

**THE IMPACT OF ORGANIZATIONAL LEARNING  
ON TURKISH ARCHITECTURAL DESIGN FIRMS'  
PERFORMANCE:  
A STRUCTURAL EQUATION MODEL**

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## ABSTRACT

### THE IMPACT OF ORGANIZATIONAL LEARNING ON TURKISH ARCHITECTURAL DESIGN FIRMS' PERFORMANCE: A STRUCTURAL EQUATION MODEL

Organizational learning is fundamental for improving performance within a rapidly changing and competitive business environment. The dissertation develops a model that assesses the impact of organizational learning on performance of architectural design firms.

An extensive literature review was realized on organizational learning, performance, and architectural design firms. The impact of organizational learning on performance of the architectural design firms was measured with an instrument. The structured questionnaire includes information about organizational learning constructs namely; learning flows (feed-forward and feedback), learning stocks (learning at individual, project, and firm levels), and performance of the firm. After a pilot study was conducted in Northern Cyprus, the main questionnaire survey was administered to 165 architectural design firms in Turkey.

A structural equation model was developed by using Structural Equation Modeling (SEM) to determine how organizational learning can be prioritized in driving performance improvement. The direct effect of “learning at firm level on performance of the firm” was high (.81). The 10 claimed hypotheses were accepted. It was found that there is a high correlation between “learning flows” (.90). The direct effect of “feed-forward on learning at individual level” and “feedback on learning at firm level” is high (.70 and .74 respectively). This research provides reference for architectural design firms on measuring the impact of organizational learning on performance of the firm. The dissertation was concluded with confirming the interrelations of organizational learning constructs and significant impact of organizational learning on performance of the firm.

## ÖZET

### ÖRGÜTSEL ÖĞRENMENİN TÜRK MİMARİ TASARIM FİRMALARININ PERFORMANSINA ETKİSİ: BİR YAPISAL DENKLEM MODELİ

Örgütsel öğrenme hızlı değişen ve rekabetçi iş ortamında performansı geliştirmek için hayati önem taşımaktadır. Bu tez örgütsel öğrenmenin mimari tasarım firmalarının performansı üzerindeki etkisini ortaya koymayı hedefleyen bir model geliştirmeyi amaçlamaktadır.

Örgütsel öğrenme, kurumsal performans, ve mimari tasarım firması kavramları üzerine kapsamlı bir literatür taraması yapılmıştır. Örgütsel öğrenmenin mimari tasarım firmasının performansı üstündeki etkisi bir araç ile ölçülmüştür. Oluşturulan anket, örgütsel öğrenme; öğrenme akışları, (ileri besleme ve geri besleme), öğrenme stokları (bireysel, proje ve firma düzeyinde) ve firmanın performansı ile ilgili bilgi içermektedir. Kuzey Kıbrıs'ta yapılan pilot çalışmadan sonra ana anket çalışması Türkiye'de 165 mimari tasarım firmasına uygulanmıştır.

Örgütsel öğrenmenin performans gelişimini belirleyen bir etken olduğunu tanımlamak için yapısal eşitlik modellemesi (SEM) kullanılarak bir model geliştirilmiştir. “Firma düzeyinde öğrenmenin firmanın performansına” direkt etkisi yüksektir (.81). Öne sürülen 10 hipotez kabul edilmiştir. Öğrenme akışları arasında güçlü bir korelasyon olduğu bulunmuştur (.90). “İleri beslemenin bireysel düzeyde öğrenme” ve “geri beslemenin firma düzeyinde öğrenme” üstünde direk etkisi yüksektir (sırasıyla .70 ve .74). Bu araştırma mimari tasarım firmalarına örgütsel öğrenmenin firma performansına olan etkisini ölçmek için bir referans sağlamaktadır. Tez, örgütsel öğrenme bileşenlerinin birbirleriyle olan ilişkilerini ve firma düzeyinde öğrenmenin firma performansı üzerindeki anlamlı etkisinin doğrulanmasıyla sonuçlanmıştır.

*This thesis is dedicated to my precious family  
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# CHAPTER 1

## INTRODUCTION

### 1.1. Problem Definition

Organizational learning has become an emerging area of theory and practice in recent years. Continuously improving organizational knowledge and adding new knowledge to an organization's repository by learning is a critical instrument for any firm to be successful. A firm's knowledge should be identified as a strategic asset and managed to contribute to the firm's performance and competitiveness. This approach is identified as the "knowledge-based view of the firm" (Kale et al., 2000; Grant, 1996; Nonaka, 1994; Kogut and Zander, 1992). Some researchers such as; Argyris (1999), Crossan and Hulland (2002), Kululanga et al. (2002), Smyth (2004), Lopez et al. (2005), Senge (1990), Stata (1989), Kim et al. (2009) argue in general that organizational learning is conducive to companies performing well in the competitive environment of today's business world. Further, according to De Geus (1988) and Stata (1989), in rapidly changing project-based and competitive environments, the capability to learn faster and more effectively than competitors is the way to sustain competitiveness. To be fast and avant-gardistin, learning is essential to a firm's ability to adapt new market conditions that are affected by prevailing conditions.

The literature on this topic has grown rapidly over the past few years. However, most contributions focus on the conceptual level to describe the impact of learning in organizations (Easterby-Smith and Araujo, 1999). From the management view, a number of studies have attempted to identify factors that facilitate the organizational learning outcomes in a variety of organizations (Appelbaum and Reichart, 1998; Teare, 1998; Solingen et al., 2000; Stonehouse et al., 2001). However, the majority of these studies either employed a normative perspective or are based on a qualitative approach. A comprehensive review of organizational learning indicated that there was limited empirical research on organizational learning (Easterby-Smith and Araujo, 1999).

## 1.2. Research Background

The concept of organizational learning is the total learning activities across an organization that occurs in its complex environment. In regular focus, organizational learning concept has existed since March and Simon (1958) discuss the topic about 52 years ago. Organizational learning is a process that takes place in a firm to structure an increasing awareness about the continuously changing environment and keeping up with adaptation and modification issues. It plays an important role in maintaining competitiveness in dynamic project-based industries (March, 1991). The transformation of the acquired data into information, knowledge, and wisdom is a fundamental requirement in the learning process. Applied adaptations and modifications within the firm that are based on knowledge transformation open the way to success. Success is the determination of improved and standardized performance along processes and the result of all end products that are produced in an organization. Many scholars comment on the impact of learning on performance (e.g., Argyris, 1999; Crossan and Hulland, 2002; Kululanga et al., 2002; Smyth, 2004; Lopez et al., 2005; Senge, 1990; Stata, 1989, Kim et al., 2009).

A wide multitude of definitions and conceptions of organizational learning exists (Crossan et al., 1999; Edmonson and Moingeon, 1998). Huber (1991) points out in his review of organizational learning “learning can be characterized by adaptation to changing environment events, by flexibility and responsiveness, by change within the organizations”. In many ways, organizational learning has become an umbrella concept that encompasses many topics in the study of organizations. It is often argued that organizational learning is concerned with collective capability and not merely with the capability of individuals in the organization. In most of the literature on organizational learning and performance, it is the ability of people to act together to well defined objectives that matters for organizational performance. According to Bontis and Crossan’s (2002) study on organizational learning and performance there is a positive relationship between the learning stocks at all levels in an organization and performance of the organization. Furthermore, the misalignment of learning stocks and learning flows in an overall organizational learning system is negatively associated with business performance.

The prior literature on the impact of overall organizational learning on performance is analyzed in this research. In the Turkish architectural designers' perspective, no empirical research has been conducted to study how the organizational learning builds the competitive advantage by improving performance. Theorists primarily assume that improving performance at all levels will lead to improvement at the organizational level, but this assumption is seldom tested. The assessment of performance has been almost exclusively at the level of individual or team, little attention has been paid to the processes and structures by which individual or team level performance could be translated to organizational level performance (Jackson et al., 2004). Studies by Nevis et al. (1995) attempt to link learning to organizational capability and performance in an empirical fashion found to be in the minority. Miner and Mezias (1996) even judge that "the ratio of systematic, empirical research to learning theories is far too low". The lack of empirical studies about organizational learning in architectural design forced this dissertation to deal with the subject comment on architectural design firms.

### **1.3. Objectives**

The research seeks to develop a model, based on the field survey on Turkish architectural design firms. The model shows the impact of organizational learning on performance of architectural design firms. This research explores the relationship of organizational learning with performance in the architectural design field with the model developed to determine how learning stocks and learning flows can be prioritized in driving performance improvement. Since every project is unique in the construction industry, architectural design firms need to perform efficient learning and knowledge transfer within organization in order to achieve better performance during a project's life cycle. A conceptual framework is developed and measurement scales are identified through a broad study on organizational learning and performance. Hypotheses are formulated according to the conceptual framework and relevant data are acquired and analyzed. Finally, the hypotheses are tested, the relationships between organizational learning constructs and performance are discussed, and recommendations are made for future work.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1. Learning

Learning can be considered as a process of change on knowledge and a process of change on knowing, which involves changes in cognition and changes in behavior (Vera and Crossan, 2003). The literature on learning has grown rapidly over the past few years. The tendency in studying learning is caused by the knowledge intensive needs of business and academic environmental factors. However learning was a concern of philosophy and researchers for a long time. As a branch of philosophy, epistemology is concerned with the nature and scope of knowledge, and whether knowledge is possible. Learning theories have existed since the late 19th and early 20th centuries. The theories of learning are listed as; Gestalt psychology (1912) (e.g., Werthelmer; Kofka; Kohler), Behaviorism (1913) (e.g., Pavlov; Watson; Skinner), Humanist (1961) (e.g., Maslow; Rogers), Cognitivist (1967) (e.g., Piaget; Miller; Neisser), Social Learning (1977) (e.g., Bandura; Rotter), and Constructivism (1994) (e.g., Dewey; Vygotsky; Piaget; Lave) in a chronological order (Ashworth et al., 2008). These theorists commented on the learning of individuals. The classification and features of learning theories can be seen in Table 2.1.

Nowadays, learning is interpreted by scholars in order to respond to current needs. Since technology has accelerated quickly in recent decades, the way that individuals learn has changed. The speed, type, and form of learning has transformed into a new morpho. However, most recent contributions focus on the conceptual level and generally describe the impact of learning (Easterby-Smith and Araujo, 1999). Learning is identified as a strategic asset for an organization (Teece et al., 1997; Bollinger and Smith, 2001). It is an essential investment on individuals. It increases the level of an individual's capability to meet strategic goals and objectives. Learning is a process that includes mechanisms and allows the development of knowledge, skills and behaviors (Argyris and Schön, 1978; Huber, 1991).

Table 2.1. Classification and features of learning theories  
(Modified from: Ashworth et al., 2008)

<i>Aspect (Chronologically ordered)</i>	Behaviorist (1913)	Humanist (1961)	Cognitivist (1967)	Social learning (1977)	Constructivist (1994)
<i>Learning theorists</i>	Guthrie, Hull, Pavlov, Skinner, Thorndike, Tolman, Watson	Maslow, Rogers	Ausubel, Bruner, Gagne, Koffka, Kohler, Miller, Neiser, Lewin, Piaget	Bandura, Rotter, Engestrom, Eraut, Lave and Wenger, Salomon, Vygotsky, Piaget, Boud	Candy, Dewey, Piaget, Rogoff, vonGlaserfeld, Vygotsky,Boud, Illeris
<i>View of the learning process</i>	change in behavior	a personal act to fulfill potential	internal mental processes (including insight, information processing, memory, perception)	interaction with and observation of others in a social context, situated learning, communities of practice, distributed cognition.	construction of meaning from experience
<i>Focus of learning</i>	stimuli in external environment	affective and cognitive needs	internal cognitive structuring	interaction of persons, behavior and environment	internal construction of reality by individual
<i>Purpose of learning</i>	achieve behavioral change in desired direction	become self- actualized and autonomous	develop capacity and skills to learn better	model new roles and behavior	construct knowledge

Learning in organizations is not a new subject in literature. The learning actions that occur in an organization have different terms such as organizational learning (Simon, 1956; Cangelosi and Dill, 1965; Argyris and Schön, 1978 and Dixon, 1994), learning organization (Senge, 1990; Swiernga and Wierdsman, 1992), learning company (Pedler, Burgoyne and Boydell, 1991), knowledge factory (Roth et al., 1994) and knowledge creating company (Nonaka and Takeuchi, 1991). An organization is a social entity that is formed of people who are dedicated to the same goal in a separated environment from its surroundings (Ackoff, 1971). The sum of learning activities occur in the circumscription of an organization is called organizational learning. Strategic direction of complex organizations consists of establishing and modifying environments within which effective, improvised, self-organized solutions can evolve. If a system is repeatedly subjected to the same environmental or internal change and increases its ability to maintain its efficiency under this type of change, then it learns how to adapt. The adaptation notion is proposed by Piaget in learning theory literature. The Organizational learning perspectives that are grounded from learning theories can be seen in Table 2.2. Piaget hypothesized to explain the learning of individual. However an organization also can be adaptive when it develops the ability to modify itself or its environment. Systems that are interested in maintaining its state or interested in gaining more efficiency are necessarily adaptive (Ackoff, 1971). Therefore, it needs to learn to adapt to the new states. The units of the organization can respond to each other's modification through observation or communication. Ackoff (1971) states that at least one unit of the organization has a system-control function. In learning, the control functions of the organization are administered to reveal the accumulated knowledge and the wisdom (the processed knowledge) through all levels of that organization.

Below, the transformation of learning theories into organizational point of view and the literature of organizational learning are mentioned. Learning stocks and its transfer throughout the organization by learning flows are conceptualized in detail. The theoretical background of the relationship between organizational learning and performance is pictured. The tables and figures that are representing measuring scales of each construct of organizational learning and performance of the firm are placed. The conceptual link is embodied in reference to architectural design firms.

Table 2.2. Organizational learning perspectives that are grounded from learning theories (Modified from: Sense, 2004)

<i>Perspectives</i>	<i>Reference (Year)</i>
Cognitive	Shrivastava, 1981; March and Olsen, 1975; Simon, 1991
Behavioral	Daft and Weick, 1984; Cyert and March, 1963; Cyert and March, 1992
Cognitive and Behavioral	Argyris and Schön, 1978; Hedberg, 1981; Huber, 1991; Levitt and March, 1988; Shrivastava and Mitroff, 1982; Fiol and Lyles, 1985; Kim, 1993; Revans, 1983; Agashe and Bratton, 2001; Steiner, 1998; Duncan and Weiss, 1979; Stata, 1989; Tsang, 1997
Sociological	Cook and Yanow, 1993; Schön, 1987; Lave and Wenger, 1991; Brown and Duguid, 1991; Wenger, 1998; Wenger et al., 2002; Saint-Onge and Wallace, 2003; Hager, 2001; Jarvinen and Poikela, 2001; Richter, 1998; Klimecki and Lassleben, 1998; Dixon, 1999; Garrick, 1998; Dodgson, 1993

## 2.2. Organizational Learning

Bontis et al. (2002) note that in order to survive organizations are forced to learn efficiently and effectively in today's tougher competitive environment and by effect of the knowledge era. De Geus (1997) stated that the only source of competitive advantage is an organization's ability to learn. Baldwin et al. (1997) noted that what seems to distinguish surviving and adapting organizations from the rest is their ability to learn. Also Nonaka (1991) argued that competitive advantage, innovation and effectiveness are the primary products of nurturing a culture of learning within a company. Organizational learning is a dynamic process. Not only does learning occur over time and across levels, but it also creates a tension between assimilating new learning (feed forward) and exploiting or using what has already been learned (feedback) (Crossan et al., 1999). Learning in organization as a promising subject have been describe by Herbert A. Simon since 1950s and followed by Chapman et.al. in 1959 and by Hirschman and Lindblom in 1962 (Cangelosi and Dill, 1965). "Organizational learning" is first made reference to the term forty seven years ago by Cyert and March (1963). According to Cyert and March (1963), organizations respond to changes in the external environment through making adaptations to achieve more effective alignment. A huge interest from both academic and practitioner communities has been sparked by this principle (Easterby-Smith, 1997).

Organizational learning literature is studied by several researchers (e.g., Argyris and Schön, 1978; Argyris and Schön, 1996; Shrivastava, 1983; Fiol and Lyles, 1985; Daft and Huber, 1987; Levitt and March, 1988; Huber, 1991; Sinkula, 1994; Crossan et al., 1995; Slater and Narver, 1995, Easterby-Smith, 1997; Bell et al., 2002). The determination of organizational learning in chronological order by appreciated authors can be seen in Table 2.3. Some researchers take organizational learning as a matter of implementation, while others take it as a matter of activating a preexisting ability. The basis of these ideas are founded on learning theories namely; behaviorist, humanist, cogniticist, social learning, and constructionist in literature. Organizational learning researchers' determination of the subject is oriented by learning streams. Behaviorism assumed the ambition to become an exact science and the belief that environment

Table 2.3. The determination of organizational learning

<i>Author and Year of Publication(Chronologically Ordered)</i>	<i>Organizational Learning Definition</i>
Kululanga, et al., 2001	Organizational learning is the systematic promotion of a learning culture within an organization such that employees at all levels, individually, collectively, and continually increase their capacity to improve their level of performance.
Schwandt and Marquardt, 2000	Organizational learning represents a complex interrelationship between people, their actions, symbols, and processes within the organization.
Crossan et al., 1999	Organizational learning is a dynamic process of strategy renewal occurring across three levels of the organization: individual, group and organizational.
Denton, 1998	Organizational learning is the ability to adapt and utilize knowledge as a source of competitiveness. Learning must result in a change in the organization's behavior and action patterns.
Braham, 1996	Organizational learning is learning about learning. The outcome will be a renewed connection between employees and their work, which will spur the organization to create a future for itself.
Schein, 1996	The key to organizational learning is helping executives and engineers (groups representing basic design elements of technology) learn how to learn, how to analyze their own cultures, and how to evolve those cultures around their strengths.
Miller, 1996	Learning is to be distinguished from decision making. The former increases organizational knowledge, the latter need not. Learning may in fact occur long before, or long after, action is taken.
Marquardt, 1996	An organization which learns powerfully and collectively and is continually transforming itself to better collect, manage, and use knowledge for success.
Cavaleri and Fearon, 1996	Organizational learning is the purposeful creation of shared meanings derived from the common experiences of people in organizations.
Nonaka and Takeuchi, 1995	The knowledge transfer from individual, group, organization to inter-organization levels.
Slater and Narver, 1995	Organizational learning is the development of new knowledge or insights that have the potential to influence behavior.
Crossan et al., 1995	Learning is a process of change in cognition and behavior. Learning in organizations occurs along four processes through three levels.

(cont. on next page)

Table 2.3. (cont.)

