middle Managers, Supervisors, Related Officers

Used in Quasi-Experimental Research

In Pre-Treatment Period (1st Week Before the CBT Program)

And In Post-Treatment Period (4th and 12th Week After CBT Program)

□ Organizational information

Name of Organization ……
Address ……
Telephone ……
Fax ……
E-Mail Address ……
Homepage . ……

Nationality of organization ……
Country that Head-office situated ……
Country that Asian-Regional-office situated ……

Number of employees
- Total ……
- Administration Unit ……
- Marketing & Detailing Unit ……
  - -Drugstore sales-staff ……
  - -Medical detailer ……
  - -Supervisor ……
  - -Sales & Marketing Manager ……
  - -Product Specialist & Product Manager ……
  - -Others (Please specify) ……
- Manufacturing Unit ……
- Training & Development Unit ……
- Personnel & Human Resource Unit ……
- Information Technology & Information System Unit ……
- Other Units (Please specify) ……

Status of your organization in Thailand.
- □ Importer
- □ Sole distributor/ agent
- □ Joint venture
- □ Other strategic alliances. (Please specify)
- □ Subsiary without own manufacturing facilities
- □ Subsiary with own manufacturing facilities
- □ Multinational company under the management of global headoffice
- □ Multinational company under the management of global headoffice
- □ Thai-originated company selling/manufacturing only locally products
- □ Others (Please specify) ……

Share holders : Thai ..... %
Foreign ..... %
Total 100 %

Nationality of foreign share holders: Country..... Share holders..... %
Country..... Share holders..... %
Country..... Share holders..... %

What is the total sales in a year? .....

What is the export sales in a year? .....

What is the import figures in a year? .....

Does your company have R&D department? □ Yes □ No

The percentage of R & D expenses in comparison to total sales ..... %

How is your company performance level for last 5 years, compared to other companies in your industries?
□ Very Poor □ Poor □ Average □ Good □ Very Good

What is the education level of the Managing Director?

- □ No formal education □ Primary School □ Secondary School
- □ Technical college □ Bachelor Degree □ Master Degree or higher ……

Which product-group(s) is(are) the primary lines of business in your organization ?

- □ Cardiovascular preparations
- □ Respiratory preparations
- □ Gastro-intestinal preparations
- □ Topical preparations
- □ Pediatric preparations
- □ Parenteral & IV preparations
- □ Topical preparations
- □ Food & nutritional products
- □ Medical supplies
- □ Other products. (Please specify) ……

Which currency do you report financial performance to your headoffice?

- □ U.S. Dollars □ Japanese Yen □ Thai Baht
- □ Other Currency. Please specify ……

For what 12-month period are your reporting data in this questionnaire?

- □ Calendar year
- □ Other please specify. …..month……year……. to month……year…….

What is the name of your 'Training & Development Unit' (if applicable)? ……
What is the name of your 'Organizational Learning Unit' (if applicable)? ……
What is the name of your 'Information Technology or Information System Unit' (if applicable)? ……
Please name the Head of 'Training & Development Unit' ……
Number of personnel working in this unit ……
Please name the Head of 'Organizational Learning Unit' ……
Number of personnel working in this unit ……
Please name the Head of 'Information Technology or Information System Unit'
……
Number of personnel working in this unit ……

What part of your organization does the training and development unit serve?

- □ Entire organization
- □ Marketing & Detailing unit
- □ Manufacturing unit
- □ Specific-sub-unit of your organization
- □ Specialized training unit
- □ Other units (Please specify) ……

Part A: Organizational Learning Capability (OLC)

When you think about learning in your company and the work you do, the people and team you work with, the systems-thinking, the memory systems your company provides, the current business climate, and other aspects

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
1. Team Orientation					
1) Cross-functional teamwork is not a regular routine-practice here.	☐	☐	☐	☐	☐
2) Individuals in teams are often defensive about their particular functional specialty.	☐	☐	☐	☐	☐
3) A team spirit always pervades our ranks.	☐	☐	☐	☐	☐
4) In this organization, cross-functional teamwork is the common way of working rather than an exception to the norm.	☐	☐	☐	☐	☐
5) Evaluation and reward system are always linked to team achievements, not just individual achievements.	☐	☐	☐	☐	☐
6) There is usually a commonality of purpose in your team.	☐	☐	☐	☐	☐
7) There is total agreement on our organizational vision across all levels, functions, divisions of marketing process.	☐	☐	☐	☐	☐
8) Our detailing team is always committed to sharing their knowledge in marketing process within or among other teams.	☐	☐	☐	☐	☐
9) Current organizational practice frequently encourages employees to solve problems together before discussing with manager.	☐	☐	☐	☐	☐
10) We cannot usually form informal groups to solve our organizational problems.	☐	☐	☐	☐	☐
11) Most problem solving groups in this organization require employees from a variety of functional areas.	☐	☐	☐	☐	☐
2. System Orientation					
1) I always have a good sense of the interconnectedness of all parts of the marketing process.	☐	☐	☐	☐	☐
2) I usually understand the basic value chain of the marketing process, and how my work fits into the chain.	☐	☐	☐	☐	☐
3) All activities that take place in the marketing process are always defined clearly.	☐	☐	☐	☐	☐
4) I frequently understand where all activities fit in the marketing process.	☐	☐	☐	☐	☐
5) I always attempts to develop new systematic ways of looking at the marketing process.	☐	☐	☐	☐	☐

