An Empirical Study on Senge's Learning Organization Model : A Taxonomic Approach[*]

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The purpose of this paper is to examine whether the five constructs of Senge's learning organization model is empirically valid in a construction company in Korea and to identify what kinds of learning groups in the company and what different characteristics of these learning groups are existed.

The final number of teams used in the analysis is 154. Six constructs were identified by factor analysis and that result seemed to reflect the characteristics of Korean construction industry. Four learning groups were finally drived through multivariate data analysis including cluster analysis, ANOVA and duncan's multiple range test and each of them showed meaningful differences on the basis of Senge's five constructs.

Some limitations were discussed and future research directions were also suggested.

Ⅰ. Introduction

To learn more rapidly and increase flexibility in a world of growing complexity and change, firms are experimenting new modes of organization. Increasingly, attention is being focused on finding ways to make corporations more responsive to customers and enable them to provide higher-quality products(de Geus, 1988; Stata, 1989).

Bold statements such as "(a) the rate at which individuals and organizations learn may become the only sustainable competitive advantage, especially in knowledge-intensive industries"(Stata, 1989, p.64) and "(b) consensus is emerging that the hallmark of tomorrow's most effective organizations will be their capacity to learn" (Adler & Cole, 1993, p.85) are difficult to disagree with. It was predicted that "learning capability" and "learning organization" would become two

key concepts of management thinking in the 1990s(Ulrich, von Glinow, & Lick, 1993).

Recently, the notion of the learning organization is becoming "a very big conceptual catchall to help us make sense of a set of values and ideas we have been wrestling with, everything from customer service to corporate responsiveness and speed" (Kiechel, 1990, p.133). Inspired by the success of Senge's The fifth discipline(1990), many management consultants and researchers have jumped on the bandwagon. A number of books on how to develop a learning organization have come out during the past few years. These books based on the Senge' Model adopt a prescriptive stance and teach managers the way that a company should learn. More often than not, these pre-scriptions lack a solid empirical foundation (Tsang, 1997). In that sense, this paper is prepared to empirically test the Senge's learning organizational model.

The most important and fundamental stage of conducting scientific inquiry in any discipline is to classify research subjects or phenomena under investigation (Carper & Snizek, 1980). Generally there have been two ways for the classification. One is seeking typologies (deductive approaches) which are exclusively based on conceptual distinctions. Another is searching taxonomies (inductive approaches) which are particularly derived from multivariate analysis of empirical data for developing the new theoretical models or research issues (Miller & Frisen, 1984).

Especially, there are two major streams in empirical taxonomies. One stream is to expand a theoretical model by adding new variables to existing components of the model for further classification. Another stream is to test the external validity of existing theoretical constructs (Kim & Lim, 1988). This research mainly focuses on the latter by applying Senge's (1990a) learning organization model to a Korean construction company, called as "Company D."

Thus, explicit objectives of this study are as follow:

1. To examine whether the five constructs of Senge's learning organization model is empirically valid in a company in Korea; and

2. To identify what kinds of learning groups exist in the company, and what are different characteristics of these learning groups.

II. Literature Review

2.1 The Background of Learning Organization: From Individual Learning to Organizational Learning

Generally, organizational learning is a

concept used to describe certain types of activity that take place in an organization while the learning organization refers to a particular type of organization in and of itself. Nevertheless, there is a simple relationship between the two- a learning organization is one which is good at organizational learning(Tsang, 1997).

The literature relevant to the learning organization is voluminous. The term 'Learning Organization' is relatively recent but the idea has been around for a long time. Since the 1950s, the development of systems thinking, and particularly the socio-technical systems view of organizations, are probably most responsible for allowing us to imagine organizations as organisms that can learn (Pedler, Burgoyne, & Boydell, 1991).

The writings of Gregory Bateson(1973) on types of learning, especially his theory of 'deutero-learning', which concerns learning to learn, have been influential. John Gardner (1969) used the term 'self-renewal' and Gordon Lippitt(1969) 'organization renewal' to capture this living and learning quality they sought. The term 'learning system' was brought into the mainstream by Donald Schon(1971) and the same term is used by Reg Revans(1982) in the UK in 1969. Much of the literature is focused on the 'organization development' movement that has change as a central concern though it is often expressed rather too systematically

as 'planned organizational change'.

The recent interest in the learning organization perhaps begins with Argyris and Schon's *Organizational Learning*(1978). They are the first researchers conceptualizing organizational learning as knowledge accumulating process. Making a point that the change of cognitive level can be possible not only at the individual level but also at the organizational level, they concluded that the change of cognitive system at the organizational level is the most important key in organizational learning. Especially they distinguished between two levels of learning. The simplest is *single-loop learning*, which implies a change of action that does not violet a pre-established norm of effectiveness. The second level, *double-loop learning* leads to a change in the very norms defining effective behavior.