Day, 1994	Organizational learning is comprised of the following processes: open-minded inquiry, informed interpretations and accessible memory.
Kim, 1993	Organizational learning is defined as increasing an organization capacity to take effective action.
Levinthal and March, 1993	Organizational learning copes with the problem of balancing the competing goals of developing new knowledge and exploiting current competencies in the face of the dynamic tendencies to emphasize one or the other.
Lee et al., 1992	The organizational learning process is viewed as a cyclical one in which individuals' actions lead to organizational interactions with the environment. Environmental responses are interpreted by individuals who learn by updating their beliefs about cause-effect relationships.
Meyer-Dohm, 1992	Organizational learning is the continuous testing and transforming of experience into shared knowledge that the organization accesses and uses to achieve its core purpose.
Senge, 1990	Organizational learning involves developing people who learn to see as systems thinkers see, who develop their own personal mastery, and who learn how to surface and restructure mental models collaboratively.
Stata, 1989	Organizational learning is the principal process by which innovation occurs. The rate at which individuals and organizations learn may become the only sustainable competitive advantage, especially in knowledge-intensive industries.
Levitt and March, 1988	Organizations are seen as learning by encoding inferences from history into routines that guide behavior.
Fiol and Lyles, 1985	Organizational learning means the process of improving actions through better knowledge and understanding.
Daft and Weick, 1984	Organizational learning is knowledge about the interrelationships between the organization's action and the environment.
Shrivastava, 1983	Addresses the issue of the organizational learning system as one depending wholly on individual learning as against practice of knowledge sharing for all the organizational members.
Argyris and Schön, 1978	Organizational learning is a process of detecting and correcting errors.

determines personality and behavior (Jones and Elcock, 2001). In behaviorism learning was manifested by a change in behavior, with an emphasis on a connection between a stimulus and a response (Merriam and Caffarella, 1999). Humanism focuses its attention on how individuals acquire emotions, attitudes, values and interpersonal skills. Humanist perspectives tend to be grounded more in philosophy than in research (Ormrod, 1999). Cognitive theorists view learning as involving the acquisition or reorganization of the cognitive structures through which human beings process and store information (Good and Brophy, 1990). Cognitivism includes the ideas of continuous assessment, group-based learning and applied practice being integrated into the learning experience. Social learning encompasses lifelong learning, informal learning, experiential learning and collaborative learning. Constructivist models include learning to learn, experiential learning, shared and negotiated learning, social contextualization of learning, self-directed learning, group work, creative problem solving, guided discovery, and reflective practices. The learner interacts with experience and environment in the construction of knowledge (Ashworth et al., 2008). These learning theories shape the basis of conceptualization on organizational learning literature. Each perspective is grounded by one or more learning theory. As pointed out by a number of organizational learning theorists, there are two main views. These theories identified in the literature as cognitive and behavioral views (Crossan et al., 1995; Fiol and Lyles, 1985; Garvin, 1993; Huber, 1991; Cangelosi and Dill, 1965). The distinction between these two views is made by Crossan et al. (1995) as; “cognitive theorists would assume learning has occurred if there is a change in thought processes (unobservable), even in the absence of adjusted behavior (observable). Behaviorists assume that learning has occurred if there is a noticeable change in behavior, even if not preceded by a change in thinking”. Beyond changes in behavior, it has been argued that organizational learning should result in some sort of improvement in performance (Fiol and Lyles, 1985; Garvin, 1993; Huber, 1991; Cangelosi and Dill, 1965; Nevis et al., 1995).

There are a few types of classification about schools of thought in organizational learning literature. Bell et al. (2002) argued that organizational learning is embedded in four schools of thought, such as; an economic school (e.g., Argote, 1993; Arrow, 1962; Lieberman, 1987), a managerial school (e.g., Galer and van der Heijden, 1992; Garvin, 1993; Hodgetts et al., 1994; McKee, 1992; Mills and Friesen, 1992; Tobbin, 1993;

Senge, 1990 ; Senge, 1993), a developmental school (e.g., Dechant and Marsick, 1991; Totbert and Fisher, 1992; Totbert, 1994), and a process school (e.g., Argyris and Schön, 1978; Dixon, 1994; Huber, 1991). Easterby-Smith (1997) states that organizational learning can be classified in six disciplines such as; psychology and organizational development (human development), management science (information processing), sociology and organizational theory (social structures), strategy (competitiveness), production management (efficiency), and cultural anthropology (meaning systems). Each view is related in some points and under the control of management. From the day the term “organizational learning” existed, researchers have been proposing different points of views about the subject. Another type of classification about organizational learning can be mainly determined as outcome-based such as; organizational change perspective (Denton, 1998); renewal perspective (Braham, 1996); cultural perspective (Schein, 1996); systems perspective (Senge, 1990). Other approaches to organizational learning are through learner-based understanding. In this type of classification some researchers claim that the stress about learning in an organization is on the individual, while others declare the organization learns as a whole. The evolutionary development of studies can be set in an order by the organizations’ learning and how to learn continually.

Organizational learning literature contains a wide range of research domains. In these research domains learning phenomenon is explored by several researchers such as; information-processing perspective (e.g., Huber, 1991), product innovation (e.g., Nonaka and Takeuchi, 1995), exploring how the cognitive limitations of managers affect learning (e.g., March and Olsen, 1975), new product development (e.g., McKee, 1992), organizational change (e.g., Lawson and Wentriss, 1992), human resource management (e.g., Pucik, 1988), market orientation (e.g., Slater and Narver, 1995), and marketing channels (e.g., Lukaset al., 1996), performance (e.g., Huber, 1991; March, 1991; Crossan et al., 1995; Popper and Lipshitz, 2000 Vera and Crossan, 2003; Lopez et al., 2005; Jiang and Li, 2008), learning from history (e.g., March et al., 1996), organization and local adaptation (e.g., Hutchins, 1996), communities-of-practice (e.g., Seely-Brown and Duguid, 1991), learning curves (e.g., Epple et al., 1996), stimulus–response (e.g., Weick, 1996), bounded rationality (e.g., Simon, 1991), technology diffusion (e.g., Attewell, 1996), personnel turnover (e.g., Carley, 1996), patterns of change (e.g., Lant and Mezias, 1992), executive succession (e.g., Virany et al., 1996),

collective mind (e.g., Weick and Roberts, 1993), technological change (e.g., Henderson, 1996), social ecology of jobs (e.g., Miner, 1991), organizational routines (e.g., Cohen and Bacdayan, 1996), culture (e.g., Cook and Yanow, 1996), continuous improvement (e.g., Winter, 1996), knowledge intensive firms (e.g., Starbuck, 1996), and learning through failure (e.g., Sitkin, 1996). However the research domains are diversified in organizational learning for the need to emerge learning in all business and academic issues. This need forced researchers to define organizational learning by means of the domain that they represent. Therefore, the conceptualizations of organizational learning have an exiguity of convergence (Crossan et al., 1999; Huber, 1991). Introducing a typology to classify organizational learning research requires an understanding of significant themes. Questions have been posed concerning whether organizational learning research, including the so called 'learning organization' literature, is designed to meet the needs of practitioners and consultants or is instead directed at the scholarly and academic communities (Arthur and Aimant-Smith, 2001; Easterby-Smith, 1997; Friedman et al., 2005; Tsang, 1997). Some authors have investigated whether or not organizational learning is a source of competitive advantage (Dodgson, 1993; Huysman, 1999; March, 1991), while others have explored how and to what extent it is possible to intervene to enhance performance (Brown and Duguid, 1991; Levinthal and March, 1991). Contrasting approaches look at whether the organization itself shapes learning activity (Scott and Yanow, 1993; Weick and Roberts, 1993), and whether and how individuals can transfer their insights into the organizational domain (Crossan et al., 1999; Dixon, 1994; Kim, 1993; Nonaka and Takeuchi, 1995). There is the challenge of establishing exactly what changes as a result of organizational learning: the behavior of members (Fiol and Lyles, 1985), their cognitive systems, representing potential for behavioral change (Hedberg, 1981; Kim, 1993) or organizational routines/standard operating procedures (Cyert and March, 1963; March and Olsen, 1975).

A clearer understanding of the learning process is a domain of organizational learning research. The vitality of internalization of the learning concept and processes triggers to wholly understanding of organizational learning and gaining continuous improvement opportunities to improve performance. For a better understanding learning processes from individualistic and organizational perspectives of literature can be seen in Table 2.4.

Table 2.4. Learning processes from individualistic and organizational perspectives

	<i>Author and Year</i>	<i>Learning Processes</i>					
<i>Individualistic perspective</i>	Kolb, 1984	observation and reflection	formation of concepts and generalization	testing of concepts in new situations	concrete experience		
		experience	reflection	conceptualizing	final action		
	Kofman, 1992	observe	assess	design	implement		
	Schein, 1993	observation and reflection	emotional reaction	judgment	intervention		
	Buckler, 1996	reflection	enactment	commitment	understanding	awareness	ignorance
<i>Organizational perspective</i>	Huber, 1991	knowledge acquisition	information distribution	information interpretation	organizational memory		
	Deming, 1992	plan	do	check	act		
	Nonaka and Takouchi, 1995	socializing	combination	externalization	internalization		
	Crossan, 1999	intuition	interpretation	integration	institutionalizing		

Scholars believe that knowledge is divided up into different levels (know-what, know-how and know-why), and point out that, the higher the level of knowledge the learner possesses; the more effective (or applicable) the learner's knowledge becomes (Garvin, 1993; Argyris, 1994; Quinn et al., 1996; Laszlo and Laszlo, 2002). Kolb (1976) believed that knowledge was formed through a learning process that involved the following four stages: observation and reflections; formation of concepts and generalizations; testing of concepts in new situations; and concrete experience. Kolb's (1984) learning cycle is perhaps the most established descriptive model of individual, team and organizational learning. This explores the cyclical pattern of four stages in learning: experience, reflection, conceptualizing and finally action. Four components are developed by Huber in 1991 to describe the learning process, which are: knowledge acquisition, information distribution, information interpretation and organizational memory. Kofman (1992) later divided the learning process into four distinct stages: observe, assess, design, and implement. Other scholars pointed out that the main process by which learners accumulate knowledge involves observation, emotional reaction, judgment, and intervention (Schein, 1993). According to Nonaka and Takeuchi (1995) mental models occur when 'human beings create working models of the world by making and manipulating analogies in their minds'. According to Buckler (1996) learning process are reflection, enactment, commitment, understanding, awareness, ignorance. The "4I's" learning processes (intuition, interpretation, integration, and institutionalizing), determined by Crossan et al. in 1999, are related in feed-forward and feedback processes across the levels. Competition for resources creates a tension, which is seen in the feed-forward and feedback processes of learning across the individual, group, and firm levels. Deming (1992) pointed out that a simple process of "plan-do-check-act (PDCA)" was helpful in discovering and resolving problems as an organization successfully promoted "total quality management", as it was during this process that the organization's knowledge was accumulated. Deming (1992) underlines the importance of "PDCA cycle" and further states that continuous development (Kaizen) requires continuous learning at all levels (e.g., product / service, process, and system). Kofman (1992) advocated "the observe-assess-design-implement (OADI) learning cycle model", stressing that individual knowledge was frequently formed by going through this learning process. There were also scholars who believed that it was during the process of "observation – emotional reaction – judgment –

intervention” that the organization gradually formed and accumulated its knowledge (Schein, 1993). Garvin (1993) notes that if all that an employee learns is how things are done (know-how), what he grasps is partial knowledge. It is necessary for him to understand why they occur (know-why). Knowing why is more fundamental; it captures underlying cause-and-effect relationships and accommodates exceptions, adaptations, and unforeseen events. Quinn et al. (1996) also point out that the majority of organizations laid emphasis on the development of basic knowledge (such as cognitive knowledge), while relatively few attach importance to the higher levels of knowledge (such as system recognition or self-creation). Quinn et al. (1996) distinguish four kinds of knowledge as follows: cognitive knowledge (know-what), Advanced skills (know-how), systems understanding (know-why), self-motivated creativity (care-why). Organizational learning literature is concerned with understanding the process by which individuals transfer their learning into the organizational domain (Goh, 2003; Sun and Scott, 2003; Tsang, 1997) and the process of organizational domain transfer its wisdom through lower levels within the organizational structure (Crossan et al., 1999).

March and Olsen (1975) and Kim (1993) proposed researches examining the link between individual and organizational learning. March and Olsen (1975) proposed a cyclic model that aimed to link up individual and organizational learning. Model constructs lead one and others in an order like; individual beliefs, individual actions, organizational actions, and environmental response and the environment may induce improved individual beliefs. The expected result of research assumed that learning occurs as better beliefs and produce better actions. Kim (1993) integrated models of Argyris and Schön (1978), March and Olsen (1975) and Kofman (1992) into a single extensive model. Furthermore, Kim (1993) analyzed all the possible breakdowns in the information flows that lead to failures in organizational learning within the model. Argyris and Schön (1978) come up with the idea of single-loop (first order) and double-loop (second order) learning. In single-loop learning, actions are modified by individuals, groups, or organizations according to the difference between expected and obtained outcomes. In double-loop learning, the values, assumptions and policies that led to the actions are questioned by individuals, groups or organization. Single loop learning represents the incremental change and double loop learning represents radical change. The idea that learning as a process could go through stages of improvement

leads to the notion of triple loop learning. An organization that continuously looks for innovative and effective ways of promoting learning are said to be in a stage of triple loop learning (Siriwardena and Kagioglou, 2005). Nonaka and Takeuchi (1995) developed a four stage spiral model of organizational learning. The model is departed from starting with the differentiation of Polanyi's concept of "tacit knowledge" from "explicit knowledge". The model describes a development model by alternating between the two. According to this model, knowledge creation and organizational learning take a path of socialization (sharing tacit knowledge), externalization (translating tacit knowledge into explicit), combination (dissemination of codified knowledge), internalization (translating explicit knowledge into tacit) in an infinite spiral. Flood (1999) discusses the concept of organizational learning to 're-think' Senge's "The Fifth Discipline" through "systems theory" and the origins of the theory from Argyris and Schön. Flood (1999) integrates theorists such as Bertalanffy, Churchman, Beer, Checkland and Ackoff and develops the concepts of organizational learning in terms of structure, process, meaning, ideology and knowledge.

The construction industry is important partly because of its large output and economic significance (Siriwardena and Kagioglou, 2005). The significant contribution of the construction industry to GNP (Gross National Product) of the whole world is approximately 10% (Hillebrandt, 2000). Being a part of the construction industry places architectural design firms in an important position in the economy. McGeorge and Palmer (1997) claim the need for reform within the industry. Kale and Arditi (1999) state that well recognized industry characteristics such as the fragmented nature of the industry structure and organization of construction process, easy entry to the construction business, post-demand production, the one of nature of projects, high uncertainty and risk involved, high capital intensiveness of the constructed facilities, temporary nature and duration of exchange relationships, impose great challenges on the companies operating in it. Tjandra and Tan (2002) indicate that organizational learning is imperative for the construction industry as the industry is widely perceived to be one with low productivity and poor performance, despite its importance to the national economy. They also state that the project based nature of the industry has made it particularly important to record and transfer lessons from project to project. Tjandra and Tan (2002) also state that over the years learning has become increasingly important due to rapid changes in the market conditions, competition and technological

developments, which leads to changes in the work and the way work is organized. Learning is considered vital for the organizations to survive.

Bontis et al. (2002) empirically tested a model of organizational learning that encompassed learning stocks and learning flows across three levels of analysis: individual, team and organization. Results showed a negative and statistically significant relationship between the misalignment of stocks and flows and organizational performance. For the purposes of this thesis research Bontis et al. (2002)'s view of organizational learning is adopted. There is confusion between the terms of intellectual capital, knowledge management and organizational learning. The nuance between these terms is determined by Bontis et al (2002). According to Bontis et al. (2002) intellectual capital as representing the learning stocks that exists in an organization at a particular point in time (Bontis, 1996; Bontis, 1998; Bontis, 1999; Bontis et al., 2002; Bontis et al., 1999; Choo and Bontis, 2002; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997). Thus, it represents what has been learned in a cognitive sense. Managing this stock of learning in a firm as it flows over time is the domain of knowledge management (Bierly and Chakrabarti, 1996; Choi and Lee, 1997; Connor and Prahalad, 1996; Demsetz, 1991; Foss 1996; Kogut and Zander, 1992; Nonaka, 1994; Nonaka and Takeuchi, 1995). More specifically, the evolving stock of intellectual capital overtime is dependent on knowledge management. Organizational learning broadens the discussion to incorporate behaviors as well as knowledge and provides a means to understand how the 'stocks' change (flow) over time. Architectural design firms as a part of the construction industry need to list learning within fundamentals in its agenda. Project based nature of architectural design firms' work environment lead learning in projects (ad hoc communities). Learning from a project is stored as learning stocks within all levels of the firm. Since architectural design firms include architectural professionals as individuals, project teams as groups, and the firm itself as an organization, the terms can be rethought. In reference to architectural design firms the levels of the firm is classified as; individual, project, and firm levels. The learned things are stored by learning stocks within the firm and disseminated among levels of the firm. The dissemination of knowledge is enabled by learning flows. Learning flows are named according to the direction of knowledge dissemination within firm structure. Feed-forward is an up-stream learning flow

(individual-project-firm) and feedback is a downstream learning flow (firm-project-individual).

### **2.2.1. Learning Stocks**

Organizational learning is multi-level: individual, group (project team), and organization (firm) (Crossan et al., 1999). The three learning levels define the structure through which organizational learning takes place (Crossan et al., 1999). Ikehara (1999) argues that although learning starts with individuals, individual learning does not necessarily lead to organizational learning. A basic assumption is that insight and innovative ideas occur to individuals not organizations (Nonaka and Takeuchi, 1995; Simon, 1991). However, knowledge generated by the individual does not come to bear on the organization independently. Ideas are shared, actions taken, and common meaning developed (Argyris and Schön, 1978, 1996; Daft and Weick, 1984; Huber, 1991; Stata, 1989). Complex organizations are more than ad hoc communities or collections of individuals. Relationships become structured. Some of the individual learning and shared understandings developed by project teams become institutionalized as organization artifacts (Hedberg, 1981; Shrivastava, 1983). There is a reasonable degree of consensus that a theory of organizational learning needs to consider the individual, project, and firm levels (Crossan et al., 1999; Djurfeldt, 1995). For the following determination of learning levels learning at individual level (individual level), learning at project level (group level), and learning at firm level (organizational level) will be used for architectural design firms.

#### **2.2.1.1. Learning at Individual Level**

The learning process starts with perception and ends with action. Perception is the experience that shapes intuition and adapts the new knowledge to respond to the external environment. Perceptive learning strategies are used to take the emotional barriers off the learning environment. The aim is to pay attention to keeping continuous focus, coming over the fear of action, and maintaining and sustaining motivation. The negative effects include attention dispersal and distrust. In contrast to

perception, cognition encompasses memory, emotions, habits, reasoning, imagination, and planning. Cognition deals with attention, the ability to concentrate while restricting irrelevant distractions, and negative emotions such as fear and stress. The cognitive process includes habitual behaviors. Actions represent the final output of the brain and the means by which one exerts one's influence on the world. Learners must be physically and intellectually capable of producing the action.

Learning allows an individual to be ready to react in a changing environment and at least to keep the standards. Learning is a process that consists of several stages where the data collected by individuals are transformed into knowledge that is eventually used in projects. According to scholars, these stages have a cyclical nature (Kolb, 1976; Kofman, 1992; Schein, 1993; Nonaka and Takeuchi, 1995; Buckler, 1996; Crossan et al., 1999). The first stage of the learning process involves data acquisition. Data acquired by individuals are represented by individuals in a useful form for the related project requirements. Data are converted into information in the second stage of the learning process. It is in the third stage that information is converted into knowledge.

Individual learning is often assumed to be a conscious and analytical process by scholars (e.g. Shanks and St. John, 2005; Sarasvathy and Menon, 2004; Stewart, 2001; Weick et al., 1999; March, 1994; Schollhammer, 1991). Freud also believed that everything that a human being becomes aware of is what is stored in that individual's consciousness. Data acquisition involves gathering architectural information through intelligence, experience, observation, creative skills, and intuition. While intelligence, experience, and observation are cognitive processes, creativity and intuition focus on the subconscious process of developing insights. Assessment of architectural knowledge consists of the interpretation of the acquired information through reflection in order to generalize it and make it ready to form concepts. Through the assessment process, individuals develop ideas about various domains such as architectural details, materials to be used, management of the design process relative to industry standards or benchmarks observed in other firms. Reviews are then conducted, the results are interpreted, and judgment is posted. This process involves conceptualization of the knowledge by interpreting past and new knowledge. Finally, the individual has to take action. An individual's action can have immediate impact or can be of value in generating project team interaction. Learning at individual level encompasses the data

acquisition and assessment phases which are directly related to the individual professional and which results in action. Group interaction is related to a set of individuals and leads to organizational learning.