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
3. Learning Orientation					
1) I am always committed to the goals of skill-development in marketing process.	□	□	□	□	□
2) I absolutely agree that our ability to learn is the key to improvement in the marketing process.	□	□	□	□	□
3) The basic values of our marketing process firmly include learning as a key to improvement.	□	□	□	□	□
4) The popular sense around here is that employee learning is not an expense , but a necessary investment.	□	□	□	□	□
5) Learning in my team is always valued as a key commodity necessary to guarantee efficiency of marketing process.	□	□	□	□	□
4. Memory Orientation					
1) Our team usually has specific mechanisms for sharing or recording lessons learned in the marketing process in any related responsibilities.	□	□	□	□	□
2) Our team always audit unsuccessful marketing endeavors, then widely communicate and record the lessons learned.	□	□	□	□	□
3) There is a good deal of organizational conversation which keeps alive the lessons learned from history.	□	□	□	□	□
4) We have formal routines that we use to uncover faulty assumptions that we may have made about the marketing process.	□	□	□	□	□

	Percentage Please write '0' in any blank in which your answer is zero. ('OL Program' is the computerized training program arranged by the researcher)	Percentage before 'OL Program'	Percentage after expected 'OL Program'in 2001-2002

(New-Product is the product which just have been launched not more than 6 months)

5. Test of New-Product Knowledge

1) When all staffs of your teams sit for a test or exam of new product knowledge arranged in your company, what are the average score (3 months) that you will rate on your teams (out of 100%). (If there is no test or exam in your company, please fill "no" in the blank)	……	……
2) When all staffs of your teams worked in the field, the average percentage amount of information from 'new product knowledge' training that your teams can remember and describe to the customers.	……	……

6. Success in New Product Launching (The new product evaluated here should be the same product in all periods.)

1) What percentage of growth sales were your teams have successfully launched new product?	……	……
2) What percentage of growth number of hospitals were your team has successfully launched new product? (The growth number of hospitals approving your new product in the hosptial druglists)	……	……

Part B: Organizational Learning Process (OLP)

When you think about learning in your company and the work you do, information acquisition, information sharing, shared interpretation of information, and organizational memory, and other aspects ……..

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
1. Information Acquisition					
1) Our detailing representatives extensively search for chance that which products or services we will need in the future.	☐	☐	☐	☐	☐
2) Our detailing representatives always does in-house research.	☐	☐	☐	☐	☐
3) Our detailing representatives are slow to detect changes in our product and service popularities.	☐	☐	☐	☐	☐
4) Our detailing representatives regularly search for intelligence about our direct and indirect competitors.	☐	☐	☐	☐	☐
5) Our detailing representatives always visit target customers to assess our quality of products or services.	☐	☐	☐	☐	☐
6) Our detailing representatives are slow to detect fundamental changes in our business environment.	☐	☐	☐	☐	☐
7) Our detailing representatives regularly review the potential effects of changes in the marketing environment.	☐	☐	☐	☐	☐
8) Information acquisition in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐
2. Information Dissemination					
1) We frequently have inter-departmental meetings, including Intra-departmental meeting, to discuss trends, changes, or developments in our marketing process.	☐	☐	☐	☐	☐
2) Our marketing representatives regularly spend time teaching or discussing their new knowledge with their colleagues.	☐	☐	☐	☐	☐
3) When something important happens to our team or any parts of our organization, we always knows about it in a short period.	☐	☐	☐	☐	☐
4) Data on satisfaction with marketing process is always disseminated at all levels in this marketing process on a regular basis.	☐	☐	☐	☐	☐
5) When our detailing representatives finds out something important about the marketing process, they are always slow to alert our team.	☐	☐	☐	☐	☐
6) Information dissemination in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
3. Shared Interpretation of information					
1) Our team always have meetings to discuss or share their opinions or techniques learned from the fields.	☐	☐	☐	☐	☐
2) We frequently have intra- or inter-departmental meetings, to show and share information about our business intelligence or dynamic.	☐	☐	☐	☐	☐
3) We regularly have inter-departmental meetings, to exchange some new ideas, techniques, or errors of our company.	☐	☐	☐	☐	☐
4) We always have consensus on the meaning of the information and its implications for businesses.	☐	☐	☐	☐	☐
5) We frequently have effective management of conflict by development of group norms that encourage open sharing of information and remove constraints on information and communication.	☐	☐	☐	☐	☐
6) We always provide forums for information exchange and discussion - through liaison positions or integrators roles.	☐	☐	☐	☐	☐
- through face-to-face contact in meeting or taskforces.	☐	☐	☐	☐	☐
- through utilization of some information technologies, e.g., creating bulletin boards system (BBS) on some relevant topics.	☐	☐	☐	☐	☐
7) Shared interpretation in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐
4. Organization Memory of Information / Knowledge					
1) We widely have company systems to record any forms of new techniques,new Information or new knowledge, which are discovered or invented.	☐	☐	☐	☐	☐
2) When something important happens to any major units or parts of the organization, most of our team regularly know about it and always prepare some ways to memorize or record such events.	☐	☐	☐	☐	☐
3) Relevant data on our customer (e.g., customer satisfaction) is frequently memorized or recorded at all levels in this organization.	☐	☐	☐	☐	☐
4) When our detailing representatives find out something important about the marketing process, they always report by some types of memory, except for oral report (e.g., handwriting report, computerized report)	☐	☐	☐	☐	☐
5) Organizational memory of information / knowledge in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐

Part C: IT-Based Organizational Learning Tools (OLT)

1. Assets, spending, personnel related to OLT.

Please estimate what percentage of formal learning activities (courses, self-paced instruction, etc.) used each of the following *distribution methods* (how information/knowledge is delivered to learners) to provide learning content to teams / groups of your employees before and after the 'OL Program'. Then, please estimate the expected percentage for the year 2001-2002.

Note that the total does NOT have to add to 100%, as a course may use more than one presentation method, or may use none at all.