The most recent contribution on the conceptual building of learning organization was done by Senge(1990). Before discussing the concept of Senge's learning organization, some reviews on the evolution process of learning theories are required to understand it. Till the advent of Senge's Model, there have been a lot of informative learning theories at the individual level and organizational level independently.

In fact, organizations ultimately learn via their individual members. Hence, theories of individual learning are crucial for under-

standing organizational learning. Psychologists have studied individual learning for decades, but they are still far from fully understanding the working of the human mind. Likewise, the theory of organizational learning is still in its embryonic stage(Kim, 1993).

The importance of individual learning for organizational learning is at once obvious and subtle - obvious because all organizations are composed of individuals; subtle because organizations can learn independent of any specific individual but not independent of all individuals. Psychologists, linguistics, educators, and others have heavily researched the topic of learning at the individual level. They have made discoveries about cognitive limitations as well as the seemingly infinite capacity of the human mind to learn new things(Simon, 1957).

Piaget's focus on the cognitive development process of children and Lewin's work on action research and laboratory training have provide much insight into how we learn as individuals and in groups(Kolb, 1984). Some of these theories are based on stimulus-response behaviorism. Some focus on cognitive capabilities, and others on psychodynamic theory. Numerous other theories have been proposed, debated, and tested, such as Pavlov's classical conditioning, Skinners operant conditioning, Tolman's signing, Gestalt theory, and Freud's

psychodynamics(Kim, 1993). Most of above findings are based on the study of observable behavior. In summary, learning theory undertaking at the individual level is concerned with observable behavior, and neglects the cognitive processes of the individual.

There is, however, an alternative psychological approach which, unlike classical learning theory, concentrates on mental processes and cognitive interactions with the environment. In the course of these interactions, individuals create their own representation of their environment, based on experience, expectations and beliefs, and on previously developed cognitive patterns. The approach centers on changes in potential behaviors and in underlying cognitive structures (Bandura, 1977). This theoretical approach is better placed to explain how new behaviors arise.

If the cognitive approach is adopted at the individual level, the learning potential is a function of a person's insight, cognitive abilities, intelligence and experience. Experience are moulded by socially transmitted skills, motivational history, interests and value judgements. These factors exercise a strong influence on a person's learning ability and, together with the difficulty of the material to be learned, they determine progress in learning(Probst & Buchel, 1997). Despite all the research done to

date, we still know relatively little about the human mind and learning process(Kim, 1993). It seems that the more knowledge we gain, the more we realize how little we know.

Although much has been said about individual learning, surprisingly little systematic research and conceptualization have taken place in the area of organizational learning, where new knowledge is manifested in new structural arrangements, new culture, new collective action. According to systems theorists, they are concerned not so much with individual learning processes as with the system or organization as a whole. From this point of view, learning by an organization can be seen as the satisfaction of the needs of a collective. The primary focus of attention is the organization as a framework for individual action. Most analysts who approach organization learning from this angle give prominence in their theories to interactions between the individual and the organization(Argyris and Schon, 1978; Morgan, 1986; Hedberg, 1981; Probst & Buchel, 1997)

In the meanwhile, Levitt and March (1988) well conceptualized the concept of organizational learning on three classical observations drawn from behavioral studies of organization. The first is that behavior in an organization is based on routines (Cyert & March, 1963; Nelson & Winter,

1982). Action stems from a logic of appropriateness or legitimacy more than from a logic of consequentiality or intention. The second observation is that organizational actions are history-dependent(Lindbloom, 1959). Routines are based on interpretations of the past more than anticipations of the future. They adapt to experience incrementally in response to feedback about outcomes. The third observations is that organizations are oriented to targets(Simon, 1955). Their behavior depends on the relation between the outcomes they observe and aspirations they have for those outcomes. Sharper distinctions are made bewteen success and failure than among gradations of either. Within such a framework, organizations are seen as learning by encoding inferences from history into routines that guide behavior.

2.2 The Concept and Theoretical Meaning of Senge's Learning Organization

Recently the concept of a learning organization has got much attention as a useful tool for managing change and business innovation(Adler & Cole, 1993). Research and application practices relating to the concept have widely spread out due to The Fifth Discipline, a work of Peter Senge (1990a). He defines a learning organization as a place "where people continually

expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspirations is set free, and where people are continually learning how to learn together (Senge, 1990a: p.3)." Using five disciplines, he especially describes the dynamic process which transforms the dimensions of individual learning into the organizational learning process. Five disciplines of a learning organization he suggests are as follows: Shared Vision, Mental Models, Personal Mastery, Team Learning, and System Thinking.