Research efforts recognize the importance of learning in architectural design firms. The architectural design process has been described as a multi-participatory distributed design environment (Huang, 1999). Architectural design professionals' experience and knowledge have important value if reused in successive projects. Because of the project-based nature of the industry, professionals in architectural design firms are faced with significant challenges. The one-of-a-kind characteristic of construction projects forces design professionals to continuously learn.

In the field of architectural design, the professionals' knowledge is tacit. It is difficult to capture, store and reuse. Kikoski and Kikoski (2004) and Bosch (2004) point out that tacit knowledge in architectural design firms includes design decisions, the design requirements, needs, constraints, natural talent, formal education, experience, taste, preferences, judgment, and skills. Knowledge totally belongs to individuals. The knowledge of the professionals in architectural design firms includes design capability, expertise, intuition, and design experience. It is used in reviewing projects, evaluating the impact of changes in assumptions and design decisions, forming a timeline of the design process, and classifying the stakeholders by their importance relative to the decision-making process (Kikoski and Kikoski, 2004). Throughout the life cycle of a design project, architects rely heavily on their tacit design knowledge to support design decisions (Schön, 1983). Because of this reason, architectural design firms attach great importance to design knowledge and expertise in their hiring and firing practices. Architectural design firms' tacit environment makes learning difficult for professionals. Individual skills, intuitive abilities, integration capabilities are important to achieve success in learning. The capability of an individual directly affects the learning process, and the outcome of learning.

Professionals with learning opportunity are developing skills to accumulate wealth for their firm. The factors presented in Table 2.5. can be used in assessing the extent of learning at individual level that involves the stock of learning of individual professionals working within architectural design firms.

Table 2.5. Measuring extent of learning at individual level

<i>Factor Code</i>	<i>Factor Name</i>	<i>Reference</i>	<i>Relevance to Architectural Design Firms</i>
LIL_1	Pride in work and in firm	Bontis et al., 2002; Crossan, 1999; Kolb, 1984	Working in reputable projects such as landmark structures, high visibility projects, projects with great impact on society, commerce, or government; working for a reputable firm that enjoys high public approval, extensive client satisfaction, and a sizeable market share in the industry.
LIL_2	Feeling of empowerment	Sicilia and Lytras, 2005; Bontis et al., 2002;	To be part of design decisions and other decision-making mechanisms including but not limited to the decision to select a client, the offer to be made to a client, the composition and organization of the design team.
LIL_3	Presence of competing interests	Bontis et al., 2002; Kolb, 1984	State of readiness in job acquisition, design, execution, control; talents and technological knowledge; basic computer knowledge and 2-D and/or 3-D design; ability to be a part of a team in the competitive environment of the architectural design world.
LIL_4	Confidence in job security	Bontis et al., 2002; Kolb, 1984	Feeling protected by the firm, being included in all phases of a project, and being secure in one's job.
LIL_5	Clarity of objectives	Khadra and Rawabdeh, 2006; Prewitt, 2003; Boyle, 2002; Bontis et al., 2002; Appelbaum and Reichart, 1998; Szulanski, 1996; Hitt, 1995; Senge, 1990	Clear design objectives (site, location, function, materials, etc.), clear architectural style, clear business objective (reputation, artistic statement, pure profit, etc.).
LIL_6	Openness to change	Bontis et al., 2002; Kolb, 1984	Being aware of innovations to design, style, management, technology, materials, methods of construction, etc.; ability to adapt these innovations rapidly and effectively.
LIL_7	Pressure to accomplish critical tasks	Bontis et al., 2002; Crossan, 1999	Responsive attitude to project milestones including initial decisions, design, technical drawings, project closure and control.

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Table 2.5. (cont.)

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LIL_8	Awareness of critical issues that affect work performance	Bontis et al., 2002; Goh, 1997; Kolb, 1984	Being aware of performance criteria in architectural design projects, i.e., ability to design functional, aesthetic, energy efficient, sustainable, and economic buildings; understanding client requirements clearly, dealing with local authority requirements, and producing quality work.
LIL_9	Pressure to create innovative ideas	Bontis et al., 2002; Hurley, 1998; Brown, 1991; Cohen, 1990; Stata1989	Responding effectively to pressure to find creative solutions to design and project management problems; delivering timely decisions to sustain competitiveness.
LIL_10	Experience and proficiency in field of work	Bontis et al., 2002; Dixon, 1994	Architectural design knowledge and experience within a multi-participant working environment.

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While some of the ten factors can be affected by individual perceptions, some are governed by environmental effects. However, when one examines these factors in depth, one finds that if a factor is predominantly affected by individual perceptions, it is also influenced to a certain extent by environmental conditions. Similarly, if a factor is predominantly affected by environmental conditions, it is also affected by individual perceptions. It is quite impractical to categorize these factors as “individual” and “environmental” as both conditions affect these ten factors in varying degrees.

### **2.2.1.2. Learning at Project Level**

Learning at project level involves distribution of information and interpretation of knowledge by a project team that develops a common understanding. A project team is another form of community that is brought together for a period of time (virtually and/or physically) to address a particular challenge. A project team is formed to realize a project objective and this team is generally led by a project manager (Turner, 1999). The management of projects inherently involves a temporary organization of people to undertake a defined objective in a finite period (PMBOK, 2004). Inevitably, the network of people from different contributing teams and organizations form and disband at the end of the project – much of their experience and knowledge dissipates as it is rarely recorded or available after the project is complete (Gulliver, 1987). Integrating occurs by learning at project level. Integrating follows to change collective understanding of the learning at project level and bridges to the level of the whole firm (Vera and Crossan, 2004). Learning at project level captures group dynamics and the development shared understandings of team members (Bontis et al., 2002). Glynn et al. (1994) state that “newer perspectives on learning focus on the more emergent nature of learning; information to be learned is constructed through the ongoing interactions among organization members”. Individuals suspend their assumptions but they communicate their assumptions freely (Senge, 1990). As stated by Senge (1990) group dynamics trigger continually learning how to learn together (Senge, 1990). Daft and Huber (1987) emphasize the need to communicate or distribute information. Information distribution through interaction focuses on mental models (Stata, 1989) and shared visions (Senge, 1990). The development of

communities that can effectively transfer knowledge and best practice offers significant value in terms of tapping into existing knowledge that might otherwise not be recognized (O'Dell and Grayson, 1998). By encouraging overlapping project teamwork during the execution process, learning activities appearing at the individual level can be spread to other members within the team. It is a group effort of creating new projects. Thus the overall organization can learn collectively from these frequent interactions between individuals and no secrets can be hidden in the process. Learning at project level enables the manipulation of the individuals' knowledge to develop a shared understanding within the project team (Weick and Roberts, 1993). The extent of learning at project level can be measured by a variety of factors, the most important of which were excerpted from the relevant literature and are presented in Table 2.6.

Table 2.6. Measuring extent of learning at project level

<i>Factor Code</i>	<i>Factor Name</i>	<i>Reference</i>	<i>Relevance to Architectural Design Firms</i>
LPL_1	Encouraging different points of view	Pham and Swierczek, 2006; Khadra and Rawabdeh, 2006; Jerez Gomez et al., 2005; Baidoun, 2003; Bontis et al., 2002; Crossan et al., 1999; Teare, 1998; Buckler, 1996; Dodgson, 1993; Huber, 1991; Senge, 1990	Appreciating design professionals' ideas relative to design alternatives, management issues, business decisions, etc.
LPL_2	Rethinking of decisions when presented with new information	Bontis et al., 2002	Considering new knowledge, new ideas and new conditions and applying needed design changes during project execution and review; responding to changes in project requirements, in local restrictions and limitations, in the composition of project team, and in business goals.
LPL_3	The right staff for the right task	Bontis et al., 2002	Placing design professionals according to their talents, skills, and abilities (e.g., design, technical drawing, marketing, project control, job tracking).
LPL_4	Considering every team member's ideas	Bontis et al., 2002	Appreciating each individual professional's ideas in every phase of the project, including preliminary design, detailed design, and construction.
LPL_5	Effective conflict resolution	Bontis et al., 2002	Encouraging on-time and effective response to conflicts between project team members, and between the project team and clients.
LPL_6	Adaptation capability to different types of project	Bontis et al., 2002	Diversity in architectural design experience in terms of site conditions, building types, project requirements, architectural styles, clients, and project teams.
LPL_7	Shared vision among team members	Pham and Swierczek, 2006; Bontis et al., 2002; Senge, 1990	Collective approach to project in terms of common project goals, project performance criteria, and architectural design objectives.

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Table 2.6. (cont.)

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LPL_8	Shared rewards for success	Khadra and Rawabdeh, 2006; Sicilia and Lytras, 2005; Bontis et al., 2002	Sharing responsibility for project success and welcoming any rewards equitably.
LPL_9	Shared responsibility for failure	Khadra and Rawabdeh, 2006; Sicilia and Lytras, 2005; Bontis et al., 2002	Sharing responsibility for design failures, delays, shifts in deadlines, and changes.
LPL_10	Generation of practical and new solutions	Jerez Gomez et al., 2005; Bontis et al., 2002; Cook and Brown, 1999	Skills, abilities, and creativity in solving design (functional, constructible, durable, aesthetic, sustainable etc.), business (contract administration, costing, scheduling, etc.), and third party (contractors, subcontractors, material dealers) problems in timely, practical, and innovative ways.

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### **2.2.1.3. Learning at Firm Level**

Learning at firm level encompasses alignment between the systems, structure, strategy, procedures and culture within the competitive environment. Several theorists have supported the need to mention about firm level (Cangelosi and Dill, 1965; Duncan and Weiss, 1979; Fiol and Lyles, 1985; Hedberg, 1981; Huber, 1991; Levitt and March, 1988; Shrivastava, 1983; Stata, 1989). Many scholars have commented on learning at the firm level (e.g., Fiol and Lyles, 1985; Huber, 1991; Stata, 1989) but their comments sometimes conflict. Some consider the organization as composed of individuals (the human perspective), while others consider organizations as systems, structures, and procedures (the systems perspective). Huber (1991) states that even though individuals have the best intentions to learn extensively, organizations may learn the wrong things. Therefore, according to Huber (1991), organizational learning involves an organization's capability to process information and develop new knowledge. Crossan et al. (1999) suggested that the organization level is more than large-scale shared understanding. It represents the translation of shared understanding into new products, processes, procedures, structures and strategy. It is the non-human artifacts of the organization that endure even though individuals may leave. Learning at firm level involves embedding learning at individual and project level into the non-human aspects of the organization including systems, structures, procedures and strategy (Bontis et al., 2002). In an architectural design environment, the learning stock at the firm level pretty much defines the expertise and reputation of a design firm. As such, the performance of a firm is likely to be dependent on learning at firm level. The extent of learning at firm level can be measured by the factors presented in Table 2.7.

Table 2.7. Measuring extent of learning at firm level

<i>Factor Code</i>	<i>Factor Name</i>	<i>Reference</i>	<i>Relevance to Architectural Design Firms</i>
LFL_1	Supportive firm structure	Pham and Swierczek, 2006; Sicilia and Lytras, 2005; Bontis et al., 2002	Appropriate and flexible firm structure that allows smooth exchange of information between project teams, and that encourages the capture of information from post-occupancy evaluations of constructed facilities.
LFL_2	Effective work environment	Pham and Swierczek, 2006; Zott, 2003; Baidoun, 2003; Bontis et al., 2002; Buckler, 1996; Hitt, 1995; Isaacs, 1993; Schein, 1993; Senge, 1990	A learning-oriented culture that rewards the acquisition and accumulation of design expertise, open communication channels that foster the buildup of a reputation for high quality work, the availability of technical hardware and software that allow the production of state-of-the-art design work, and comfortable work conditions that are conducive to productive work.
LFL_3	Effective competing strategy	Khadra and Rawabdeh, 2006; Pham and Swierczek, 2006; Crossan and Berdrow, 2003; Boyle, 2002; Bontis et al., 2002; Crossan et al., 1999; Fiol and Lyles, 1985	A competing strategy that is based on rapid response to technological novelties and, on the creation and/or adaptation of innovative trends, and on achieving great reputation on the basis of expertise gained through learning from experiences.
LFL_4	Growth-aligned vision	Khadra and Rawabdeh, 2006; Prewitt, 2003; Boyle, 2002; Bontis et al., 2002; Appelbaum and Reichart, 1998; Szulanski, 1996; Hitt, 1995; Senge, 1990	A vision that involves growth in a specialized field such as high-rise building design, and that aims to capitalize on accumulated expertise to expand to other fields.
LFL_5	Trust in all levels in firm	Bontis et al., 2002; Isaacs, 1993; Schein, 1993	Harmony and trust in social relationships within the firm (i.e., between different departments and between different levels of the hierarchy) and in relationships with third parties such as clients, contractors, and consultants, sharing needed knowledge resources throughout the firm and with third parties.

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Table 2.7. (cont.)

LFL_6	Effective operational procedures	Jerez Gomez et al., 2005; Bontis et al., 2002; Buzzell and Gale, 1987	Defined and effective processes that promote smooth and productive design performance and systemic working mechanisms that foster efficient decision-making, marketing, design, job tracking, and project control.
LFL_7	Innovative firm culture	Pham and Swierczek, 2006; Khadra and Rawabdeh, 2006; Bontis et al., 2002; Pool, 2000; Hurley, 1998; Teare, 1998; Schein, 1993; Brown, 1991; Stata, 1989	Innovative design, construction methods, project management, and firm management.
LFL_8	Robust firm strategies	Pham and Swierczek, 2006; Bontis et al., 2002; Senge, 1990	Long-term and short-term strategies formulated to achieve growth, market share, reputation, and competition.
LFL_9	Continuously developing systems	Bontis et al., 2002; Crossan et al., 1999; Isaacs, 1993; Schein, 1993	A dynamic environment and effective communication channels that allow rapid response to technological and aesthetic developments, and that is conducive to the generation of novel ideas and design.
LFL_10	Effective management of knowledge	Khadra and Rawabdeh, 2006; Pham and Swierczek, 2006; Jerez Gomez et al., 2005; Bontis et al., 2002; Crossan et al., 1999; Grant, 1996; Nevis et al., 1995; Kim, 1993	Effective transformation of project data into information, knowledge, and wisdom for utilizing learnt things through all learning levels in present project and future projects.

## 2.2.2. Learning Flows

Organizational learning involves a tension between assimilating new learning (exploration / feed-forward) and using what has already been learned (exploitation / feedback) (Crossan et al., 1999). Feed-forward relates to exploration. It is the transference of learning from individuals and project teams through to the learning that becomes embedded in the form of systems, structures, strategies, and procedures (Hedberg, 1981; Shrivastava, 1983). Feedback relates to exploitation and to the way in which institutionalized learning affects individuals and project teams (Crossan et al., 1999). The summary of the articles that research in feed-forward and feedback and the research areas about the subject are listed in Table 2.8. The tension between the feed-forward and the feedback flows of learning represents the tension between exploration and exploitation (March, 1991). Recognizing and managing the tension between feed-forward and feedback are a critical challenge and a requirement in a theory of organizational learning (Crossan et al., 1999). The tension between assimilating new learning and using what has already been learned arises because the institutionalized learning impedes the assimilation of new learning. Fully assimilating new learning requires the feed-forward of learning from the individual and project team to become institutionalized within the organization. Utilizing what has been learned is a feedback loop of institutionalized learning from the firm to project teams and individuals. Any theory of organizational learning needs to recognize the levels, processes, and dynamic nature of the learning process itself that create a tension between the feed-forward and feedback of learning (Crossan et al., 1999).

Throughout the feed-forward and feedback, the interactive relationship between cognition and action is the critical one that cannot be divorced from the other (Neisser, 1976). Understanding guides action, but action also informs understanding (Seely-Brown and Duguid, 1991; Weick, 1979). Organizational learning links cognition and action. This differentiates it from the related fields of knowledge management and intellectual capital.

Table 2.8. Summary of the articles on managing feed-forward and feedback  
(Source: Gupta et al., 2006)

<i>Author</i>	<i>Level of analysis</i>	<i>Role of feed-forward / feedback</i>	<i>Definitions and connotations of feed-forward / feedback</i>
Miller, Zhao, and Calatone	Individual and organization	Dependent variable	Differences in rate of learning
Taylor and Greve	Individual and team	Dependent variable	Differences in how teams use knowledge for either radical or incremental innovation
Beckman	Team and organization	Dependent variable	Differences in level of learning
Perretti and Negro	Team	Dependent variable	Feed-forward vs. feedback in team design
Siggelkow and Rivkin	Organization	Independent variables (local or distant search and tight coupling)	Differences in interdependencies between organizational levels can reverse the effects of decentralized feed-forward activity
Lavie and Rosenkopf	Organization	Dependent variable	Differences in alliance function, structure, and attribute across time and between domain
Wadhwa and Kotha	Inter-organizational	Independent variables (impact of exploratory moves on knowledge creation)	Corporate venture capital investments treated as exploratory moves

### **2.2.2.1. Feed-Forward**

Feed-forward deals with whether and how learning at individual feeds forward into learning at project level and project team feeds forward to learning at the firm level (e.g., changes to structure, systems, projects, strategy, procedures, and culture). There is a need to nurture common ground to stimulate the learning flow through the transfer of individual learning to organizational learning (Kim, 1993). Otherwise the individual insights gained from the learning process cannot be made known to others in the project team, lessening the chances of having another learning opportunity. Therefore, the appropriate type of organizational structure provides a necessary condition for facilitating the emergence of learning activities. Feed-forward learning flow allows the firm to innovate and renew (Crossan et al., 1999). The “ontological dimension point of view” is the knowledge transfer from individual, project, firm to inter-firm levels (Nonaka and Takeuchi, 1995). Crossan et al., (1999) assume the feed-forward learning flow may begin with individuals’ intuitive insights and experiences. These, after being filtered through individual perceptions and shaped through project team conversations, emerge as shared understanding and may, in time, become integrated into a sense of collective action. From the information processing perspective, knowledge is perceived to be “hard” and “transferable” as in the case of scientific, technical and commercial information. It can easily be codified, documented, and transferred to other people. However, the process of transferring “soft” knowledge, such as values, behavior patterns, assumptions and emotions may not be the same. Feed-forward learning flow entails taking personally constructed cognitive maps and integrating them in a way that develops a shared understanding among the project team members. There are many challenges in changing an existing shared reality. The first is that individuals need to be able to communicate, through words and actions, their own cognitive map. Since many aspects of cognitive maps are tacit, communicating them requires a process of surfacing and articulating ideas and concepts. This process makes tacit knowledge explicit (Polanyi, 1967). Making something explicit does not necessarily mean the understanding is shared. The real test of shared understanding is coherent action. As in experiential learning (Crossan et al., 1995), action provides the opportunity to

share a common experience, which may aid in the development of shared understanding.

Lateral communication patterns have become the dominant form for transmitting information among different members. Free flow of information can guarantee the availability of timely and accurate data to every member from their precursor. Table 2.9. shows the measures for the capability of feed-forward learning activity which were excerpted from the relevant literature.