Please write '0' in any blank in which your answer is zero. ('OL Program' : The computerized training program arranged by the researcher)	% of courses that used method before 'OL Program'	% of courses that used method after 'OL Program'	% of courses that will use that method in 2001-2002
1) Non-electronic media: any paper manuals, handout, books, textbook, etc.	……	……	……
2) Computer-Based Training: CBT (text only): any leanring event that is text-based and computer-delivered	……	……	……
3) Multimedia: a computer apllication that uses any combination of text, graphics, audio, animation, and/or full-motion video or text between two or more individuals or groups at two or more locations.	……	……	……
4) Interactive TV: one-way video combined with two-way audio or other electronic response system.	……	……	……
5) Teleconferencing: the instantaneous exchange of audio, video, or text between two or more individuals or groups at two or more locations	……	……	……
6) Groupware: an integrated computer application that supports collaborative group efforts through the sharing of calendars for project management and scheduling, collective document preparation, E-mail handling, shared database access, electronic meetings, and other activities.	……	……	……
7) Virtual reality: a computer application that provides an interactive, immersive, and three dimensional learning experience through full-functional, realistic models.	……	……	……
8) Electronic performance support system (EPSS): an integrated computer application that uses any combination of expert systems, hypertext, embedded animation, and/or hypermedia to help a user perform a task in real-time quickly and with a minimum of support by other people.	……	……	……
9) Others : (Please describe) ……	……	……	……

Assets and Spending of IT-Based Organizational Learning Tools (OLT)

10) Percentage of total assets related to 'IT-infrastructures in CBT'	……	……	……
11) Percentage of **spending** related to 'IT-infrastructures in CBT'	……	……	……

Number of Personnel Related to OLT.

12) Number of personnel related to 'IT-infrastructures in CBT'	……	……	……

Please estimate what percentage of formal learning activities (courses, self-paced instruction, etc.) used each of the following *distribution methods* (how information/knowledge is delivered to learners) to provide learning content to teams / groups of your employees before and after the 'OL Program'. Then, please estimate the expected percentage for the year 2001-2002.

Note that the total does NOT have to add to 100%, as a course may use more than one presentation method, or may use none at all.

Please write '0' in any blank in which your answer is zero. ('OL Program' : The computerized training program arranged by the researcher)	% of courses that used method before 'OL Program'	% of courses that used method after 'OL Program'	% of courses that will use method in 2001-2002
13) Cable TV: the transmission of television signals via cable technologies	……	……	……
14) CD-ROM: a format and system for recording, storing, and retrieving electronic information on a compact disc that is read using an optic drive.	……	……	……
15) Electronic mail (e-mail): the exchange of message or transfer of information, knowledge, or learning through computers	……	……	……
16) Extranet: a collaborative network that uses internet technology to link organizations with their suppliers, customers, or other organizations that share common goals, or transferring information, knowledge, and learning.	……	……	……
17) Internet: a loose connection of computer networks around the world that are connected through several primary networks used to in transferring, information, knowledge, learning among connected targets.	……	……	……
18) Intranet: a general term describing any network contained within an organization; used to refer primarily to networks that use internet technology, or transferring, information, knowledge, learning among connected targets.	……	……	……
19) Local Area Network (LAN): a network of computers sharing the resources of a single processor or server within a relatively small geographic area, or transferring, information, knowledge, learning among connected targets.	……	……	……
20) Satellite TV. : the transmission of television signals via satellites.	……	……	……
21) Simulator: a device or system that replicates or imitates a real device or system.	……	……	……
22) Voicemail: an automated, electronic telephone answering system.	……	……	……
23) Wide area network: a network of computers sharing the resources of one or more processors or servers over a relatively large geographic area, or transferring, information, knowledge, learning among connected targets.	……	……	……
24) World Wide Web: all of the resources and users on the Internet using Hypertext Transport Protocol (HTTP), a set of rules for exchanging files, or transferring, information, knowledge, learning.	……	……	……
25) Others : (Please describe) ……	……	……	……

2. Orientation in IT-infrastructures

When you think about learning in your company and relationship to information system, information technology, CBT, information acquisition, information sharing, shared interpretation of information, and organizational memory, and other aspects ……..

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
1) We routinely have computer-based training (CBT), which facilitate our organizational learning capabilities.	□	□	□	□	□
2) We frequently used such CBT tools as our routines to facilitate our organizational learning capabilities.	□	□	□	□	□
3) We always create such CBT tools internally by our staffs.	□	□	□	□	□
4) We regularly hire outsider to create such CBT tools.	□	□	□	□	□
5) We always borrow such CBT tools from our headoffice from abroad.	□	□	□	□	□
6) We never have problem in understanding such CBT tools from abroad.	□	□	□	□	□
7) We usually use our **intra**organizational IT-infrastructures to enhance the four orientations (team, systems, learning, memory orientations)	□	□	□	□	□
8) We frequently have efficient **inter**organizational IT-infrastructures in order to facilitate our organizational learning capabilities.	□	□	□	□	□
9) We often use our **inter**organizational IT-infrastructures to enhance the four orientations (team, systems, learning, memory orientations)	□	□	□	□	□
10) IT-infrastructures in our organization significantly enhance the organizational learning capabilities of our teams.	□	□	□	□	□

Personal Information :

Name ……

Title ……

Address ……

Years of working in this organization ……..years.

Total years of experience (including working in other organizations) ……..years.

Would you like to have a copy of result summarized from this research ?

[ ] Yes [ ] No

Thank you for your kind attention and cooperation

Prasert Sirisereewan

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Questionnaire

For Top Executives

Used in Personal Survey Research

(Telephone or Face-to-Face)

In Post-Treatment Period (12th Week After CBT Program)

□ Organizational information

Name of Organization ……
Country of origin ……
Country that headoffice situated ……..