Senge's learning organization model has two important characteristics: one is the relationship of the model to other theories in micro and macro organizational behavior, and another is the multifaceted interrelationship among five constructs. First, five constructs of Senge's learning organization model reflect some important theoretical features in micro and macro organizational behavior. These features can be explained briefly as follows (Figure 1):

Shared Vision: It means that members of an organization know and agree on what is a common goal of an organization and why it is important. Shared vision also enables people to be tied together around common identity and sense of destiny. Therefore, the vision should be created not by a leader or limited members of a brain

group alone but by continuous open communication among all members of an organization regardless rank and/or department. An organization should form shared vision through all members' participation with genuine commitment based on an organizational culture of open communication and trust. Thus, shared vision is a construct that is closely related to visionary and/or transformational leadership as well as organizational culture.

Mental Models: The concept of mental models refers to cognitive system that interprets surroundings. Mental models are referential frames or mind sets for understanding what happens outer world. Mental models are our internal pictures of the world which influence our understanding and action. Mental models reflect two kinds of cognition: semi-permanent perception and short-term perception. On going change in short-term perceptions gradually builds up and eventually has impact on an individual's long-term beliefs and strategic thinking. Therefore, mental models have close linkage to theories in the area of perception and strategic thinking.

Personal Mastery: It is an on going learning discipline that enhances ones capacity to create the results he or she truly aspires. Personal mastery helps one to pursue continuous clarification and deepening her or his vision. An organization
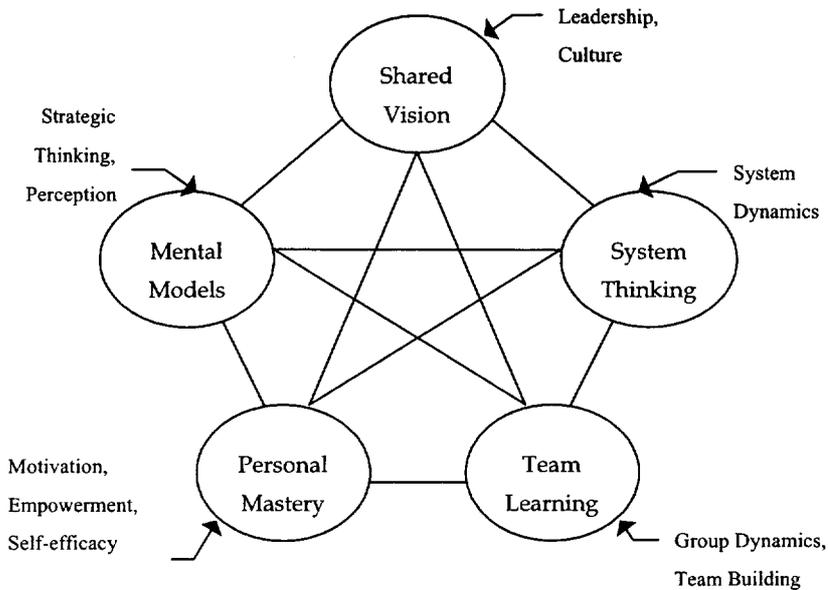
(Figure 1) Theoretical Bases of Five Disciplines(Sohn et all,1996)

can facilitate personal mastery by empowering and motivating individuals based on their self-efficacy. It is therefore closely related to theories in the area of organizational behavior such as motivation, empowerment and self-efficacy.

Team Learning: The concept systematically describes intended learning behaviors of a team for achieving organizational goals effectively. Members in a team, a key unit in a learning organization, have a genuine respect for each other with skillful conversation and collective thinking. A team can maximize its synergy effect through dialogue and skillful discussion. Therefore, team learning is closely related to group dynamics and team building as well as problem solving process and communication practices.

System Thinking: It is a problem solving mechanism that starts from seeing a whole rather than parts. It begins with a comprehensive understanding of causal relationship or dynamics among parts of a whole system rather than parts themselves and their static phenomena. The concept has been actively discussed, particularly among researchers from MIT since Forrester (1961) introduced the concept.

The essence of Senge's model is the connectivity of these five disciplines as shown in Figure 1 (Sohn et al, 1996). Although Senge's learning organization

model suggests a useful typology for organization change and development, its theoretical backgrounds are not discussed much. Furthermore, the empirical justification of the model has not been discussed yet. Sohn et al (1996) applied this model for the change and innovation processes of "Company D" by using case study method. This is an extension of our research effort for validating empirical evidence of Senge's model. This study attempts to conduct an empirical analysis of the model.