Table 2.9. Measuring Feed-forward  
(Modified from: Bontis, 2002)

<i>Factor Code</i>	<i>Factor Name</i>	<i>Relevance to Architectural Design Firms</i>
FF_1	Ideas for design development	Extent to which ideas generated by design professionals are used in design development. Adding value in projects via supporting by new and practical ideas to improve design projects and avoid unnecessary changes during design project life cycle.
FF_2	Ideas for development of firm	Extent to which ideas generated by design professionals are used in development of firm. Firm is supported via architectural and specific content knowledge repositories about the project.
FF_3	Contribution to the firm's strategy	Extent to which design professionals contribute to the firm's long-term business strategy. To make projections for firm's business strategy by awareness of the work environment, architectural field knowledge, and latest technological developments.
FF_4	Generation of innovative ideas	Extent to which design professionals generate innovative ideas. To put forward original, practical, and state-of-the-art solutions for the project requirements and project limitations.
FF_5	Improved design processes via project outcomes	Extent to which project outcomes are used to improve design processes. Outcomes from the previous projects namely; knowledge gained via previous project processes (design drawings, client information, site information, etc.) are utilized by architectural professionals for recruitment in newly developed projects to avoid high cost, low quality, and long duration in projects.
FF_6	Shared lessons learned	Extent to which lessons learned by a design professional and shared with others. To share the knowledge that is gained via experience on project types, project styles, client, site, location, local limitations, etc.

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Table 2.9. (cont.)

FF_7	Awareness of duties and responsibilities	Extent to which design professionals are cognizant of each other's duties and responsibilities. The awareness of responsibility limits (project admission, design research, preliminary design, final design, application drawings, shop drawings, project approval, design control), territory of empowerment (decision making in design processes), decision making mechanisms (hierarchical improvement and approval of design and management decisions) in a project.
FF_8	Knowledge sharing	Extent to which design professionals share knowledge with each other. To share the knowledge that is gained via design and job experience, field professionalism, and technical and technological knowledge with other design professionals and project team.
FF_9	Anticipation future mistakes and making assumptions	Extent to which design professionals can anticipate future mistakes and make appropriate assumptions to avoid them. To make future predictions grounded by experience and architectural profession knowledge for keeping unnecessary change and eliminating probable errors that are detected in previous projects.
FF_10	Benchmarking and best practices for project development	Extent to which benchmarking and best practices are used in project development. Searching for best practices and benchmark for learning from strengths and weakness of others from an outsider point of view to improve project processes, procedures, policies, and system in architectural design and in the architectural design firm.

### **2.2.2.2. Feedback**

Feedback learning flow deals with whether and how the learning that is embedded in the organization (e.g., systems, structure, strategy, procedures, processes) affects learning at individual and project level (Vera and Crossan, 2004) via learning at firm level and learning at project level (e.g., changes to projects, processes, cognition, behavior). Feedback helps an organization that seeks to improve its performance in making required adjustments. The feedback learning process reinforces what the firm has already learned (Crossan et al., 1999) and ensures that firm level repositories of knowledge guide learning at individual and project level. Feedback learning flow relates to the way in which institutionalized learning affects individuals and project teams (Vera and Crossan, 2004). This flow is about refreshing and reinforcing learning while ensuring that routines are not neglected or forgotten so that the organization can continue to produce and perform (Crossan et al., 1999). Actions making up the institutionalizing process feedback to individuals and project teams by creating a context through which they interpret subsequent events and experiences. This process involves changes in cognition and behavior, as individuals and project teams continue to make sense of prior routines when contexts shift. Received feedback is used in decision making on how to apply the new knowledge to the process. The greatest level of success is found in an organization by accepting, analyzing, and using any kind of feedback for future decision making (Folkman, 2006). Firms that lack feedback learning "fail to remember", their members disregard past learning and, since routines fail to provide guidance, individual learning is driven entirely by the context. Feedback also operates in situations where a newly institutionalized routine needs to be communicated (horizontally and vertically within organizational structure) to the organization so that all members, not just the ones who developed the routine, will learn and use it (Vera and Crossan, 2004). Table 2.10. shows the measures for the capability of feedback learning activity which were excerpted from the relevant literature.

Table 2.10. Measuring Feedback  
(Modified from Bontis, 2002)

<i>Factor Code</i>	<i>Factor Name</i>	<i>Relevance to Architectural Design Firms</i>
FB_1	Influence of collective decisions making	Extent to which collective decisions influence individual professionals' works. Decisions that are taken collectively by firm level influence the project teams and design professionals and decisions that are taken by project level influence team members and design professionals. Collectively made decisions are accepted and applied throughout the firm.
FB_2	Dissemination of objectives	Extent to which the objectives of the firm are disseminated to design professionals. Architectural design firm's management goals and objectives such as, the projects types that are enrolled by firm, the architectural style that is preferred in projects, the profit-deficit acceptance limits, etc. are shared throughout the firm.
FB_3	Databases of knowledge are made available to professionals	Extent to which databases of knowledge are made available to professionals. State of readiness to share knowledge gained by previous project via keeping firm databases open to obtain necessary design and management information to the design professionals or design team when it is required.
FB_4	Articulated policies and procedures	Extent to which policies and procedures are articulated to stream line the feedback process. Existing and improving firm policies and procedures about project admission, design execution, project approval, and design control are helpful for design professionals to work straight forward in firm's system.
FB_5	Improved efficiency in learning of professionals' by training	Extent to which training programs improve professionals' efficiency in learning from past actions and increase the knowledge shared. Firm's opportunities to obtain training for its professionals result in efficient learning from previous projects. Training increases the possibility of dissemination, amount and the quality of design and management knowledge throughout the firm.

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FB_6	Recruitment of professionals sensitive to feedback	Extent to which recruiting processes affect the hiring of professionals sensitive to the feedback process. Firm's approach for appropriate employment to achieve successive feedback throughout the firm within a team and within a project-based working environment.
FB_7	Rewarding system for professionals	Extent to which a reward system encourages professionals' feedback activities. To activate feedback process on a project-based or on an approval-based rewarding system is utilized.
FB_8	Cross-training of professionals	Extent to which cross-training of professionals promotes sensitivity to feedback. Encompassing a wide range of design profession knowledge, cross-training of professionals in an architectural design firm lets employees to feedback to the related professional or project team on right time and in the right context.
FB_9	Appropriate structure to share acquired knowledge	Extent to which information system, computerized databases, and effective communication system to share acquired knowledge. Enabling knowledge sharing among professionals and project teams via successfully operating information system (design and drawing databases, knowledge sources such as; the membership of online databases, hardcopy references, rules and regulations, etc. , documented lessons learned, etc.).
FB_10	Firm is endowed with a collective memory	Extent to which the firm is endowed with a collective memory that shapes professionals behaviors. Architectural design firm's organizational knowledge repository that is fed by collective memory with a cooperative effort of design professionals is open to shape positively their behavior and action for project and process improvement.

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### **2.3. Performance of the Firm**

Much research has recently been conducted in firm performance (e.g., Gorelick and Tantawy-Monsou, 2005; McGraw et al., 2001; Kululanga et al., 2002; Smyth, 2004). Williams (1992) argues that a business must create a difference to sustain competitiveness. The creation of a difference in the rapid changing competitive business environment requires organizational learning. De Gaus (1988) states that “the ability to learn faster than competitors may be the only sustainable competitive advantage”. Organizational learning is a dynamic activity and covers all levels in an organization. The result of learning as an organization is expected to be improvement in performance. Slater and Narver (1995) state that obtaining and sustaining a high capability to learn is fundamental because of the rapid improvements of industry and technology changes and the importance of proactive action. Organizational learning facilitates change in organizations that may lead in turn to improved performance. According to Fiol and Lyles (1985) it is possible to presume that learning will improve future performance. Senge (1990) states that superior performance depends on superior learning. The positive impact of learning to performance is recognized by authors (Stata, 1989; Stewart, 1997; Bontis et al., 2002; Decarolis and Deeds, 1999; Prieto, 2003). Performance has been measured addressing issues such as customer’s satisfaction, number of customer’s growth (Kaplan and Norton, 1996; Saint Onge, 2002), employee’s satisfaction (EFQM, 2001; Goh and Ryan, 2002; Johansson et al., 1998) and the organizational reputation (Bontis, 1999; Bontis et al., 2002; EFQM, 2001). Financial performance is described through return on assets (Bierley and Chakrabarty, 1996; Calantone et al., 2002; Goh and Ryan, 2002), sales growth (Tippins and Sohi, 2003), overall profitability (Johansson et al., 1998; Tippins and Sohi, 2003), productivity (Vekstein, 1998) and cost reduction. The factors identified in this research to assess the performance of a firm are presented in Table 2.11. along with the researchers whose work inspired those factors.

Table 2.11. Measuring performance of the firm

<i>Factor Code</i>	<i>Factor Name</i>	<i>Reference</i>	<i>Relevance to Architectural Design Firms</i>
PF_1	Financial success	Denison, 2000; Crossan et al., 1999; Bontis and Crossan, 2002; Yang, 2007; Kaplan and Norton (1992); Systematic, 2004	Criteria of sustaining the firm by profitable projects, employee turnover, investment turnover, etc.
PF_2	Satisfied staff	Crossan et al., 1999; Bontis and Crossan, 2002; Yang, 2007; Kaplan and Norton, 1992; Slater and Narver, 1995; Cumby and Conrod, 2001; Bontis et al., 2002; Systematic, 2004	Rewarding pay scale and fair promotions; opportunities to work in projects with significant impact, working for a firm that has great reputation in the marketplace for high quality design, working in a harmonious and peaceful firm culture.
PF_3	Satisfied client	Crossan et al., 1999; Bontis and Crossan, 2002; Wong and Cheung, 2008; Yang, 2007; Hoque and James, 2000; Systematic, 2004	Achieving successful project closure and control, submitting a high quality design (functional, constructible, aesthetic, durable, sustainable), establishing and sustaining trustworthy business relations, and providing financial satisfaction to client.
PF_4	Confidence in future performance	Bontis and Crossan, 2002; Wong and Cheung, 2008; Bontis, 2000; Systematic, 2004	A state of readiness for future work, competitiveness ensured by confidence in future performance via reputation, intellectual capital, and continuous improvement (learning and innovation).
PF_5	High project team performance	Bontis and Crossan, 2002; Systematic, 2004	Project teams' state of readiness to handle all types of projects, improving processes via constructive feedback.
PF_6	Harmonious teamwork	Bontis and Crossan, 2002; Systematic, 2004	Creating harmonious environment by working as a part of a whole.
PF_7	Project team contributing to firm strategy	Crossan et al., 1999; Bontis and Crossan, 2002; Yang, 2007; Systematic, 2004	Maintaining valuable project feedback and feed-forward for entire firm to form an organizational memory for future projects and business decisions.

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PF_8	Long-term strategies	Bontis and Crossan, 2002; Wong and Cheung, 2008; Bontis, 2000; Systematic, 2004	To be able to capture trends in the construction industry and general economic conditions and state long-term business strategies.
PF_9	High performing individuals	Bontis and Crossan, 2002; Yang, 2007; Systematic, 2004	As the smallest component of the firm high performing architectural professionals who have skills, abilities, experience, and knowledge; high performing individuals who act as leaders of projects teams; high performing individuals in the upper management.

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Organizational learning is a dynamic process (Crossan et al., 1999) that includes learning stocks and learning flows. Learning stocks are the static depots of learned things within architectural professionals' as competence, capability, and motivation; project teams' as group dynamics and development of shared understandings; and architectural design firm's as nonhuman storehouses of learning. Learning at individual, project, and firm levels are the reservoir of knowledge in an architectural design firm. Learning occurring simultaneously at different levels may be 'nested' as suggested by Levinthal and March (1993). This means that learning at one organizational level may be a substitute for learning at another and/or that a trade-off between learning at different levels may be considered (Sydow et al., 2004). The kept knowledge within the levels is to be used in an appropriate situation and place by an appropriate level. How does this happen? Making use of reserved knowledge is possible if learning flows are enabled. The transfer of stored learned things is the way to utilize the knowledge of one level in other levels. The transfer of learned things among levels to upwards and downwards in firm structure is enabled by feed-forward and feedback learning flows. The dynamic nature of organizational learning is achieved by the flow of stocks of learning among levels to utilize knowledge within the firm. "The knowledge hierarchy" (Rowley, 2007) is built up by feed-forward learning flow, which enables the transportation of learning at individual into learning at project level and learning at the firm level (Crossan et al., 1999). Wisdom as the top of knowledge hierarchy pyramid is communicated to downwards by feedback learning flow in a firm structure. Learning at firm level that is embedded in the firm flows to learning at individual and project levels (Crossan et al., 1999). Many authors (Fiol and Lyles, 1985; Senge, 1990; Stata, 1989; Stewart, 1997; Bontis et al., 2002; Decarolis and Deeds, 1999; Prieto, 2003; Prieto and Revilla, 2006) state that organizational learning as learning stocks and flows has an impact on performance of the firm. In next chapters, the interrelations of organizational learning constructs namely; learning at individual, project, and firm levels, feed-forward and feedback will be questioned. The impact of organizational learning on performance of architectural design firms will be examined.

## CHAPTER 3

# DEVELOPMENT OF HYPOTHESES AND METHODOLOGY

### 3.1. Development of Hypotheses

Since architects deal with unique projects, their knowledge is largely experience-based, tacit, and embedded within the design and construction process (Heylighen et al., 2007). Today's highly competitive environment is subject to continuous changes and dynamism. Companies widely identify learning as a critical attribute for achieving and remaining competitive (Prieto and Revilla, 2006). The focus of the research is the relationship between learning stocks as learning at all levels and feed-forward and feedback learning flows, and their affect on performance of the firm in architectural design sector. Learning stocks refer to all that is already known or needs to be known, which includes learning at the individual, project and firm levels. Learning flows are about relationship and interconnection (Crossan et al., 1999). Crossan et al. (1999) and Dierickx and Cool (1989) argue that all organizations own learning stocks, which need to continually flow to adapt to the requirements of the work environment. Learning is a social process developed through the interaction of learners within specific contexts as well as being individual (Brown and Duguid, 1991; Cook and Yanow, 1993; Nicolini and Mezner, 1995; Wenger, 1998). Prieto considers that knowledge is intuited, interpreted, integrated, and institutionalized through learning flows (Prieto, 2003). As Sanchez (2001) states learning flows process learning stocks, which in turn create new or transformed learning stocks for new mental schemes and taking action in it (Sanchez, 2001). The link between learning flows and learning stocks is reflected in the tension between the feed-forward (exploration) and the feedback (exploitation) of knowledge (Crossan et al., 1999; March, 1991). Learning is enabled through both learning stocks and learning flows in organizations. Learning at individual, project, and firm levels as learning stocks form the knowledge repositories of a firm through feed-forward and feedback learning flows, enable learning to move from one level of the

firm to another. The link between learning and performance is researched by some scholars (Huber, 1991; Crossan et al., 1995; Popper and Lipshitz, 2000; Bontis et al., 2002). Senge (1990) indicates that, along time, superior performance depends on superior learning. In this research, the affect of learning stocks and learning flows on performance of architectural design firms is questioned. The hypotheses are built by considering the learning stocks (extent of learning at the individual, project, and firm levels) and the learning flows (extent of feed-forward and feedback) since individual professionals form collective project teams and project teams form the firm. The hypotheses are built by considering directions of feedback and feed-forward learning flows within an organization structure which is constructed through individual professionals, collective project teams formed by individuals, and the architectural design firm formed by project teams.

Organizational learning prioritizes the creation and acquisition of new knowledge, and emphasizes the role of people in the creation and utilization of that knowledge (Denton, 1998). In this way, organizational learning presents an important route to performance, success and competitive advantage for the organizations (Dunphy and Griffiths, 1998; and Lei et al., 1999). On the academic front, most of the scholars are agreeing with Drucker's (1993) assertion that "value is created by productivity and innovation" and organizations must acquire knowledge as a source of sustainable competitive advantage. Yet, this is a recurring theme with little or no agreement as to how organizations can establish link between organizational learning, on the one hand, and organizational performance on the other. Many studies on the issue offer very little empirical evidences to substantiate this. In this study, we first present the argument that organizational learning is positively related to organizational performance. Then to study this relationship, we examined 165 architectural design firms. The need for the organizations to learn as holistic entities became more pronounced for favoring organizational learning as a means of creating competitive advantage (Senge, 1990; Heracleous, 1995; Jackson et al., 2004). The concept of learning, organizational learning and learning organization (e.g., Shrivastava, 1983; Levitt and March, 1988; Huber, 1991; Gopinath, 1994; Miner and Mezias, 1996; Easterby-Smith, 1997; Edmonson and Moingeon, 1998; Tsang, 1997; Sharma, 2001; Sharma and Sharma, 2002) has been studied by many researchers.

Individuals' learning is vital for starting the learning processes in a firm. Individuals learn things as tacit knowledge (Polanyi, 1967) and expertise (Prietula and Simon, 1989). In an architectural design firm, this corresponds to design professionals getting familiar with codes, specifications and established design methods. According to Nonaka and Takeuchi (1995), an individual's tacit insights are translated and transferred into explicit knowledge through interpreting. An individual's transferable learning stock is processed and quoted to others in related domains. This transfer requires interaction among the individuals to transform data into information, knowledge, and wisdom (Teece et al., 1997). Therefore individuals take a valuable role in shaping the results of learning (Polanyi, 1967; Nevis et al., 1995). In the context of the architectural design firm, a project team's expertise grows through the interaction between the design professionals serving in the team. Since individuals are the origin of learning, this transfer of knowledge seems to indicate that learning at individual level may have an effect on learning at project level. The impact of learning at individual level on performance of a firm may occur by transferring acquired knowledge of individuals. Therefore learning at the individual level deserves a good understanding and special attention. The first hypothesis investigates whether learning at individual level positively affects learning at project level.

*Hypothesis 1: Learning at individual level affects learning at project level.*

Learning at project level involves the sharing of individual interpretations to develop a common understanding (Bontis et al., 2002). A collective mind is developed through continuous interaction among individuals (Weick and Roberts, 1993). The collaboration of design professionals promotes a common culture in a design team's operations. Projects as temporary organizations refer to teams comprising a mix of different specialists' competences, which have to achieve a certain goal or carry out a specific task within limits that are set as to cost and time. Such a view is informative of the transient and multidisciplinary nature of projects. Another characteristic is that projects are comprised of individuals that represent different specialties, with different knowledge backgrounds and ways of interpreting experience. Once stocks of learning that are accumulated by individuals are integrated into groups of people, the shared understandings are then processed for transferring to the learning at firm level. The learning stock at firm level is the result of commuted ideas and processed collective

understandings. Learning at project level is translated into processes, procedures, structures, and systems at the firm level (Crossan et al., 1999). Indeed, a design firm's know-how, expertise and competence are likely to be dependent on the sum of its project teams' experiences. Therefore, the second hypothesis investigates whether learning at project level has an effect on learning at firm level.

*Hypothesis 2: Learning at project level affects learning at firm level.*

Many scholars such as; Yeung et al. (1999), Slater and Narver (1995), and Ellinger et al. (2002) agree that organizational learning positively affects firm performance. In other words, learning at individual, project, and firm levels is expected to affect the performance of the firm. Indeed, being the mother of knowledge in a firm, learning at individual level may affect the design firm's performance. Learning at project level, where project teams are composed of individual professionals, is also expected to affect the performance of the firm. Finally, learning at firm level is also expected to affect firm performance since learning at firm level involves an organization's capability to manipulate and utilize gathered knowledge and develop wisdom (Argyris, 1999; Quinn et al., 1992; Huber, 1991; Kolb, 1984). Architectural design firms that are effective in learning at all levels should be able to detect problems easily and to quickly respond to novelties and trends in the industry. If initial learning efforts at individual level end up with utilizable information for project teams to focus collectively on clear targets and if knowledge that is improved by project teams feeds the development of the organization's wisdom, then learning at each level may have an effect on the performance of the firm. This argument is tested in hypothesis 3, 4, and 5.