Status of your organization in Thailand.

- □ Importer
- □ Sole distributor/ agent
- □ Joint venture
- □ Other strategic alliances. (Please specify)
- □ Subsidiary without own manufacturing facilities
- □ Subsidiary with own manufacturing facilities
- □ Multinational company under the management of global headoffice
- □ Multinational company under the management of global headoffice
- □ Thai-originated company selling/manufacturing only locally products
- □ Others (Please specify) ……

Which product-group(s) is(are) the primary lines of business in your organization?

- □ Cardiovascular preparations
- □ Respiratory preparations
- □ Gastro-intestinal preparations
- □ Topical preparations
- □ Pediatric preparations
- □ Parenteral & IV preparations
- □ Topical preparations
- □ Food & nutritional products
- □ Medical supplies
- □ Other products. (Please specify) ……

How long has your company established in Thailand? …… years.

Does your company have R&D department? □ Yes □ No

How is your company performance level for last 5 years, compared to other companies in your industries?

□ Very Poor □ Poor □ Average □ Good □ Very Good

What is the education level of top executive (please specify the position ……..) of your company?

□ No formal education □ Primary School □ Secondary School
□ Technical college □ University □ Post graduate (Master Degree or higher) ……

Which currency do you report financial performance to your headoffice?

- □ U.S. Dollars □ Japanese Yen □ Thai Baht
- □ Other Currency. Please specify ……

Part A: Organizational Learning Capability (OLC)

When you think about learning in your company and the work you do, the people and team you work with, the systems-thinking, the memory systems your company provides, the current business climate, and other aspects

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
1. Team Orientation					
1) Cross-functional teamwork is not a regular routine-practice here.	☐	☐	☐	☐	☐
2) Individuals in teams are often defensive about their particular functional specialty.	☐	☐	☐	☐	☐
3) A team spirit always pervades our ranks.	☐	☐	☐	☐	☐
4) In this organization, cross-functional teamwork is the common way of working rather than an exception to the norm.	☐	☐	☐	☐	☐
5) Evaluation and reward system are always linked to team achievements, not just individual achievements.	☐	☐	☐	☐	☐
6) There is usually a commonality of purpose in your team.	☐	☐	☐	☐	☐
7) There is total agreement on our organizational vision across all levels, functions, divisions of marketing process.	☐	☐	☐	☐	☐
8) Our detailing team is always committed to sharing their knowledge in marketing process within or among other teams.	☐	☐	☐	☐	☐
9) Current organizational practice frequently encourages employees to solve problems together before discussing with manager.	☐	☐	☐	☐	☐
10) We cannot usually form informal groups to solve our organizational problems.	☐	☐	☐	☐	☐
11) Most problem solving groups in this organization require employees from a variety of functional areas.	☐	☐	☐	☐	☐
2. System Orientation					
1) I always have a good sense of the interconnectedness of all parts of the marketing process.	☐	☐	☐	☐	☐
2) I usually understand the basic value chain of the marketing process, and how my work fits into the chain.	☐	☐	☐	☐	☐
3) All activities that take place in the marketing process are always defined clearly.	☐	☐	☐	☐	☐
4) I frequently understand where all activities fit in the marketing process.	☐	☐	☐	☐	☐
5) I always attempts to develop new systematic ways of looking at the marketing process.	☐	☐	☐	☐	☐

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
3. Learning Orientation					
1) I am always committed to the goals of skill-development in marketing process.	□	□	□	□	□
2) I absolutely agree that our ability to learn is the key to improvement in the marketing process.	□	□	□	□	□
3) The basic values of our marketing process firmly include learning as a key to improvement.	□	□	□	□	□
4) The popular sense around here is that employee learning is not an expense , but a necessary investment.	□	□	□	□	□
5) Learning in my team is always valued as a key commodity necessary to guarantee efficiency of marketing process.	□	□	□	□	□
4. Memory Orientation					
1) Our team usually has specific mechanisms for sharing or recording lessons learned in the marketing process in any related responsibilities.	□	□	□	□	□
2) Our team always audit unsuccessful marketing endeavors, then widely communicate and record the lessons learned.	□	□	□	□	□
3) There is a good deal of organizational conversation which keeps alive the lessons learned from history.	□	□	□	□	□
4) We have formal routines that we use to uncover faulty assumptions that we may have made about the marketing process.	□	□	□	□	□

Please write '0' in any blank in which your answer is zero. ('OL Program' is the computerized training program arranged by the researcher)	Percentage before 'OL Program'	Percentage after 'OL Program'	Percentage expected in 2001-2002
(New-Product is the product which just have been launched not more than 6 months)			
5. Test of New-Product Knowledge			
1) When all staffs of your teams sit for a test or exam of new product knowledge arranged in your company, what are the average score (3 months) that you will rate on your teams (out of 100%). (If there is no test or exam in your company, please fill "no" in the blank)	…….	…….	…….
2) When all staffs of your teams worked in the field, the average percentage amount of information from 'new product knowledge' training that your teams can remember and describe to the customers.	…….	…….	…….
6. Success in New Product Launching (The new product evaluated here should be the same product in all periods.)			
1) What percentage of growth sales were your teams have successfully launched new product?	…….	…….	…….

Part B: Organizational Learning Process (OLP)

When you think about learning in your company and the work you do, information acquisition, information sharing, shared interpretation of information, and organizational memory, and other aspects ……..

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
1. Information Acquisition					
1) Our detailing representatives extensively search for chance that which products or services we will need in the future.	☐	☐	☐	☐	☐
2) Our detailing representatives always does in-house research.	☐	☐	☐	☐	☐
3) Our detailing representatives are slow to detect changes in our product and service popularities.	☐	☐	☐	☐	☐
4) Our detailing representatives regularly search for intelligence about our direct and indirect competitors.	☐	☐	☐	☐	☐
5) Our detailing representatives always visit target customers to assess our quality of products or services.	☐	☐	☐	☐	☐
6) Our detailing representatives are slow to detect fundamental changes in our business environment.	☐	☐	☐	☐	☐
7) Our detailing representatives regularly review the potential effects of changes in the marketing environment.	☐	☐	☐	☐	☐
8) Information acquisition in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐
2. Information Dissemination					
1) We frequently have inter-departmental meetings, including Intra-departmental meeting, to discuss trends, changes, or developments in our marketing process.	☐	☐	☐	☐	☐
2) Our marketing representatives regularly spend time teaching or discussing their new knowledge with their colleagues.	☐	☐	☐	☐	☐
3) When something important happens to our team or any parts of our organization, we always knows about it in a short period.	☐	☐	☐	☐	☐
4) Data on satisfaction with marketing process is always disseminated at all levels in this marketing process on a regular basis.	☐	☐	☐	☐	☐
5) When our detailing representatives finds out something important about the marketing process, they are always slow to alert our team.	☐	☐	☐	☐	☐
6) Information dissemination in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
3. Shared Interpretation of information					
1) Our team always have meetings to discuss or share their opinions or techniques learned from the fields.	☐	☐	☐	☐	☐
2) We frequently have intra- or inter-departmental meetings, to show and share information about our business intelligence or dynamic.	☐	☐	☐	☐	☐
3) We regularly have inter-departmental meetings, to exchange some new ideas, techniques, or errors of our company.	☐	☐	☐	☐	☐
4) We always have consensus on the meaning of the information and its implications for businesses.	☐	☐	☐	☐	☐
5) We frequently have effective management of conflict by development of group norms that encourage open sharing of information and remove constraints on information and communication.	☐	☐	☐	☐	☐
6) We always provide forums for information exchange and discussion - through liaison positions or integrators roles.	☐	☐	☐	☐	☐
- through face-to-face contact in meeting or taskforces.	☐	☐	☐	☐	☐
- through utilization of some information technologies, e.g., creating bulletin boards system (BBS) on some relevant topics.	☐	☐	☐	☐	☐
7) Shared interpretation in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐
4. Organization Memory of Information / Knowledge					
1) We widely have company systems to record any forms of new techniques,new Information or new knowledge, which are discovered or invented.	☐	☐	☐	☐	☐
2) When something important happens to any major units or parts of the organization, most of our team regularly know about it and always prepare some ways to memorize or record such events.	☐	☐	☐	☐	☐
3) Relevant data on our customer (e.g., customer satisfaction) is frequently memorized or recorded at all levels in this organization.	☐	☐	☐	☐	☐
4) When our detailing representatives find out something important about the marketing process, they always report by some types of memory, except for oral report (e.g., handwriting report, computerized report)	☐	☐	☐	☐	☐
5) Organizational memory of information / knowledge in our organization significantly enhance the organizational learning capabilities of our teams.	☐	☐	☐	☐	☐

Part C: IT-Based Organizational Learning Tools (OLT)

1. Assets, spending, personnel related to OLT.

Please estimate what percentage of formal learning activities (courses, self-paced instruction, etc.) used each of the following *distribution methods* (how information/knowledge is delivered to learners) to provide learning content to teams / groups of your employees before and after the 'OL Program'. Then, please estimate the expected percentage for the year 2001-2002.

Note that the total does NOT have to add to 100%, as a course may use more than one presentation method, or may use none.

Please write '0' in any blank in which your answer is zero. ('OL Program' : The computerized training program arranged by the researcher)	% of courses that used method before 'OL Program'	% of courses that used that will use method aftermethod 'OL Program'in 2001-2002	
1) Non-electronic media: any paper manuals, handout, books, textbook, etc.	……	……	……
2) Computer-Based Training: CBT (text only): any leanring event that is text-based and computer-delivered	……	……	……
3) Multimedia: a computer apllication that uses any combination of text, graphics, audio, animation, and/or full-motion video or text between two or more individuals or groups at two or more locations.	……	……	……
4) Interactive TV: one-way video combined with two-way audio or other electronic response system.	……	……	……
5) Teleconferencing: the instantaneous exchange of audio, video, or text between two or more individuals or groups at two or more locations	……	……	……
6) Groupware: an integrated computer application that supports collaborative group efforts through the sharing of calendars for project management and scheduling, collective document preparation, E-mail handling, shared database access, electronic meetings, and other activities.	……	……	……
7) Virtual reality: a computer application that provides an interactive, immersive, and three dimensional learning experience through full-functional, realistic models.	……	……	……
8) Electronic performance support system (EPSS): an integrated computer application that uses any combination of expert systems, hypertext, embedded animation, and/or hypermedia to help a user perform a task in real-time quickly and with a minimum of support by other people.	……	……	
9) Others : (Please describe) ……	……	……	

Assets and Spending of IT-Based Organizational Learning Tools (OLT)

10) Percentage of total assets related to 'IT-infrastructures in CBT'	……	……	……
11) Percentage of **spending** related to 'IT-infrastructures in CBT'	……	……	……

Number of Personnel Related to OLT.

12) Number of personnel related to 'IT-infrastructures in CBT'	……	……	……

Please estimate what percentage of formal learning activities (courses, self-paced instruction, etc.) used each of the following *distribution methods* (how information/knowledge is delivered to learners) to provide learning content to teams / groups of your employees before and after the 'OL Program'. Then, please estimate the expected percentage for the year 2001-2002.

Note that the total does NOT have to add to 100%, as a course may use more than one presentation method, or may use none at all.