*Hypothesis 3: Learning at individual level individually affects performance of the firm.*

*Hypothesis 4: Learning at project level individually affects performance of the firm.*

*Hypothesis 5: Learning at firm level individually affects performance of the firm.*

Feed-forward learning flow enables learning at individual level to move to learning at project level (Crossan et al., 1999). Salas et al.'s definition of a team as; a set of two or more individuals who interact dynamically, interdependently, and adaptively toward a common and valued goal, each having specific roles or functions to perform and a

limited life-span of membership (Salas et al., 1992). Project team's feed-forward enables learning at project level to move to learning at firm level (Crossan et al., 1999). Feed-forward learning flow enables individual learning to move to project and firm levels of learning thereby allowing firms to innovate and renew (Crossan et al., 1999).

*Hypothesis 6: Feed-forward has an impact on learning at individual level.*

*Hypothesis 7: Feed-forward has an impact on learning at project level.*

Feedback is known to direct attention toward aspects of the task on which feedback is available and to affect subsequent goal setting (Kluger and DeNisi, 1996). Learning at project level involves distribution of information and interpretation of knowledge. Daft and Huber (1987) emphasize the need to communicate or distribute information. Information distribution through interaction focuses on "mental models" (Stata, 1989), and "shared visions" (Senge, 1990). Learning enables the manipulation of individuals' knowledge to develop a shared understanding within the project team (Weick and Roberts, 1993). Feedback learning flow enables learning at firm level to move to learning at project and individual levels thereby allowing firms to reinforce what it has already been learnt and ensures that organizational repositories guide learning at project and individual levels (Crossan et al., 1999).

*Hypothesis 8: Feedback has an impact on learning at project level.*

*Hypothesis 9: Feedback has an impact on learning at firm level.*

Feed-forward and feedback are the learning flows in organizational learning. Feed-forward captures the input of learning at individual and project levels to upper levels in a firm's structure. The outcomes of feed-forward can be observed in improved projects and procedures, and in firm structure, culture, systems, and strategy. Feedback captures the input of learning at firm and project level to lower levels in a firm's structure. The outcomes of feedback can be observed by change in behaviors, attitudes of individual professionals and in project processes. Levinthal and March (1993), claim that it is a good strategy for any firm to emphasize feedback of successful feed-forward of others. Many scholars commented on the relationship between feed-forward and feedback (March, 1991; Levinthal and March, 1993; Gupta et al., 2006; Van Deusen and Mueller; 1999). Levinthal and March (1993), state that there is a

relationship between feed-forward and feedback and this relationship should be in balance. Otherwise the impact of feed-forward on learning becomes a slow learning or an unlearning effect. Feed-forward is profitable in the long-run. The result of slow learning or unlearning is to be difficulty in sustaining competitiveness which in turn negatively affects performance (Gupta et al., 2006). Therefore the relationship between feed-forward and feedback should be well observed, defined, and controlled. Since feed-forward and feedback are utilized via using same channels to upwards or downwards in a firm structure, learning flows may have a relationship between each other.

*Hypothesis 10: Feed-forward and feedback have an inter-relationship.*

### **3.2. Methodology**

An extensive literature review was conducted on learning stocks, learning flows, performance, and architectural design firms. A survey instrument was adapted to assess the extent of learning at different levels, the flow of learning stocks and the performance of architectural design firms. The survey was administered to a total of 165 respondents from 165 firms out of 262 randomly selected architectural design firms registered with the Turkish Chamber of Architects, representing a response rate of 63% of the total population. This population is composed of small, medium, and large firms. Firms' average age is 16, and average permanent employee number is 8. The number of operating professionals increases during project life cycle because of temporary cooperation among project participants. Only the İstanbul, İzmir, Ankara, and Antalya regions were targeted in the survey, as these areas constitute the most populated and the most architecturally active regions in Turkey. The respondents were professionals including architects and technicians but excluded administrative support personnel. The responses to the questionnaire were assessed to determine the relationship between the extent of learning at all levels, the extent of flow of learning stocks, and performance of the firm. This was the first time an attempt was made to develop and apply a measurement tool to assess the impact of organizational learning on performance of the architectural design firms. The survey instruments that measure

the extent of learning stocks and learning flows, and that assess performance of the firm were developed in two steps to ensure reliable and valid outcomes.

**Model Generation:** The goal in this step was to identify the constructs of organizational learning that affect performance of the firm. The factors learning stocks as; learning at individual, project, and firm levels, learning flows as; feed-forward and feedback and the factors of performance in architectural design firms are modified from the study of Bontis et al. (2002). An extensive literature review was conducted to accomplish this task. To ensure construct validity, the item generation process must be comprehensive (Nunnally, 1978). Ten factors were identified for each learning stock and each learning flow, and nine factors for performance of the firm. The factors were formulated into statements that could be easily understood by respondents. The respondents were asked to rate the statements on a five-point Likert scale, where 5 represents strongly agree, 4 agree, 3 neutral, 2 disagree, 1 strongly disagree.

**Pilot study:** The goal of this step was to evaluate and refine the survey instrument. If a survey questionnaire is to be used as a measurement tool for a conceptual model, its validity and reliability must be established before it is applied. To achieve this goal a pilot study was administered to 25 professionals working in 25 architectural design firms in Northern Cyprus. The questionnaire was revised based on the suggestions of the respondents. The terminology was corrected, and the language was refined.

## **CHAPTER 4**

### **FINDINGS AND ANALYSIS**

#### **4.1. Model Development**

Structural equation modeling (SEM) was used to analyze the data. SEM is a statistical method that allows assessing the strength of the relationships in a complex model. Hair et al. (1998) suggest that SEM is preferable especially when several latent variables exist that are represented by several observed variables or when a latent variable is a dependent and an independent variable at the same time. Both cases exist in the conceptual model of this research. Bollen and Long (1993) claim that the model must fit the data in order to test hypotheses.

The software that is used in this analysis was a computer package called Analysis of Moment Structures (AMOS) Version 7.0. The SEM model consists of a measurement component and a structural component. The measurement component determines how well observed variables measure latent (unobserved) variables. The structural component models the relationships between latent variables. The rectangular boxes in Figures 4.1. to 4.5. represent the observed variables and the oval boxes represent the latent variables.

##### **4.1.1. Measurement Model**

A conceptual model was developed based on the theoretical background presented in the previous sections. As literature states organizational learning presumed to have impact on performance of the firm. It was argued that learning at all levels has a direct effect on performance of the firm and it was argued that learning at individual level has a direct effect on learning at project level, and that learning at project level has a direct effect on learning at firm level. In addition, feed-forward has a direct affect on learning at individual and project levels and feedback has a direct affect on learning at project and firm levels. Feed-forward and feedback in turn may have an effect on

performance. Indeed, there is a correlation between feed-forward and feedback. This model (Conceptual Model I) is presented in Figure 4.1. The numbers on the arrows in Figure 4.1. represent path coefficients and determine the strength of the relationship between observed variables and latent variables or between latent variables (Joreskog and Sorbom 1993).

All path coefficients in Conceptual Model I were statistically significant at  $\alpha = 0.05$  except for the path coefficients between “learning at individual level” and “performance of the firm” and “learning at project level” and “performance of the firm”. When these relationships were eliminated, the model reduced to the one seen in Figure 4.2. (Conceptual Model II). In this model, it is argued that learning at individual level affects learning at project level, which in turn affects learning at firm level, which in turn affects performance of the firm. The model also argued that feed-forward has a direct affect on learning at individual and project levels and feedback has a direct affect on learning at project and firm levels. Another premise of the model is the correlation between feed-forward and feedback.

As seen in Table 4.1. the factor loadings of the observed variables on the latent variables for Conceptual Model II, III, and IV (Figure 4.2., 4.3., 4.4.) and Refined Model (Figure 4.5.) range from 0.17 to 0.83. For example, in Table 4.1. learning at individual level explains 62% of the variability in ‘clarity of objectives’ (LIL\_5), whereas e\_5 in Figures 4.2., 4.3., 4.4., 4.5., 4.6. explains other portions. All factor loadings are statistically significant at  $\alpha = 0.05$ , indicating that the research variables extensively determine their unobserved constructs.

Goodness of fit indices are optimized to improve the model over iterations by removing the variables with the factor loading lower than .20 (Hooper et al., 2008). Therefore Conceptual Model III includes a total of 57 variables (Figure 4.3.). The factor loadings of these 57 variables have statistical significance at  $\alpha = 0.05$  level and are presented in Table 4.1. The conceptual model III was further refined by using a combination of modification indices that reduce the  $\chi^2$  levels for each possible path as recommended by Hair et al. (1998), Arbuckle (2007), and Hoyle (1995). According to Klein (1998), this process should be done when it makes substantive as well as statistical sense. Conceptual Model III turned into Conceptual Model IV (Figure 4.4.). The new model is checked one more time for factor loadings and factors lower than .20 are eliminated. After this elimination process the Refined Model has a total number of

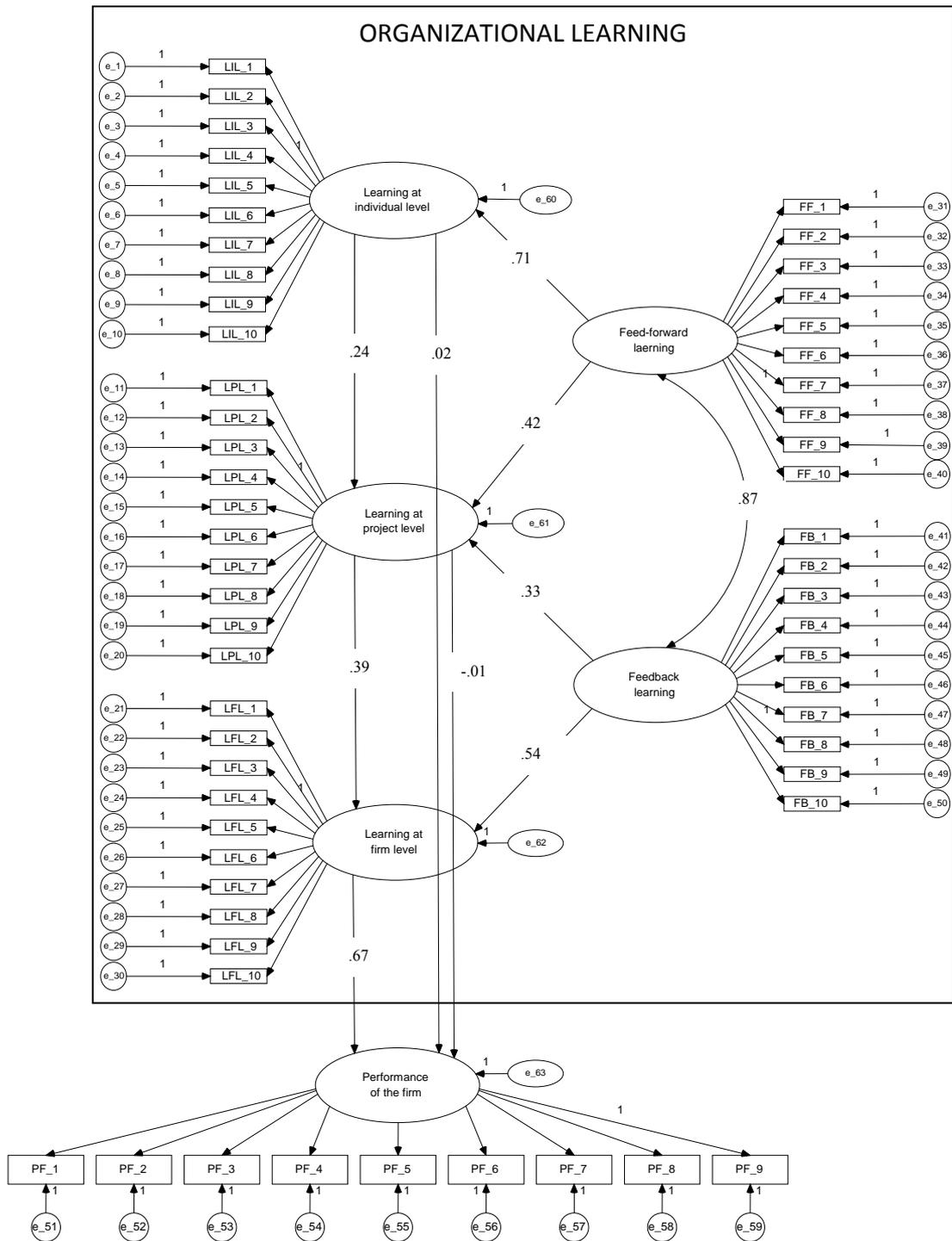


Figure 4.1. Conceptual Model I for assessing the impact of organizational learning on performance of the firm.

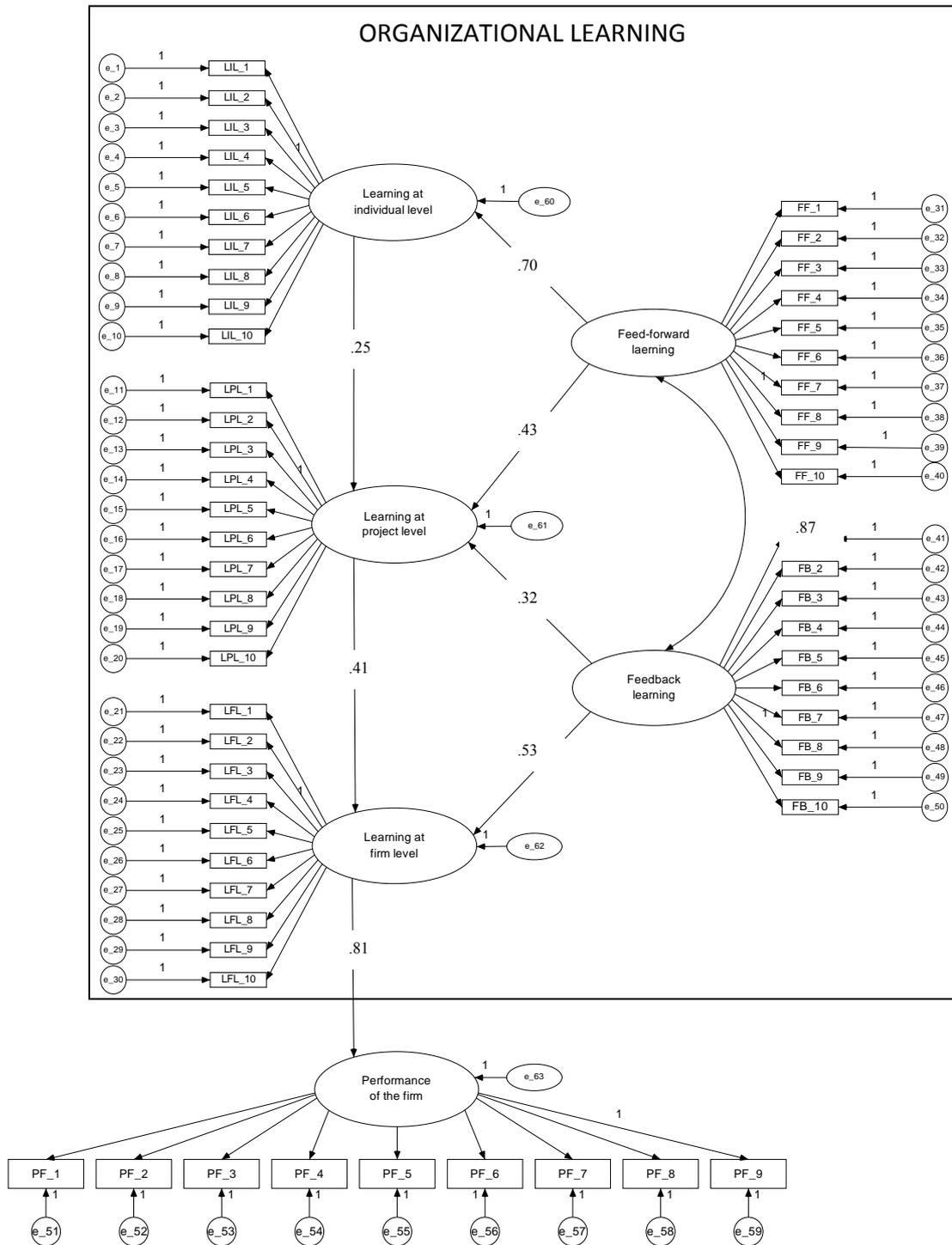


Figure 4.2. Conceptual Model II for assessing the impact of organizational learning on performance of the firm.

Table 4.1. Parameter estimates of measurement model

Latent variables	Code	Observed variables	Conceptual Model				Refined Model	
			II		III		Path Coefficients	Factor Loadings
			Path Coefficients	Factor Loadings	Path Coefficients	Factor Loadings		
<b>Learning at individual level</b>								
	LIL_1	Pride in work and firm	.57	.33	.56	.32	.58	.34
	LIL_2	Feeling of empowerment	.78	.61	.78	.61	.78	.60
	LIL_3	Presence of competing interests	.41	.17	---	---	---	---
	LIL_4	Confidence in job security	.69	.48	.68	.47	.69	.47
	LIL_5	Clarity of objectives	.78	.61	.78	.61	.79	.62
	LIL_6	Openness to change	.43	.19	---	---	---	---
	LIL_7	Pressure to accomplish critical tasks	.66	.43	.67	.45	.61	.44
	LIL_8	Awareness of critical issues that affect work performance	.61	.38	.62	.39	.66	.37
	LIL_9	Pressure to create innovative ideas	.66	.43	.66	.43	.52	.44
	LIL_10	Experience and proficiency in field of work	.71	.50	.72	.52	.71	.50
<b>Learning at project level</b>								
	LPL_1	Encouraging different points of view	.79	.63	.79	.63	.80	.64
	LPL_2	Rethinking of decisions when presented with new information	.68	.46	.68	.46	.66	.44
	LPL_3	The right staff for the right tasks	.53	.29	.53	.29	.50	.25
	LPL_4	Considering every team member's ideas	.79	.62	.79	.62	.79	.62
	LPL_5	Effective conflict resolution	.79	.63	.80	.63	.77	.60
	LPL_6	Adaptation capability to different types of projects	.48	.23	.48	.23	.45	.20
	LPL_7	Shared vision among team members	.49	.24	.49	.24	.46	.21
	LPL_8	Shared rewards for success	.75	.56	.75	.56	.76	.57
	LPL_9	Shared responsibility for failure	.64	.41	.64	.41	.63	.40
	LPL_10	Generation of practical and new solutions	.77	.59	.77	.59	.78	.60

(cont. on next page)

Table 4.1. (cont.)

Learning at firm level							
LFL_1	Supportive firm structure	.75	.56	.75	.56	.75	.56
LFL_2	Effective work environment	.83	.69	.83	.69	.83	.69
LFL_3	Effective competing strategy	.76	.58	.76	.58	.75	.57
LFL_4	Growth aligned vision	.78	.60	.78	.60	.77	.59
LFL_5	Trust in all levels in firm	.82	.68	.82	.68	.83	.69
LFL_6	Effective operational procedures	.78	.61	.78	.61	.77	.59
LFL_7	Innovative firm culture	.75	.56	.75	.56	.74	.55
LFL_8	Robust firm strategies	.73	.53	.73	.53	.71	.51
LFL_9	Continuous developing systems	.54	.29	.54	.29	.52	.28
LFL_10	Effective management of knowledge	.73	.53	.73	.53	.73	.54
Feed-forward							
FF_1	Ideas for design development	.73	.53	.73	.53	.73	.53
FF_2	Ideas for development of firm	.73	.54	.73	.54	.72	.52
FF_3	Contribution to the firm's strategy	.54	.29	.54	.29	.53	.28
FF_4	Generation of innovative ideas	.73	.53	.73	.53	.73	.53
FF_5	Improved design processes via project outcomes	.74	.55	.74	.55	.73	.53
FF_6	Shared lessons learned	.71	.51	.71	.51	.69	.48
FF_7	Awareness of duties and responsibilities	.68	.46	.68	.46	.65	.43
FF_8	Knowledge sharing	.73	.54	.73	.54	.73	.53
FF_9	Anticipation of future mistakes and making assumptions	.69	.47	.69	.47	.68	.46
FF_10	Benchmarking and best practices for project development	.65	.42	.65	.42	.65	.42

(cont. on next page)

Table 4.1. (cont.)

Feedback							
FB_1	Influence of collective decisions making	.51	.26	.51	.26	.50	.25
FB_2	Dissemination of objectives	.73	.53	.73	.53	.74	.54
FB_3	Databases of knowledge are made available to professionals	.60	.36	.60	.36	.59	.35
FB_4	Articulated policies and procedures	.45	.21	.45	.21	---	---
FB_5	Improved efficiency in learning of professionals' by training	.57	.32	.57	.32	.56	.31
FB_6	Recruitment of professionals sensitive to feedback	.61	.37	.61	.37	.58	.34
FB_7	Rewarding system for professionals	.53	.28	.53	.28	.49	.24
FB_8	Cross-training of professionals	.64	.64	.64	.41	.60	.36
FB_9	Appropriate structure to share acquired knowledge	.80	.41	.80	.64	.77	.60
FB_10	Firm is endowed with a collective memory	.70	.49	.70	.49	.71	.50
Performance of the firm							
PF_1	Financial success	.79	.63	.79	.63	.80	.64
PF_2	Satisfied staff	.80	.64	.80	.64	.81	.65
PF_3	Satisfied client	.69	.47	.69	.47	.69	.47
PF_4	Confidence in future performance	.71	.50	.71	.50	.71	.51
PF_5	High project team performance	.81	.66	.81	.66	.81	.65
PF_6	Harmonious teamwork	.77	.59	.77	.59	.75	.56
PF_7	Project team contributing to firm strategy	.75	.56	.75	.56	.72	.52
PF_8	Long-term strategies	.70	.49	.70	.49	.70	.50
PF_9	High performing individuals	.77	.60	.77	.60	.78	.60

56 variables (Figure 4.5.). Competing models were compared using goodness of fit indices. The refined model presented in Figure 4.5. was selected in this study on the basis of compliance with both theoretical expectations and goodness-of-fit measures, as described in the following section.

#### **4.1.2. The Structural Equation Model (SEM)**

The data collected in the questionnaire survey were tested for content validity and convergent validity as well as the reliability of the constructs. The presence/absence of multicollinearity was also investigated. Finally, the goodness of fit of the models was assessed.

According to Carmines and Zeller (1991), content validity is based on the extent to which a measurement instrument reflects the intended domain. It seeks correlation between a theoretical concept and a specific measuring instrument. An extensive literature review was conducted to ensure content validity. The variables representing learning stocks, learning flows, and performance of the firm were extracted by Bontis et al. (2002) and from the works of distinguished scholars' publishing in reputable journals. The variables that form the measurement instrument were adapted from Bontis et al.'s (2002) instrument for use in architectural design firms.

Convergent validity is demonstrated when a set of variables accurately represents the construct (Churchill, 1979). Convergent validity is assessed on the basis of the level of significance of the factor loadings. Anderson and Gerbing (1988) suggest that if the individual factor loadings are significant, then the variables are effectively converging to measure the same construct. As seen in Table 4.1. all factor loadings in this research were significant at  $\alpha = 0.05$ , which provides evidence of convergent validity.

Reliability is a measure of the ability of an instrument to yield consistent results. While validity is concerned with the study's success at measuring the concept that is being investigated, reliability is concerned with the accuracy of the actual measurement instrument. The internal consistency of a construct is a measure of its reliability. It measures whether variables that propose to measure the same construct produce similar scores. The internal consistencies of the five latent variables that are used in the model

were assessed by calculating their Cronbach's alpha coefficients (Cronbach, 1951). Internal consistency ranges between zero and one. According to Churchill (1979), coefficients between 0.6 and 0.7 are acceptable for exploratory studies, whereas Nunnally (1978) and Flynn et al. (1990) consider 0.7 and higher to be preferable and 0.8 or higher to be good reliability. Coefficients of 0.95 or higher are not necessarily desirable because this indicates that the variables may be redundant (Streiner, 2003). The goal in designing a reliable construct is for scores on constituent variables to be related (internally consistent), but for each to contribute some unique information as well. The analysis was conducted by using the statistical package for social sciences (SPSS) version 15 on data collected in the questionnaire survey. The Cronbach's alpha coefficients for each latent variable are presented in Table 4.2. As seen in Table 4.2, the Cronbach's alpha coefficients in the Refined Model do not differ much from the coefficients in Conceptual Models I, II, III, and IV range from 0.86 to 0.93, well above the threshold recommended by Nunnally (1978) and Flynn et al. (1990).

Multicollinearity is a state of very high inter-correlations among the variables. It is a kind of disturbance and unwanted situation in the data. If multicollinearity occurs in the data, then the statistical inferences made about the data may be unreliable. Multicollinearity leads to unreasonable coefficient estimates, large standard errors, and consequently poor interpretation of the survey data. Multicollinearity can be detected by determining the correlations between variables. Therefore Pearson correlation analysis was conducted on the observed variables of each latent variable. The correlation matrices of observed variables were calculated for each construct separately. All inter-correlation coefficients were found to be below 0.90, the threshold recommended by Hair et al. (1998), which shows that there is no multicollinearity in this study.

Table 4.2. Reliability analysis results

Latent Variables	Conceptual Models						Refined Model	
	II (Figure 4.2.)		III (Figure 4.3.)		IV (Figure 4.4.)		(Figure 4.5.)	
	Number of Variables	Cronbach's Alpha Coefficient	Number of Variables	Cronbach's Alpha Coefficient	Number of Variables	Cronbach's Alpha Coefficient	Number of Variables	Cronbach's Alpha Coefficient
Learning at individual level	10	0.86	8	0.87	8	0.87	8	0.87
Learning at project level	10	0.89	10	0.89	10	0.89	10	0.89
Learning at firm level	10	0.93	10	0.93	10	0.93	10	0.93
Feed-forward	10	0.90	10	0.87	10	0.87	10	0.87
Feedback	10	0.86	10	0.86	10	0.86	9	0.86
Performance of the firm	9	0.92	9	0.92	9	0.92	9	0.92

### 4.1.3. Fit Indices of the Structural Equation Model

The goodness of fit of a model describes its fit to data acquired. The discrepancy between observed values and the values expected under the model is summarized by measures of goodness of fit. The chi-square test ( $\chi^2$ ) is normally used to test if a sample of data came from a population with a specific distribution (Snedecor and Cochran 1989). But the chi square test is sensitive to the size of the sample and of the correlations in the model.  $\chi^2 / df$  (Chi square / degrees of freedom) is the minimum sample discrepancy divided by degrees of freedom. This is called relative chi-square or normal chi-square (Garson, 2009). Some researchers allow values as large as 5 as being an adequate fit (Wheaton et al., 1977), but conservative use calls for rejecting models with relative chi-square greater than 2 or 3 (Jaspara 2003; Carmines and McIver, 1981; Byrne, 1989; Hair et al., 1998).

As recommended by Klein (1998), the overall fit of the structural model was also assessed using a number of other goodness-of-fit tests which included the Goodness of Fit Index (GFI), the Comparative Fit Index (CFI), the Tucker-Levis Fit Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). GFI checks for sample size effects and varies from 0 to 1. TLI, also called the Bentler-Bonett non-normed fit index, considers a correlation for model complexity (Klein 1998) and close to 1 indicates a good fit, and values above 0.70 an acceptable fit (Arrindell et al., 1999). The comparative fit index (CFI) is interpreted in the same way as the TLI and represents the relative improvement in fit of the hypothesized model over the null model. CFI also varies from 0 to 1. CFI close to 1 indicates a very good fit, and values above 0.73 an acceptable fit (Chou and Bentler 1990; and Brennan and Brannan, 2005). The root mean square error of approximation (RMSEA) is an estimate of the discrepancy between the observed and estimated covariance matrices in the population (Hair et al., 1998). There is close model fit if RMSEA is less than or equal to 0.05. There is a good fit if it is less than or equal to 0.08. There is adequate fit if it is less than or equal to 0.1 (Chou and Bentler, 1990; Bollen and Long, 1992; and Browne and Cudeck, 1993).

Table 4.3. Goodness-of-fit indices for SEM models

<i>Model</i>	$\chi^2 / df$	<i>p-value</i>	<i>GFI</i>	<i>TLI</i>	<i>CFI</i>	<i>RMSEA</i>
Conceptual Model II (Figure 4.2.)	1.748	.000	.627	.794	.802	.068
Conceptual Model III (Figure 4.3.)	1.768	.000	.633	.799	.807	.068
Conceptual Model IV (Figure 4.4.)	1.588	.000	.677	.846	.856	.060
Refined Model (Figure 4.5.)	1.601	.000	.678	.847	.856	.061

<i>Goodness of fit indices</i>	<i>Goodness of fit range (Hair et al. (1998))</i>	<i>References</i>
df = Degrees of freedom		
X <sup>2</sup> /df = Chisquare / degrees of freedom	0 or above	Jaspara (2003)
GFI = Goodness-of-fit index	0 (no fit) to 1 (perfect fit)	Arrindell et al. (1999)
TLI = Tucker-Lewis fit index	0 (no fit) to 1 (perfect fit)	Arrindell et al. (1999)
CFI = Comparative fit index	0 (no fit) to 1 (perfect fit)	Chou and Bentler (1990); and Brennan and Brannan (2005)
RMSEA = Root mean square error of approximation	0 (perfect fit) to 1 (no fit)	Chou and Bentler (1990); Bollen and Long (1992); and Browne and Cudeck (1993)

Table 4.3. shows the results of the goodness of fit tests for the SEM models. In the refined model the  $\chi^2/df$  ratio of 1.601 was below the recommended maximum of 3.00 (Chau, 1997). Similarly, RMSEA of 0.061 was below the level of 0.08 and indicates a good fit. Additionally, GFI, CFI, and TLI were all close to 1 and indicated a good fit.

## 4.2. Tests of Hypotheses

The tests of the hypotheses are based on the strength of the path coefficients between the latent variables in the model (see Figure 4.5.) and direct, indirect and total effects (see Table 4.4.). All hypotheses were tested at  $p \leq 0.05$  significance level.

Cohen and Bailey (1997) define the group as “a collection of individuals who are interdependent in their tasks, who see themselves and are seen by others as an intact social entity, and who are embedded in a larger social system”. Therefore individual professionals, as the factors of learning at project level in an architectural design firm, may have impact on learning at project level. Senge (1990) claims that organization learn only through individuals who learn, individual learning does not guarantee organizational learning. But without it no organizational learning occurs (Senge, 1990). As Klein (1998) suggests organizational learning is more complex and dynamic than a mere magnification of learning at individual level. The firm as a system of combination of individuals, project teams and firm itself has a complex environment of learning. Individuals have an impact on the learning at project level whether they intend to or not (Argote and McGrath, 1993; McGrath, 1991). Hypothesis 1 states that ‘learning at individual level affects learning at project level’. As seen in Figure 4.5. the path coefficient of 0.20 that represents this relationship in the refined model was statistically significant and positive. The finding suggests a parallel view to the literature on the relationship between learning at individual and project levels. Even though learning at individual level does not obtain a substantial difference in learning at project level, it has a statistically significant impact on learning at project level. The results also show that to achieve extensive learning at individual level the highest scored factors loadings belongs to the factors of “clarity of objectives”, “feeling of empowerment”, and “experience and proficiency in field of work” respectively (Table 4.1.). If clear design objectives, clear architectural style, clear

Table 4.4. Tests of Hypotheses

<i>Hypothesis Name</i>	<i>Hypothesis</i>	<i>Path Coefficient Direct Effect</i>	<i>Path Coefficient Indirect Effect</i>	<i>Path Coefficient Total Effect</i>	<i>Predicted Direction</i>	<i>Status of hypothesis</i>
H1	LIL → LPL	0.20	-----	0.20	+	Accepted
H2	LPL → LFL	0.32	-----	0.32	+	Accepted
H3	LIL → PF	-----	0.05 *	0.05	+	Accepted
H4	LPL → PF	-----	0.26 **	0.26	+	Accepted
H5	LFL → PF	0.81	-----	0.81	+	Accepted
H6	FF → LIL	0.70	-----	0.70	+	Accepted
H7	FF → LPL	0.42	0.14***	0.56	+	Accepted
H8	FB → LPL	0.38	-----	0.38	+	Accepted
H9	FB → LFL	0.62	0.12****	0.74	+	Accepted
SEM Finding 1	FF → LFL	-----	0.18*****	0.18	+	
SEM Finding 2	FB → PF	-----	0.60*****	0.60	+	
SEM Finding 3	FF → PF	-----	0.15*****	0.15	+	

<i>Hypothesis Name</i>	<i>Hypothesis</i>	<i>Correlation Coefficient</i>	<i>Status of hypothesis</i>
H10	FF ↔ FB	0.90	Accepted

LIL	learning at individual level
LPL	learning at project level
LFL	learning at firm level
FF	feed-forward
FB	feedback
*	indirect effect of learning at individual level through learning at project level and learning at firm level on performance of the firm.

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Table 4.4. (cont.)

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**	indirect effect of learning at project level through learning at firm level on performance of the firm.
****	indirect effect of feedback through learning at project level on learning at firm level.
*****	indirect effect of feed-forward through learning at project level on learning at firm level.
*****	indirect effect of feedback through learning at project level and learning at firm level on performance of the firm.
*****	indirect effect of feed-forward through learning at individual level, learning at project level and learning at firm level on performance of the firm.

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business objective are communicated through individual professionals, learning at individual level is significantly achieved. Individual professionals' desire is to be part of design decisions and other decision-making mechanisms including but not limited to the decision to select a client, the offer to be made to a client, the composition and organization of the design team which in turn extends learning at individual level. Another effective factor in learning at individual level is architectural design knowledge and experience within a multi-participant working environment. The experience about the field of profession eliminates the wasted efforts in learning unnecessary things and slow learning. As claimed in the literature and in the hypothesis, the result that if the individual professionals employed by architectural design firms are involved in extensive learning, the learning at project level is likely to be more extensive. Thus, Hypothesis 1 was accepted.

Kim (1993) claims that individual mental model alone is not sufficient to achieve learning at firm level. Therefore, there is a need to organize the fragmented learning into shared ones through the design and implementation of micro worlds and learning laboratories as Senge (1990) suggested. Though learning at individual level is important to learning at firm level, learning at firm level is not simply the sum of each individual's learning (Fiol and Lyles, 1985). Groups are a microcosm of organizations (Cohen and Bacdayan, 1994). Therefore firms develop and maintain learning systems within the organizational context (Lawrence and Dyer, 1983; Martin, 1982; Mitroff and Kilmann, 1976). As literature states learning at project level may have an impact on learning at firm level. Hypothesis 2 posits that 'learning at project level affects learning at firm level'. As in Figure 4.5. the path coefficient of 0.32 that represents this relationship was statistically significant and positive. The finding validates the existence of an impact. The maximization of this impact can be enabled with the highest scored factors namely; "encouraging different points of view", "considering every team member's ideas", "effective conflict resolution" and "generation of practical and new solutions". The loadings of related factors are listed in Table 4.1. The highest ranked factors evidenced that appreciating design professionals' ideas relative to design alternatives, management issues, business decisions; appreciating each individual professional's ideas in every phase of the project; encouraging on-time and effective response to conflicts; and skills, abilities, and creativity in solving design, business, and third party problems in timely, practical, and innovative ways leads

extensive learning at project level and in turn impacts learning at firm level. This result suggests that architectural design firms that display extensive learning at project level can expect to experience increased learning activity at firm level. Thus, Hypothesis 2 was accepted.

The primary rationale of learning activities in organizations is improving performance based on individual level learning stock to the workplace (Rothwell and Sredl, 2000). Bandura (1997) states that individual's behavior changes organizations. The impact of socio-structural factors on organizational performance is mediated by individual learning. DeLong (2004) puts forward that learning at individual level is one of the key factors to improve performance. Broad (2003) suggests that the learning at individual level improves performance. Song et al. (2008) consistently posits that performance improvement is strongly associated with learning at individual level and the transfer of learned knowledge to the workplace. Scholars such as DeLong (2004), Gupta and Sharma (2004), and Senge (1990) take learning of an individual professional as a fundamental factor for competitiveness. Hypothesis 3 posits that 'learning at individual level affects performance of the firm'. By contrast of the literature, according to the path coefficients displayed in Figure 4.1., the relationship between learning at individual level and performance of the firm (0.02) was not statistically significant. As Senge (1990) states that individual learning does not guarantee organizational learning by itself. Therefore this relationship had to be dropped out of the model. However, performance of the firm is also indirectly affected by learning at individual level as evidenced by the indirect path coefficient of 0.05 (Table 4.1.). In other words, the finding indicates that improvement in learning at individual level has a positive, albeit indirect impact on performance of the firm, mediated by learning at project level and learning at firm level. This result suggests that architectural design firms that display extensive learning at individual level can expect higher firm performance. Thus, Hypothesis 3 was accepted.

Bontis et al. (2002) suggest that some project level activities such as; dialogue (Isaacs, 1993) and communities of practice (Seely-Brown and Duguid, 1991) may foster a better performance. Liebeskind (1996) claims that the knowledge generated at learning at project level may lead competitiveness. Therefore, performance is expected to increase associated with the increase of learning at project level. Hypothesis 4 claims that 'learning at project level affects performance of the firm'. Bontis et al.

(2002) found that learning at project level has an impact on performance. Controversially to the literature, according to the path coefficients displayed in Figure 4.1. the relationships between learning at individual level and performance of the firm (-0.01) was not statistically significant. This relationship had to be dropped out of the model. In addition, performance of the firm is indirectly affected by learning at individual level as evidenced by the indirect path coefficient of 0.26 (Table 4.1.). In other words, the finding indicates that improvement in learning at project level has a positive, albeit indirect impact on performance of the firm, mediated by learning at firm level. This result suggests that architectural design firms that display extensive learning at project level can expect higher firm performance. Thus, Hypothesis 4 was accepted.

Senge (1990) suggests that the long run superior performance depends on learning of an organization. Fiol and Lyles (1985) suggest that it is possible to presume that learning will improve future performance. Goh (1998) and Shaw and Perkins (1991) claim that organizations that have learning enabling visions are performing better than competitors. Goh and Ryan (2002) suggested that learning of a firm is associated with performance. Some authors (Senge, 1990; Harung, 1996; Cunningham and Gerrard, 2000) assume learning, as one of the strategic means of long-term performance. As hypothesized by Liao and Wu (2009), learning at firm level is positively related to performance. Liao and Wu (2009) tested learning at firm level on performance and the result is found to be partially significant. Calantone et al. (2002) evidenced that learning at firm level is positively associated with performance of the firm. Bontis et al. (2002) found that learning at firm level has an impact on performance. Hypothesis 5 posits that ‘learning at firm level affects performance of the firm’. When one looks at the final refined model in Figure 4.5., one sees that learning at firm level effects performance of the firm (path coefficient = 0.81). According to the findings the higher the learning at firm level is, the higher the performance of the firm will be. Therefore, the three highest scored factors are as follows; “effective work environment”, “trust in all levels in firm”, “effective operational procedures”, “growth aligned vision”, and “effective competing strategy”. The loadings of related factors are listed in Table 4.1. The factors that are the most effective on learning at firm level are evidenced that a learning-oriented culture, open communication channels, easy accessible technical hardware and software, and comfortable work conditions enable the extensive learning

at firm level. Harmony and trust in social relationships within the firm and in relationships with third parties, sharing needed knowledge resources are other effective elements in achieving a higher degree of learning at firm level. Defined and effective processes and systemic working mechanisms trigger learning at firm level. A vision that involves growth in a specialized field and that aims to capitalize on accumulated expertise to expand to other fields and a competing strategy foster learning at firm level. This result suggests that architectural design firms that display extensive learning at firm level can expect higher firm performance. Thus, Hypothesis 5 was accepted.