Please write '0' in any blank in which your answer is zero. ('OL Program' : The computerized training program arranged by the researcher)	% of courses that used method before 'OL Program'	% of courses that used method after 'OL Program'	% of courses that will use method in 2001-2002
13) Cable TV: the transmission of television signals via cable technologies	……	……	……
14) CD-ROM: a format and system for recording, storing, and retrieving electronic information on a compact disc that is read using an optic drive.	……	……	……
15) Electronic mail (e-mail): the exchange of message or transfer of information, knowledge, or learning through computers	……	……	……
16) Extranet: a collaborative network that uses internet technology to link organizations with their suppliers, customers, or other organizations that share common goals, or transferring information, knowledge, and learning.	……	……	……
17) Internet: a loose connection of computer networks around the world that are connected through several primary networks used to in transferring, information, knowledge, learning among connected targets.	……	……	……
18) Intranet: a general term describing any network contained within an organization; used to refer primarily to networks that use internet technology, or transferring, information, knowledge, learning among connected targets.	……	……	……
19) Local Area Network (LAN): a network of computers sharing the resources of a single processor or server within a relatively small geographic area, or transferring, information, knowledge, learning among connected targets.	……	……	……
20) Satellite TV. : the transmission of television signals via satellites.	……	……	……
21) Simulator: a device or system that replicates or imitates a real device or system.			
22) Voicemail: an automated, electronic telephone answering system.	……	……	……
23) Wide area network: a network of computers sharing the resources of one or more processors or servers over a relatively large geographic area, or transferring, information, knowledge, learning among connected targets.	……	……	……
24) World Wide Web: all of the resources and users on the Internet using Hypertext Transport Protocol (HTTP), a set of rules for exchanging files, or transferring, information, knowledge, learning.	……	……	……
25) Others : (Please describe) ……	……	……	……

2. Orientation in IT-infrastructures

When you think about learning in your company and relationship to information system, information technology, CBT, information acquisition, information sharing, shared interpretation of information, and organizational memory, and other aspects ……..

	Strongly Agree	Somewhat Agree	Not Sure	Somewhat Disagree	Strongly Disagree
1) We routinely have computer-based training (CBT), which facilitate our organizational learning capabilities.	□	□	□	□	□
2) We frequently used such CBT tools as our routines to facilitate our organizational learning capabilities.	□	□	□	□	□
3) We always create such CBT tools internally by our staffs.	□	□	□	□	□
4) We regularly hire outsider to create such CBT tools.	□	□	□	□	□
5) We always borrow such CBT tools from our headoffice from abroad.	□	□	□	□	□
6) We never have problem in understanding such CBT tools from abroad.	□	□	□	□	□
7) We usually use our **intra**organizational IT-infrastructures to enhance the four orientations (team, systems, learning, memory orientations)	□	□	□	□	□
8) We frequently have efficient **inter**organizational IT-infrastructures in order to facilitate our organizational learning capabilities.	□	□	□	□	□
9) We often use our **inter**organizational IT-infrastructures to enhance the four orientations (team, systems, learning, memory orientations)	□	□	□	□	□
10) IT-infrastructures in our organization significantly enhance the organizational learning capabilities of our teams.	□	□	□	□	□

Personal Information :

Name ……

Title ……

Address ……

Years of working in this organization ……..years.

Total years of experience (including working in other organizations) ……..years.

Would you like to have a copy of result summarized from this research ?

[ ] Yes [ ] No

Thank you for your kind attention and cooperation

Prasert Sirisereewan

JDBA Program. Chulalongkorn University.

Tel : 02-4638538; 02-8191725; 01-3123499

Fax : 02-4633650

E-mail: sertjdba@hotmail.com; aprsi@mail.utcc.ac.th

APPENDIX-VI: SAMPLES OF HTML CODES FOR CREATING ONLINE-CBT USED IN QUASI-EXPERIMENTAL RESEARCH

Index.htm

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<head>
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<meta name="ProgId" content="FrontPage.Editor.Document">
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</head>
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<p align="left"> </p>
<p align="left"> </p>
<p><img border="0" src="images/skybckgr.gif" width="640" height="85"></p>
<p></p>
<p></p>
<p><b><font face="Arial" size="2">This 'OL Development Program' is composed of 2
parts:</font></b></p>
<p><b><font face="Arial" size="2">1.<u>Lesson</u>: Consists of 3 lessons of texts and
theories (Chapter 1, 2, and 3).</font></b></p>
<p><b><font face="Arial" size="2">2.<u>Workshop</u>: Consists of 2 lessons of workshops
and  questionnaires (Chapter 4 and 5).</font></b></p>
<p><b><font face="Arial" size="2">The '<u>WebBoard</u>' is designed for learners to
pose questions or comments related to this program to other learners or the
author.</font></b></p>
<p><font face="Arial" size="2"><b>You can automatically <u> register</u> yourself to be
a user of this OL Development Program by filling out and submitting this form.
Only registered users are allowed into OL Development Program. Choose a username
for yourself (such as your last name) and make sure this username contains no
spaces. Also create a private password. Together these will be your
&quot;key&quot; into OL Development Program from now on. </b></font></p>
<p><font face="Arial" size="2"><b>After you are successfully registered, your
web browser will ask you to type in your username and password the first time
you try to access OL Development Program. The browser will remember this
information for as long as it continues to run, so you can access any document
in OL Development Program without being asked for it again.</b></font></p>
<hr>
<form action="--WEBBOT-SELF--" method="POST" onSubmit="">
  <!--webbot bot="Registration" startspan S-Service="Name of your sub web"
  S-Username-Fields="Username" S-Password-Fields="Password PasswordVerify"
  I-Password-Min-Length="6" B-Check-Password-Against-User="TRUE"
  U-File="C:\1webOrg\_private\regdb.txt" S-Format="TEXT/TSV"
  S-Label-Fields="TRUE" S-Builtin-Fields="Date Time REMOTE_NAME HTTP_USER_AGENT"
  S-Form-Fields="Username EmailAddress" --><strong>[FrontPage Registration Component]</strong><!--webbot
  bot="Registration" endspan -->
  <h2> </h2>
  <h2><i><font face="Arial Black" color="#FF0000" size="4"> <u>Form Submission</u> </font><font face="Arial Black" size="3"
color="#FF0000">        
```

```
                        
;         
  </font></i></h2>
  <p><b><font face="Arial Narrow" size="3" color="#0000FF">Make up a username:</font></b><br>
  <input type="text" size="25" maxlength="256" name="Username">   
  ( <em>you can use mixed case )</em><br>
  <font face="Arial Narrow" color="#0000FF"><b>Make up a password:</b></font><br>
  <input type="password" size="25" maxlength="256" name="Password">   
  ( <em>keep this private! )</em><br>
  <b><font face="Arial Narrow" color="#0000FF">Enter password again:</font></b><strong><br>
  </strong><input type="password" size="25" maxlength="256" name="PasswordVerify">   
  ( <em>for verification )</em><br>
  <font face="Arial Narrow"><b>Enter e-mail address:</b></font><strong><br>
  </strong><input type="text" size="25" maxlength="256" name="EmailAddress">   
  ( <em>if you have one )</em></p>
  <p> </p>
  <h2><input type="submit" value="Register Me"> <input type="reset" value="Clear Form"></h2>
</form>
<hr>
<h5><br>
<font size="1">Copyright &copy; 2000. All rights reserved.<br>
Revised: July 10, 2000.</font></h5>

<p align="left"> </p>
<p align="left"> </p>
</body>
</html>
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Page1.htm

```
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<meta http-equiv="Content-Type" content="text/html; charset=windows-1252">
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<meta name="ProgId" content="FrontPage.Editor.Document">
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</head>
<body>

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u-overlaysrc="_overlay/lesson1Text.htm_txt_skybckgr.gif" --></p>
<p> </p>
<p><b><i><font face="Arial Black" size="3" color="#0000FF"><a href="#OL Definition">Organizational Learning:
Definition</a></font></i></b></p>
<p><b><i><font face="Arial Black" size="3" color="#0000FF"><a href="#OL Process">Organizational Learning
Process</a></font></i></b></p>
<p><b><i><font face="Arial Black" size="3" color="#0000FF"><a href="#OL Capability">Organizational Learning
Capabilities</a></font></i></b></p>
<p> </p>

<p><b><i><font face="Arial" size="3" color="#FFFFFF"><span style="background-color: #0000FF"> </span></font><a href="#Organizational Learning : Definition"
name="OL Definition"><span style="background-color: #0000FF"><font face="Arial" size="3" color="#FFFFFF">Organizational
Learning : Definition</font></span></a><font face="Arial" size="3" color="#FFFFFF"><span style="background-color: #0000FF"> </span></font></i></b></p>
<p><font face="Arial" size="2"><b>'Organizational Learning' is defined as the
process of improving actions through better knowledge and understanding (Fiol
and Lyles, 1985). Organizational learning occurs through shred insights,
knowledge, and mental models and builds on past knowledge and experience on
memory.</b></font></p>
<p><font face="Arial" size="2"><b>'Organizational learning' is classified in two
different types, the fundamental level and advanced level.</b></font></p>
<p><font face="Arial" size="2"><b>1.<u>Fundamental level</u> (adaptive, or
first-loop, or operational level) is learning which occurs within a set of
recognized and unrecognized constraints that reflect the organization's
assumptions about its environment and itself. It is the most basic forms of
learning which can be developed to the advanced (higher) level of learning if
organization is well-prepared as the conditions.</b></font></p>
<p><font face="Arial" size="2"><b>2.<u>Advanced level</u> (generative, or
second-loop, or conceptual level) is learning which occurs when the organization
is willing to question long-held assumptions about its mission, customers,
capabilities, or strategies. It requires the development of a new way of looking
at the world based on an understanding of the systems and relationships that
link key issues and events. Systems thinking disciplines the organization to
focus on interrelationships and dynamic processes of change rather than on
linear cause-effect chains (Senge, 1990; Argyris and Schone, 1977).</b></font></p>
<p><font face="Arial" size="2">(Use 'scroll-bar' to scroll back to the chapter
index.)</font></p>
<p> </p>
<p><b><i><span style="background-color: #0000FF"><font face="Arial" size="3" color="#FFFFFF"> </font><a href="#Organizational Learning : Definition"
name="OL Process"><font face="Arial" size="3" color="#FFFFFF">Organizational
```

Learning Process
'Organizational learning process' is defined
as the process of creating or promoting organizational learning, which involved
in information acquisition, information dissemination, shared interpretation,
and information memory (Sinkula, 1994). The details of each subprocess are as
follows.
1.<u>Information acquisition</u> refers to the
collection and assessment of organizational information or knowledge (e.g.,
selling techniques, development skills, insights, etc.) that influence the
organizational development and achievement of organizational objectives.

2.<u>Information dissemination</u> refers to
the process of dissemination or distribution of organizational information or
knowledge (e.g., selling techniques, development skills, insights, etc.) that
influence the organizational development and achievement of organizational
objectives.
3.<u>Shared interpretation</u> refers to the
process of verification, evaluation, and assessment of organizational
information or knowledge (e.g., selling techniques, development skills,
insights, etc.) that influence the organizational development and achievement of
organizational objectives.
4.<u>Information memory</u> refers to the
collection, compilation, and storage of organizational information or knowledge
(e.g., selling techniques, development skills, insights, etc.) that influence
the organizational development and achievement of organizational objectives.
(Use 'scroll-bar' to scroll back to the chapter
index.)