Learning stocks themselves are a basis for the learning flows (Prieto and Revilla, 2004). Organizational learning system consists of more than static relationships between individual professionals, project teams, and the firm. Learning flows are the agents that enable organizational learning to transform into a dynamic system. The adapted measurement instrument is the Strategic Learning Assessment Map (SLAM) that is developed by Crossan et al (1999). In reference of Strategic Learning Assessment Map the measurement scale for feed-forward enables to define whether learning at individual level and learning at project level feed-forward to learning at project and firm levels (e.g. changes to structure, systems, products, strategy, procedures, culture) and how feed-forward capability affects the extent of learning at the level that it is provided by. Hypothesis 6 posits that ‘feed-forward has an impact on learning at individual level’. As in Figure 4.5. the path coefficient of 0.70 that represents this relationship was statistically significant and positive. This result suggests that architectural design firms that feed-forward can expect to experience increased in feed-forward learning activity via learning at individual level. This result also suggests that architectural design firms that display feed-forward can expect extensive learning at firm level, which in turn affects performance of the firm. Thus, Hypothesis 6 was accepted. Hypothesis 7 claims that ‘feed-forward has an impact on learning at project level’. As in Figure 4.5. the path coefficient of 0.42 that represents this relationship was statistically significant and positive. The indirect effect of feed-forward on learning at project level is presented in Table 4.4. This finding indicates that the capability feed-forward has indirect impact on learning at project level as evidenced by the indirect path coefficient of 0.14 (Table 4.4.). In other words, feed-forward, albeit indirect impact on learning at project level, mediated by learning at

individual level. The total impact of feed-forward on the extent of learning at project level is 0.56 as presented in Table 4.4. This result suggests that architectural design firms that have the capability of feed-forward can expect to experience an increase in learning at project level which in turn affects performance of the firm. Thus, Hypothesis 7 was accepted. The highest ranked factors for feed-forward are “ideas for design development”, “generation of innovative ideas”, “improved design processes via project outcomes”, “knowledge sharing”, “ideas for development of firm”, and “shared lessons learned”. Achieving high scores in those factors depends on the extent to which ideas generated by design professionals are used in design development, adding value in projects to the extent to which design professionals generate innovative ideas, to put forward original, practical, and state-of-the-art solutions, to the extent to which project outcomes are used to improve design processes, outcomes from the previous projects, to the extent to which design professionals share knowledge with each other, extent to which ideas generated by design professionals are used in development of firm, extent to which lessons learned by a design professional are shared with others.

Feedback mechanisms are increasingly being recognized as key elements of learning (Serrat, 2009). Project team leaders are mentioned by scholars (Garvin, 1993; McGill et al., 1993) to be important for fostering a learning climate through feedback seeking behavior, being open to criticism, and admitting mistakes. Goh and Ryan (2008) claim that such practices and behaviors as; willingness to acknowledge and learn from failures, an orientation to encouraging continuous experimentation, acquiring and sharing of knowledge, emphasis on group-problem solving and collective learning and leaders that are open to feedback and new experiences are important in promoting organizational learning. Feedback can be defined as the process of reorganizing the existing knowledge schemas of the firm. Reorganizing is a continuous genesis and a process of creation and recreation, as Piaget describes in 1968. In reference of Strategic Learning Assessment Map (SLAM), the scale for feedback enables to define whether learning at firm level and learning at project level feed back to learning at project level and learning at individual level. The measurement scale for feedback also explains how feedback capability affects the extent of learning at the levels that feedback is provided by. Hypothesis 8 puts forward that ‘feedback has an impact on learning at project level’. As in Figure 4.5. the path coefficient of 0.38 that represents this relationship was statistically significant and positive. This result

suggests that architectural design firms that employ feedback can expect to experience increased feedback learning activity via project level. Thus, Hypothesis 8 was accepted. Hypothesis 9 postulates that ‘feedback has an impact on learning at firm level’. As in Figure 4.5. the path coefficient of 0.62 that represents this relationship was statistically significant and positive. The indirect effect of feedback on learning at firm level is presented in Table 4.4. This finding indicates that feedback has an indirect impact on the extent of learning at firm level as evidenced by the indirect path coefficient of 0.12 (Table 4.4.). In other words, feedback, albeit indirect impact on learning at firm level, mediated by learning at project level. The total impact of feedback on learning at firm level is 0.74 as presented in Table 4.4. This result suggests that architectural design firms that employ feedback can expect to experience increased learning activity at project level. Thus, Hypothesis 9 was accepted. The factors of feedback that are highest in score are “appropriate structure to share acquired knowledge”, “dissemination of objectives”, “firm is endowed with a collective memory”. Achieving high scores in these factors depends on the extent to which information system, computerized databases, and effective communication systems to share acquired knowledge, enabling knowledge sharing among professionals and project teams, extent to which the objectives of the firm are disseminated, architectural design firm’s management goals and objectives are shared throughout the firm, to the extent to which the firm is endowed with a collective memory that shapes professionals behaviors, architectural design firm’s organizational knowledge repository that is fed by collective memory with a cooperative effort.

Feed-forward is needed to learn new knowledge and interpret the environment. Feedback of routines is utilized in needed conditions, at the time of making accurate investigation and comparison is made to previous projects. Gupta et al. (2006) state that the relationship between feed-forward and feedback depends on whether the two compete for scarce resources and whether or not the analysis focuses on a single or on multiple domains. Gupta et al. (2006) posit three considerations such as; the scarcer the resources needed to pursue both feed-forward and feedback, the greater the likelihood that the two will be mutually exclusive; within a single domain, feed-forward and feedback will generally be mutually exclusive; across different and loosely coupled domains, feed-forward and feedback will generally be orthogonal, in that high levels of feed-forward or feedback in one domain may coexist with high levels of feed-

forward or feedback in the other domain. Van Deusen and Mueller (1999) put forward that “feed-forward is negatively related to feedback”. Authors found that the hypothesis is supported in that there is a negative correlation between feed-forward and feedback. Hypothesis 10 claims that feed-forward and feedback have an inter-relationship, which is evidenced in Table 4.4. Contrary to Van Deusen and Mueller (1999), there is a positive correlation between feed-forward and feedback and the coefficient that is representing this relationship is 0.90 (Table 4.4.). The finding of hypothesis appreciated the third premise of Gupta et al. (2006). Since learning flows are executed via using the same channels, there is a strong correlation between these two learning flows. In other words, learning flows increase and decrease correlatively and accordingly, learning at all levels are affected by this correlative acceleration. The project-based environment of the field of architecture profession leads to use both of learning flows. This result suggests that architectural design firms that improve one of learning flows can expect improvement in the other learning flow, in learning at all levels, and accordingly in performance of the firm.

There are findings that are provided by the structural equation modeling (SEM) software, which lets to calculate indirect and total effect relationships among latent variables. In spite of not being hypothesized other three major findings are assigned. One of these findings is that SEM Finding I, which posits that “feed-forward has an indirect impact on learning at firm level”. The indirect affect of feed-forward on learning at firm level is presented in Table 4.4. This finding indicates that feed-forward learning flow has positive indirect impact on learning at firm level as evidenced by the indirect path coefficient of 0.18 (Table 4.4.). In other words, feeds forward, albeit indirect impact on learning at firm level, mediated by learning at individual level and learning at project level. This result suggests that architectural design firms that feed-forwards can expect improvement in learning at firm level via improvements in learning at individual and project levels.

Feedback is the dynamic process of presenting and disseminating information to improve performance (Serrat, 2009). SEM Finding II is that “feedback has an indirect impact on performance of the firm” as evidenced by the indirect path coefficient of 0.60 (Table 4.4.). In other words, feedback, albeit indirect impact on performance of the firm, mediated by learning at firm level. This result suggests that architectural

design firms that feedbacks can expect improvement in performance via improvement in feedback.

The performance of organizational learning as a whole is more than the sum of learning at each level. Based on the basic organizational learning cycles that are developed earlier (March and Olsen, 1975; Hedberg, 1981; Kim, 1993), there are various ongoing learning cycles and processes. SEM finding III is that ‘feed-forward impacts performance of the firm’. The indirect effect of feed-forward on performance of the firm is presented in Table 4.4. This finding indicates that “feed-forward has indirect impact on performance of the firm” as evidenced by the indirect path coefficient of 0.15 (Table 4.4.). In other words, feeds forward, albeit indirect impact on performance of the firm, mediated by learning at project level and learning at firm level. This result suggests that architectural design firms that feed-forwards can expect improvement in performance through improvement in learning at project level and learning at firm level.



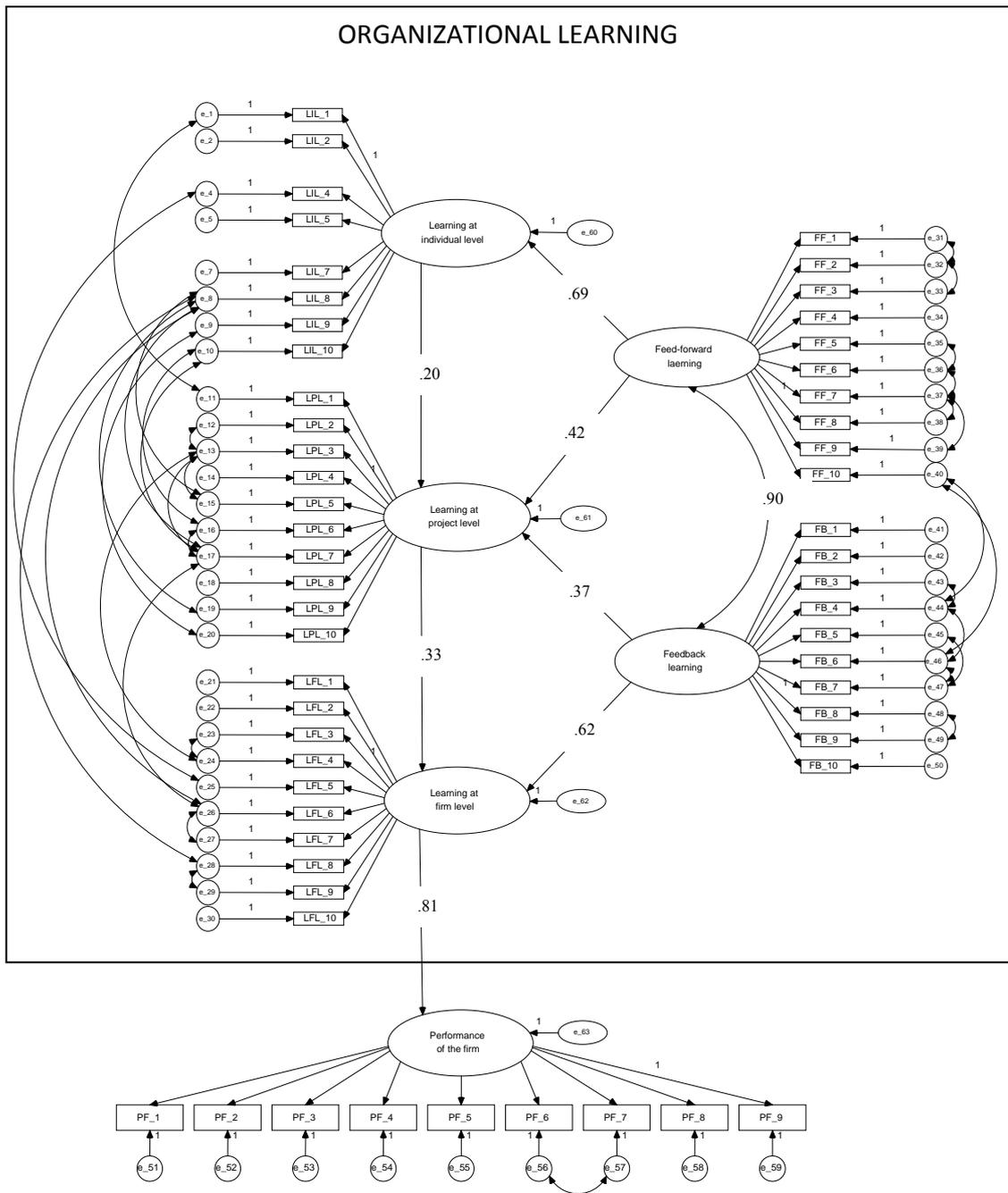


Figure 4.4. Conceptual model IV for assessing the impact of organizational learning on performance of the firm.

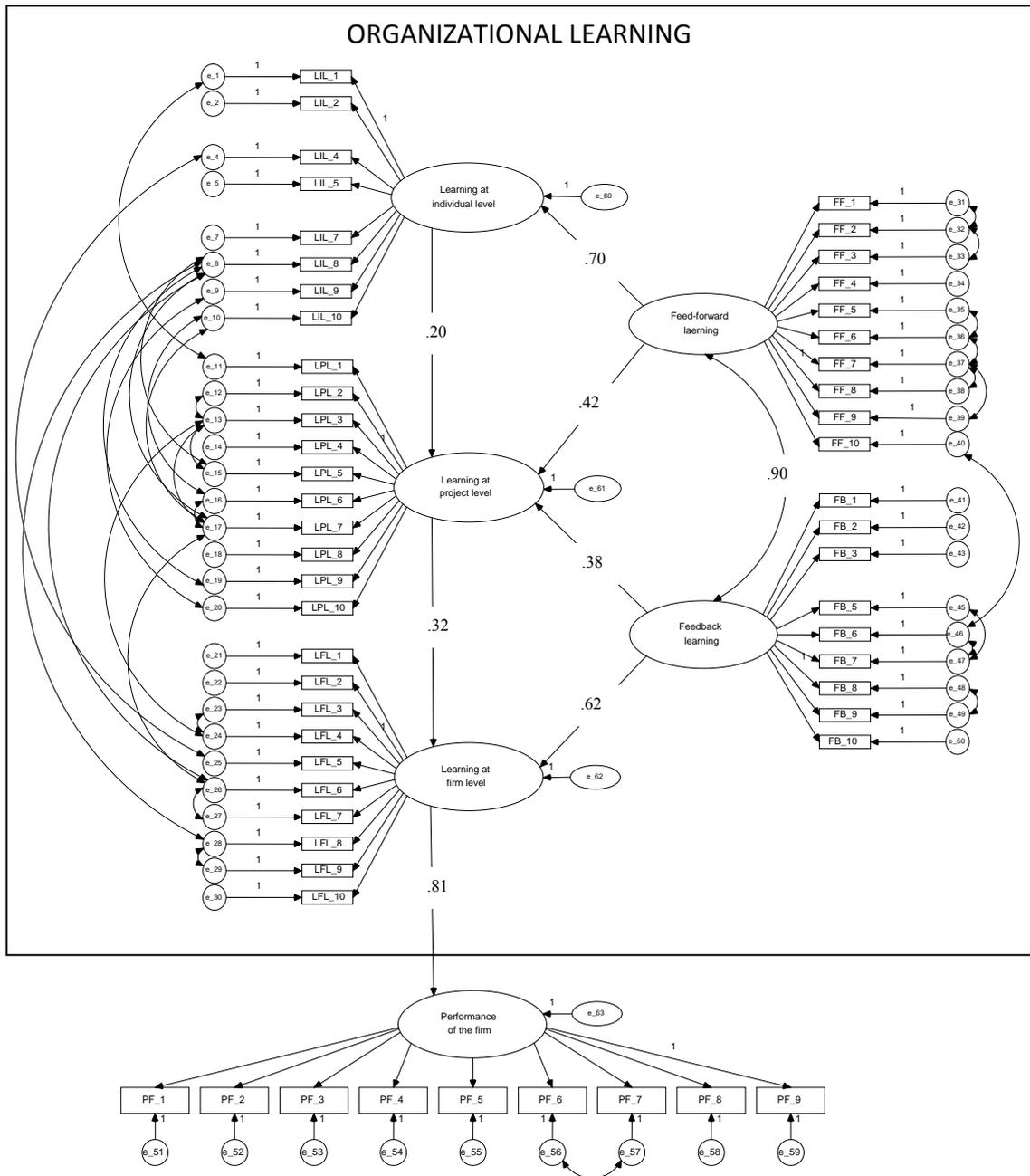


Figure 4.5. Refined model for assessing the impact of organizational learning on performance of the firm.

## CHAPTER 5

### CONCLUSIONS

Architectural design firms compose art in a limited time and competitive environment. Effective and efficient working, and keeping up the quality of work in satisfactory level is not an easy issue in project-based and multi participant industries. However, learning is the path to remain competitive. Despite the fact that architectural design firms structured in three working units (individual, project, and firm levels), these working units learn by themselves and from each other. The knowledge repository within a unit is called a 'learning stock'. The transfer of these learning stocks can be enabled by the flow among units. These flows are called 'learning flows'. The learning stocks of all levels are transferred from one to another by feed-forward and feedback activities via related levels.

This thesis is established to hold forth an evident fact that there is a relationship between organizational learning and performance in architectural design firms. An attempt was made in this study to assess the relationship between learning stocks, learning flows, and the performance of the firm. The Strategic Learning Assessment Map (SLAM) was adapted as a measurement instrument in reference to architectural design firms. Data were collected from architectural design firms in Turkey through a questionnaire survey to record the organizational learning (learning at individual, project, firm levels and feed-forward and feedback), and to measure performance of those firms. The research was conducted by means of a structural equation model (SEM) that investigated the relationship between organizational learning and performance of the firm. A model was constructed according to the theoretical background. Statistical tests indicate that the validity and reliability of the model's variables and the fit of the overall model were satisfactory. Hypotheses are tested via performing structural equation modeling method. Thirteen findings are noted in this research. The method has another overture apart from dealing with the relationships among latent variables. This overture is to picture the indirect and total effect relationships of variables among each other in addition to direct relationships.

The tests of the hypotheses are based on the strength of the path coefficients between the latent variables in the model (see Figure 4.5.) and direct, indirect and total effects (see Table 4.4.). All hypotheses were tested at  $p \leq 0.05$  significance level. The interpretation of the findings of thirteen hypotheses involves three central considerations. The first is related to the inter-relations of learning stocks. The second is related to the inter-relations of learning flows, and learning stocks. The third consideration is the relationship between organizational learning and performance of the firm. A brief examination of research results are placed in the above mentioned disposition.

### ***First Consideration : The inter-relationships among learning stocks***

The first premise of the thesis is the inter-relationships among learning stocks. There are two hypotheses that investigate the direction and the power of relationships. The hypotheses test whether stocks of learning affect each other and if so, do they result in an improvement in stocks. Since the main consideration of the research is to examine the impact of organizational learning on performance of the firm, learning at all levels are questioned for their impact area. Klein (1998) states that the firm as a system of combination of individuals, project teams and firm itself has a complex environment of learning. The nature of the working environment and firm structure of architectural design firms led the research to shift in multi-level perspective of organizational learning. The levels of learning for an architectural design firm are learning at individual, project, and firm level. As literature claims that learning in an organization is not only realized by individuals, but by individual professionals, project team, and the firm itself. Learning accumulates in each level. The accumulated learning at all levels called learning stocks. After an intensive literature review and the construction of the subject on architectural design firms, two hypotheses are put forward within the first premise. The questioned hypotheses are as follows; “learning at individual level affects learning at project level” and “learning at project level affects learning at firm level”.