 <a href="#Organizational Learning : Definition"
name="OL Capability">Organizational
Learning Capabilities
'Organizational learning capabilities' are
defined as capabilities which occurs within a set of recognized and unrecognized
constraints that reflect the organization's assumptions about its environment
and itself. The constraints may be fundamental (adaptive) level or advanced
(generative) level.
'Organizational learning capabilities' are
composed of 4 orientations:
1.<u>Team orientation</u> is defined as the
degree to which individuals, team, or subunit-officers/operators stress on
collaboration and cooperation in performing organizational activities, in
achieving common goals, and in making decisions.
2.<u>System orientation</u> is defined as the
(Use 'scroll-bar' to scroll back to the chapter
index.)

</body>
</html>

APPENDIX-VII: USER'S MANUAL FOR SUBJECTS PARTICIPATED IN 'OL. DEVELOPMENT PROGRAM'

Congratulation! ! You are one of the qualified subjects selected to participated in this 'Organizational Learning Development Program'. You will have opportunity to develop your 'organizational learning capabilities' which facilitated by IT-infrastructures.
Your capabilities will be developed through studying and practicing from the online-computer-based training (CBT)

The online-computer-based training (CBT) titled as "Organizational Learning Development Program" (OL-CBT) used in this program was produced and distributed via the website http://www.utcc.ac.th/itol. This online-CBT is programmed to be studied, practiced, tested, and implemented by subjects recruited. You will be told 'password' to access to such website and this 'password' will be changed every month until the end of the program.

The 'Instruction Manual' of this OL-CBT software and details of 'Organizational Learning Development' are also presented in the scrolling text in the button 'Instruction Manual', which are in the major part of button 'Organizational Learning Development'. For your best achievement, please strictly follow all instructions.

There are five chapters in this online-CBT program. The five-chapter-CBT-program can be classified into two main parts, **Part 1** : "Theory in OL" (Chapter 1-3) and **Part 2 :** "Workshop" (Chapter 4-5). Please study each chapter consecutively and do not skipped the order of each lesson. After finishing all the three chapters (Chapter 1-3) , please practice your skills and try to implemented concepts learned in "Workshop" (Chapter 4) and strictily filled in the questionnaire (Chapter 5) as directed. Details of each chapter are as follows.

Chapter 1 "Theories related to Organizational Learning Capabilities and Organizational Learning Process"

Chapter 2 "Information Technology and Organizational Learning".

Chapter 3 "Integration of IT & Organizational Learning in International Business"

Chapter 4 "Implementation & Activities"

The objectives of this chapter are to facilitate learners and teams in organizations to implement the theories and knowledge studied from the previous chapters. Organizational learning depends on various factors, especially IT factors. This workshop shows some IT tools for learners and teams in organizations to create or change their work, routines, systems, procedures. For example, "Outlook" or "Internet" can be used to create information acquisition, dissemination, sharing, and memory. "Database" can help modify the information memory in organizations. "Project Management" can help monitor the learning of organizations. This changes or creations will be different in various organizations, depending on organization creativity and nature of their businesses. Learners and teams can creatively apply other electronic tools except for the tools suggested in this chapter.

Chapter 5 "Questionnaire".

The objectives of this chapter are to collect data related to learners and teams in organizations to audit, test, and improve their organizational learning capabilities and IT. Organizational learning is not an overnight single process. Rather, it is the iteration process of change. It takes time to change into the desired status, especially in international business. The questionnaire in this workshop will help learners and teams to audit and develop their organization. Then they will improve their defects according to the theories studied. There are three sets of questionnaire which subjects must completed and posed to the researcher as directed (at 1st week, 4th week, and 12th week).To achieve your goal of creating your organizational learning capabilities, please strictly follow the "Instruction" and "schedule" as designed by the researcher. Learners should not skip any chapter, but study each chapter one by one consecutively. Details and directions for each questionnaire will be presented in the online-CBT-Program. In case of any question or need for advice, please contact the researcher by e-mail or telephone as identified in the electronic questionnaire (Chapter 5) in the website.

Your response data in the questionnaires will be recorded in the server computer of the researcher, and all will be kept secret only for this research. All data will be destroyed within three months after finishing this research project.

APPENDIX-VIII: 'CERTIFICATE OF RECOGNITION' AWARDED TO TOP EXECUTIVES

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The Certificate of Recognition has been awarded to

Name …….

Company ……

who has made significant contribution to the accomplishment of the dissertation entitled "IT-Facilitated Adaptive-Organizational-Learning in Thai subsidiaries of Global Corporations" by Mr. Prasert Sirisereewan.

Date ……

Assoc. Prof. Dr. Ananchai Kongchan
Secretariat
The JDBA Program, Thailand.

BIOGRAPHY

Mr. Prasert Sirisereewan was born in Lampang Province, the Northern part of Thailand, in June 4, 1957. He holds the Bachelor Degree in Pharmaceutical Science, majoring in Microbiology, from Chulalongkorn University since 1980. After his graduation, he worked as a hospital pharmacist in Sukhumvit Hospital for two years and as a Product Manager in the Astra Pharmaceutical Company for about fourteen years. During working in Astra, he graduated the Master Degree in Business Administration from Chulalongkorn University in 1992. Since 1994, he has started working as a full-time lecturer in Faculty of Business Administration, University of the Thai Chamber of Commerce (UTCC.) In 1996, he received a scholarship from his workplace, UTCC, to enroll in the Joint Doctoral Program in Business Administration (JDBA), Bangkok, Thailand.