1. Hypothesis 1 posits that “learning at individual level affects learning at project level”. Some scholars (Argote and McGrath, 1993; McGrath, 1991) affirm that

individuals have an impact on the learning at project level. As seen in Figure 4.5. the path coefficient of 0.20 that represents this relationship in the refined model was statistically significant and positive. The prevailing perspective of literature about the subject is supported by that finding. In spite of being statistically significant the result is not satisfying. In that point, the main dilemma may be the ad hoc structure of project-based organizations. Rather than knowing everything about a one-of-a-kind project, architects learn by the project. Since every project is unique in construction industry, the questions that trigger learning appear with the project. The results also show that the fundamental factors of learning at individual level are about “clarity of objectives”, “feeling of empowerment”, and “experience and proficiency in field of work” respectively (Table 4.1.).

Kim (1993) argues that individual schemas alone are not sufficient to achieve learning at firm level. As Senge (1990) claimed, there is a need to organize the fragmented learning into shared mental models. Literature leads the perspective that learning at project level may have an impact on learning at firm level.

2. Hypothesis 2 posits that ‘learning at project level affects learning at firm level’. As seen in Figure 4.5. the path coefficient of 0.32 that represents this relationship was statistically significant and positive. The finding suggests that the existence of the impact is validated. The fundamental factors of this latent variable are “encouraging different points of view “, “considering every team member’s ideas “, “effective conflict resolution“ and “generation of practical and new solutions“ (Table 4.1.).

These results suggest that architectural design firms that is passionate to display extensive learning at project level must improve learning at individual level. If the improvement in learning at firm level is expected to be extensive, learning at project level must be improved by the factors presented. Two hypotheses within the context of the relationship among learning stocks are accepted.

***Second Consideration : The inter-relationships among learning stocks and learning flows***

The second premise of the thesis is the inter-relationships among learning stocks and learning flows. There are five hypotheses and one SEM Finding that investigate the direction and the power of relationships. The hypotheses 6 and 7 test whether and how learning at individual level feeds forward into learning at project level and learning at firm level which in turn enables the changes to structure, systems, products, strategy, procedures, culture. There is another finding suggested by the Structural Equation Modeling (SEM). The premise of the method is to measure the indirect and total effects of latent variables one on another. Thus the SEM Finding 1 is calculated. The hypotheses 8 and 9 test whether and how the learning that is embedded in the firm as; systems, structure, strategy, affects learning at project level and learning individual at level. There is another hypothesis that is stated within the second consideration of the thesis. Hypothesis 10 claims that there is an inter-relationship between feed-forward and feedback.

Learning flows are used to transform organizational learning into a dynamic system. The Strategic Learning Assessment Map (SLAM) that is developed by Crossan et al. (1999) is adapted for measurement. In reference of Strategic Learning Assessment Map the measurement scale enables one to define whether learning at individual level and learning at project level feed-forward to learning at project and firm levels and by which factors that is enabled.

1. As stated in Hypothesis 6 ‘feed-forward has an impact on learning at individual level’ with the path coefficient of 0.70 that represents this relationship was statistically significant and positive (Figure 4.5.). This result suggests that architectural design firms that feed-forward can expect to experience increased in feed-forward learning activity via learning at individual level and an extensive learning at firm level, which in turn affects performance of the firm.
2. As claimed in Hypothesis 7 ‘feed-forward has an impact on learning at project level’ has the path coefficient of 0.42, which represents that the relationship was statistically significant and positive (Figure 4.5.). The indirect effect of feed-forward on learning at project level mediated by learning at individual level is evidenced by the indirect path coefficient of 0.14 (Table 4.4.). The total impact of feed-forward on learning at project level is 0.56 as presented (Table 4.4.). This result suggests that architectural design firms that feed-forward can expect

to experience increased feed-forward learning activity via project level which in turn affects performance of the firm.

The highest ranked factors for feed-forward are “ideas for design development”, “generation of innovative ideas”, “improved design processes via project outcomes”, “knowledge sharing”, “ideas for development of firm”, and “shared lessons learned”.

Learning is about building schemas, the state of unbalance caused by learned things in case of new learning, and reorganizing the existing schemas according to the new knowledge, a continuous genesis and a process of creation and recreation, as Piaget describes in 1968. The adapted instrument’s feedback measurement section is designed to assess “whether and how the learning that is embedded in the firm (e.g. systems, structure, and strategy) affects learning at individual and project level”. In reference of Strategic Learning Assessment Map the measurement scale enables one to define whether learning at firm level and learning at project level feedback to learning at project and individual levels and by which factors that is enabled.

3. As Hypothesis 8 puts forward ‘feedback has an impact on learning at project level’ with the path coefficient of 0.38 that represents this relationship was statistically significant and positive (Figure 4.5.). This result suggests that architectural design firms that employ feedback can expect to experience increased feedback learning activity via project level.
4. As Hypothesis 9 postulates ‘feedback has an impact on learning at firm level’ with the path coefficient of 0.62 that represents this relationship was statistically significant and positive (Figure 4.5.). The indirect effect of feedback on learning at firm level is evidenced by the indirect path coefficient of 0.12 (Table 4.4.). Thus feedback, albeit indirect impact on learning at firm level, mediated by learning at project level. The total impact of feedback on learning at firm level is 0.74 (Table 4.4.). This result suggests that architectural design firms that feedback can expect to experience increased feedback learning activity via project level.

The factors of feedback that are highest in score are “appropriate structure to share acquired knowledge”, “dissemination of objectives”, “firm is endowed with a collective memory”.

5. Feed-forward is about gathering data and information, new learning and interpreting it into knowledge and wisdom. Feedback of wisdom and

knowledge is utilized in needed conditions. As Hypothesis 10 claims, feed-forward and feedback have an inter-relationship, which is evidenced by a positive correlation between feed-forward and feedback with the correlation coefficient of 0.90 (Figure 4.5.). Learning flows increase and decrease correlatively and accordingly. Since both learning flows are evidenced to have impact on learning stocks, learning at all levels are affected by this correlative acceleration.

6. As SEM finding 1 suggests “feed-forward has an indirect impact on learning at firm level” that feed-forward learning flow has positive indirect impact on learning at firm level as evidenced by the indirect path coefficient of 0.18 (Table 4.4.). Feed-forward albeit indirect impact on learning at firm level, mediated by learning at individual level and learning at project level. This result suggests that architectural design firms that can feed-forward may expect improvement in performance via improvements in learning at individual and project levels.

***Third Consideration : The relationship between organizational learning and performance of the firm***

1. Improving performance is the fundamental aim of learning in organizations via learning at individual level (Rothwell and Sredl, 2000). Many scholars (Bandura, 1997; De Long, 2004; Broad, 2003; Song et al., 2008; Gupta and Sharma, 2004; Senge, 1990) take learning of an individual professional as an important determinant of performance. Hypothesis 3 suggests that ‘learning at individual level affects performance of the firm’. However, it is evidenced that the path coefficient of 0.02 was not statistically significant (Figure 4.1.). However, performance of the firm is indirectly affected by learning at individual level as evidenced by the indirect path coefficient of 0.05 (Table 4.4.). Improvement in learning at individual level has a positive, albeit indirect impact on performance of the firm, mediated by learning at project level and learning at firm level.
2. Controversially to the literature the Hypothesis 4 namely, ‘learning at project level affects performance of the firm’ was not statistically significant with the

path coefficient of -0.01 (Figure 4.1.). As evidenced by the indirect path coefficient of 0.26, the improvement in learning at project level has a positive, albeit indirect impact on performance of the firm, mediated by learning at firm level (Table 4.4.).

3. As claimed in Hypothesis 5 'learning at firm level affects performance of the firm. Has a path coefficient of 0.81 (Figure 4.5.). According to the findings the higher the learning at firm level is, the higher the performance of the firm will be. The three highest scored factors are as follows; "effective work environment", "trust in all levels in firm", "growth aligned vision", "effective operational procedures" and "effective competing strategy".
4. The performance of organizational learning as a whole is more than the sum of learning at each level. There are different learning cycles and processes based on the earlier developed ones (March and Olsen, 1975; Hedberg, 1981; Kim, 1993). One of the learning methods apart from learning at all levels is feed-forward. Albeit indirect impact of feed-forward on performance of the firm, mediated by learning at project level and learning at firm level is evidenced by the indirect path coefficient of 0.15 (Table 4.4.).
5. As the dynamic process of presenting and disseminating information to improve performance (Serrat, 2009), feedback has albeit indirect impact on performance of the firm, mediated by learning at firm level, as evidenced by the indirect path coefficient of 0.60 (Table 4.4.).

The limitations of the current study are not numerous but should be considered when discussing the findings. First, this research took place within the frame of reference of one branch (architectural design firms) of a complex system (the construction industry). Thus, a generalization about the construction industry could not be made as a conclusion of this research. Second, this research commented only on local firms, excluding inter-organizational and international relationships. However, architectural design firms operate in the complex environment of the construction industry where relationships with clients, contractors and consultants cannot be ignored. The impact of external dynamics of organizational learning should be researched in the future. Third, since the employee number of architectural design

firms is limited compared to large organizations, one should be careful while interpreting the results of this study.

In conclusion, this research has shown that firm performance can be enhanced through feed-forward, feedback, and effective learning across individual, project and firm levels. The results of this research support the premise that there is a positive relationship between learning at firm level and performance of the firm, and that learning at firm level is dependent on learning at project level, which is dependent on learning at individual level. The relationship between learning flows and learning stocks is evidenced by the structural equation model. Feed-forward has positive effect on learning at individual and project levels which in turn has an impact on performance of the firm. Feedback has an effect on learning at project and firm levels which in turn has an impact on performance of the firm. The analysis of the acquired data confirms that learning at all levels, feed-forward, and feedback are vital considerations in the management strategy of an architectural design firm as related to improve its performance. Hence, any effort dedicated to encourage organizational learning has a powerful probability to improve performance of the firm.

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# APPENDIX A

## QUESTIONNAIRE DOCUMENT

### A. Firm's Generic Information

1. Firm Name : .....
  2. Firm Address:.....
  3. Firm Tel. : ..... Fax:.....
  4. Firm URL : ..... e--mail:.....
- 
- 

5. The average number of annual permanently personnel employed in your firm.

<i>Employment Type</i>	<i>Number</i>
Management Personnel (General manager and vice directors, department managers, etc.)	.....
Technical Personnel (engineer, architect, technician, etc.)	.....
Non-Technical Personnel	.....
Total	.....

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6. The demographic investigation of the personnel employed in your firm.

<i>Demographic Investigation</i>	<i>Number</i>	<i>Average Age</i>
Women Employee	.....	.....
Men Employee	.....	.....

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7. Determine the production amount in terms of m<sup>2</sup> and the production value of projects that are held by your firm in USD in last five years.

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Total production in m <sup>2</sup>	.....
Total value in USD	.....

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8. Determine the field of expertise of your firm.

---

<i>No</i>	<i>Field of Expertise</i>
1	
2	
3	

---

9. Which is/are your target market segment in the sector?

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<i>Type of market segment</i>	<i>Yes</i>	<i>No</i>	<i>Level of income</i>
Public organizations	.....	.....	
Private organizations	.....	.....	
Private individuals	.....	.....	Low Income : .....
			Middle Income : .....
			High Income : .....

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## **B. Measurement of Organizational Learning in the Architectural Design Firm**

Please answer the questions by highlighting your choice from 1 to 5 according to Likert Scale mentioned below;

**1** Absolutely Disagree, **2** Disagree, **3** Neutral, **4** Agree, **5** Strongly Agree

### **a) Learning Stocks**

#### **I. Learning at individual level**

Individual competence, capability and motivation to undertake the required tasks.

1. Individual professionals feel pride in their work and in firm by working in reputable projects and firm.

1      2      3      4      5

2. Individual professionals feel to be part of decisions making mechanism related to projects and firm.

1      2      3      4      5

3. Individual professionals have competing interests in their field of profession.

1      2      3      4      5

4. Individual professionals feel confidence in being included to all project phases and in job security.

1      2      3      4      5

5. Individual professionals have a clear sense of direction in their work that is stream lined by firm and the project content.

1      2      3      4      5

6. Individual professionals are able to develop new perspectives to see things in different views via awareness of innovations and adapting innovative ideas into projects.

1      2      3      4      5

7. Individual professionals can accomplish the critical issues of a project that are addressed by the firm during design project life cycle.

1      2      3      4      5

8. Individual professionals are aware of the critical determinants of performance that affect the project.

1      2      3      4      5

9. Individual professionals generate new and timely insights for design and management problems to sustain competitive.

1      2      3      4      5

10. Individual professionals are experienced and proficient about their field of work.

1      2      3      4      5

## **II. Learning at project level**

Group dynamics and the development of understanding of shared learning.

1. Different points of views of individual professionals are encouraged in project team and in firm.

1      2      3      4      5

2. Project team members are prepared to rethink decisions when presented with new information.

1      2      3      4      5

3. Project teams have the right people involved in addressing the issues.

1      2      3      4      5

4. Each member of design team's point of view is appreciated in every phase of the project.

1      2      3      4      5

5. On-time and effective conflict resolution is encouraged when working within project teams and with clients in projects.

1      2      3      4      5

6. Project team members have diversity in their backgrounds which leads to have the ability to adapt to different types of projects that the firm is contracted.

1      2      3      4      5

7. Project team members have the common understanding about the critical requirements of the project.

1      2      3      4      5

8. Project success is shared by each member of the related project team.

1      2      3      4      5

9. Project failure is shared by each member of the related project team.

1      2      3      4      5

10. Team working in projects results in generation of practical and new solutions.

1      2      3      4      5

### **III. Learning at firm level**

Organizational dynamics and the improvement of understanding of firm level learning.

1. Firm structure allows smooth exchange of information and encourages the capture of information.

1      2      3      4      5

2. Firm environment (learning-oriented culture, open communication channels, availability of technical hardware and software, and comfortable work conditions) is efficient for learning and learning by knowledge sharing.

1      2      3      4      5

3. The firm has a competing strategy that is based on rapid response and achievement of great reputation.

1      2      3      4      5

4. The firm has intention to expand profession fields in a growth aligned vision.

1      2      3      4      5

5. The firm culture lays on trust through all levels within the firm and with third parties.

1      2      3      4      5

6. Firm's well defined operational procedures allow professionals to work smoothly, productively, and efficiently.

1      2      3      4      5

7. The firm culture is innovative in design and management decisions.

1      2      3      4      5

8. The firm's robust short-term and long-term strategies are targeted to achieve growth, to expand market share, increase reputation, and competitiveness.

1      2      3      4      5

9. Systems of the firm are continuously developing for achieving rapid response to dynamic work environment.

1      2      3      4      5

10. The firm has an effective transformation system of acquired data into information, knowledge, and wisdom, and well designed dissemination methods to utilize the stocks of knowledge in all levels of the firm through all project processes.

1      2      3      4      5

## **b) Learning Flows**

### **I. Feed-forward**

Whether and how learning at individual level feeds forward into learning at project level and learning at firm level (e.g. changes to structure, systems, products, strategy, procedures, and culture).

1. Ideas of individual professionals and project team are used to develop the project and to avoid unnecessary changes during design project life cycle.

1      2      3      4      5

2. Individual professionals and project team recommendations are adopted by the firm.

1      2      3      4      5

3. Professionals input into the firm's long-term strategy by making projections.

1      2      3      4      5

4. Innovative solutions are developed for the requirements of the project by the individual professionals and project team.

1      2      3      4      5

5. Outcomes from the previous projects are used to improve project processes.

1      2      3      4      5

6. Lessons learned by a professional are actively shared with others.

1      2      3      4      5

7. All professionals are cognizant of each other's duties and responsibilities in the project.

1      2      3      4      5

8. Professionals share knowledge with each other.

1      2      3      4      5

9. Professionals can anticipate future mistakes and make appropriate assumptions to avoid probable failures.

1      2      3      4      5

10. Benchmarking and best practices are used to improve project processes, procedures, policies and systems.

1      2      3      4      5

## II. Feedback

Whether and how the learning that is embedded in learning stocks flow in the firm (e.g. changes in behaviors, attitudes of individual professionals and in processes of project team).

1. Collective decisions influence individual professionals' works.

1      2      3      4      5

2. The objectives of the firm are disseminated to professionals.

1      2      3      4      5

3. Databases of knowledge are made available to professionals.

1      2      3      4      5

4. Policies and procedures are articulated to stream line the feedback process.

1      2      3      4      5

5. Training programs improve professionals' efficiency of learning from past and increase the knowledge shared.

1      2      3      4      5

6. Recruiting processes affect the hiring of professionals sensitive to the feedback process.

1      2      3      4      5

7. Reward system encourages professionals' feedback activities.

1      2      3      4      5

8. Cross-training of professionals promotes sensitivity to feedback.

1      2      3      4      5

9. Information system, computerized databases, and effective communication system are used to share acquired knowledge among professionals and project teams.

1      2      3      4      5

10. The firm is endowed with a collective memory that shapes professionals behaviors.

1      2      3      4      5

### **C. Measurement of Performance of the Architectural Design Firm**

Individual professional's, project teams' and firm's performance outcomes for related firm.

Please answer the questions by highlighting your choice from 1 to 5 according to Likert Scale mentioned below;

**1** Absolutely Disagree, **2** Disagree, **3** Neutral, **4** Agree, **5** Strongly Agree

1. The firm is successful in financial aspects such as; profitable project acquisition, employee turnover, and investment turnover.

1      2      3      4      5

2. The individual professionals are satisfied in the firm.

1      2      3      4      5

3. The clients of the firm are satisfied.

1      2      3      4      5

4. There is a state of readiness for future work performance and competitiveness in firm.

1      2      3      4      5

5. Project teams meet high performance targets.

1      2      3      4      5

6. Project team performs as a harmonious team.

1      2      3      4      5

7. Project team contributes to the firm strategy.

1      2      3      4      5

8. The firm is positioned for long-term business strategies.

1      2      3      4      5

9. Individuals are high performing as architectural professionals, project team leaders, and upper-level managers.

1      2      3      4      5

## VITA

Gözde Başak Öztürk-Barlak was born on 11th August 1980 in Söke. She attended Söke Hilmi Fırat Anatolian High School in Söke, and was graduated in 1998. She was admitted to European University of Lefke in September 1998 and received her bachelor's degree in Architecture in June 2002 being an honor student. She was accepted to the Masters of Business Administration Program in September 2002 and received her MBA Degree from European University of Lefke in February 2004 being a high honor student. She was accepted to the Masters of Science in Construction Management Program in February 2004 and received her M.Sc. Degree European University of Lefke in February 2006 being a high honor student.

She is accepted to the PhD in Architecture Program in İzmir Institute of Technology in September 2006. From February 2009 to February 2010 she worked as a visiting research scholar in the Department of Civil, Architectural, and Environmental Engineering, Illinois Institute of Technology, Chicago, Illinois, USA. From September 2008 to September 2009 she worked as a lecturer in the Department of Architecture, Girne American University, Girne, North Cyprus. From September 2007 to September 2008 she worked as a research assistant in the Department of Civil Engineering, European University of Lefke, Lefke, North Cyprus. From September 2007 to September 2008 she worked as a research member in Centre for Construction Innovation and Research, European University of Lefke, Lefke, North Cyprus. During her master degree, she established her own architectural design office in Didim. From September 2004 to September 2006 she worked as an architect in her architectural design office. From September 2002 to September 2004 she worked as a research assistant and a student advisor in the Department of Architecture, European University of Lefke, Lefke, North Cyprus. She is a member of the Chamber of Architects of Turkey.

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