Another important characteristic of Senge's learning organization model is that it has a multifaceted interrelationship among five constructs as shown figure 1. Traditional research approaches in the field of organization theory and organizational behavior have tried to ensure conceptual consistency in order to enhance explanation power of phenomena. Furthermore, such interpretation has relied on static analyses based on bivariate analysis or limited multivariate analysis. However, traditional research methods have shortcomings or limitations in explaining nonlinear phenomena such as complex social reality with a high connectivity among variables and relationship of individuals and of organizations besides cross relationship between individuals and organizations (Hambrick, 1984).

Consequently, traditional research methods may see certain parts but not the whole.

Adding the new research methods that reflect complex social reality can be complementary to traditional research approaches. For this reason, this study adopts the research method that can take complex interrelationship among five constructs of Senge's learning organization model. In detail, after identifying five constructs using a factor analysis, a cluster analysis is to be undertaken in order to find out learning groups that show similar responses to those five constructs of a learning organization. Although this kind of approach is popular in the research field of defining strategic groups (Miller, 1986; Kim & Lim, 1988; Fahey & Christensen, 1986), it is the first try in the area of learning organization research in our knowledge. In this sense, this study is an exploratory study.

III. Method

3.1 Samples and Subject

This study focuses on teams in "Company D". The company has recently gone through a series of organizational innovation process. The construction industry in Korea has lately experienced rapidly changing business environments, so does "Company D." In order

to actively respond to the rapid change, "Company D" has restructured its structure from functional structure to divisional structure. At the same time, the company declared "Three-year Planned Management Revolution Project" in 1991, and had successfully implemented the project until 1993. The company also introduced BPR (Business Process Reengineering) in 1994 for the purpose of improving management practice. As the result, the company was able to form its new vision and long-term strategies for preparing the twenty first century.

In 1995, "Company D" initiated structural transformation to embody the new vision and long-term strategies. The outcome was a learning organization with team based structure. The company has declared for becoming a learning organization and encouraged its members to become lifetime learners while providing learning climate throughout the organization (Sohn et al, 1996).

In order to understand each team's char-

acteristics, we have focused on a team's key members who have enough knowledge and information on their team. However, it is difficult to identify who is a qualified key person in a team. Therefore, respondents for survey for each team are selected randomly, but including an official team leader for each team.

There are total 700 survey questionnaires distributed, and 512 questionnaires(73.1%) were collected. Among 512 questionnaires, researchers omitted 26 questionnaires which had unqualified responses for the analysis and 20 executives' responses since they were not a member of a team. Therefore, the number of questionnaires used in the analysis was 466(66.6%) in an individual level. In a team level, there were 196 teams in "Company D" in 1995, and the number of teams used in the analysis was 154(78.6%). Information regarding respondents' rank, position, job and function is presented in the Table 1 and Table 2, at a team level and at an individual level respectively.

〈Table 1〉 Composition of Teams

Business Function	Sample Number (%)
Sales	28 (18.2)
Architectural Construction/Housing	34 (22.1)
Public Sector	21 (13.6)
Research and Development	34 (22.1)
Management	37 (24.0)
Total	154 (100)

〈Table 2〉 Composition of Respondents

Classification	Area	Number	Percentage(%)
Rank (N=463), Missing: 3	1st line employees	221	47.7
	Managers	200	43.2
	General Managers	39	8.4
	Executives	3	0.6
Position (N=466)	Team Leaders	105	22.5
	Team Members	361	77.5
Job (N=465) Missing: 1	Civil Construction	84	18.1
	Architectural Construction(A.C.)	102	21.9
	Mechanical/Electronic/Equipment	101	21.7
	Office Works	172	38.3
Function (N=466)	Sales	67	14.4
	A.C./Housing	116	24.9
	Public Sector	83	17.8
	R&D	94	20.2
	Management	106	22.7

3.2 Measures

A theoretical review was conducted for the concept of Senge's learning organization model and its five constructs to develop first draft of survey questionnaire. Based on the first draft, researchers worked with insiders who had considerable information and knowledge of "Company D," and thereby improved questionnaire's validity. The final version of questionnaire was developed after modification based on the pilot test results. Then survey questionnaires were distributed and collected for one month period during October 1995.

The final survey questionnaires include 25 variables, designed to measure of five constructs of Senge's learning organization model, and each construct's measurements are as follows(Table 3):

• Measurements for Shared Vision: These consist of five variables that were developed based on Nanus' visionary leadership measure ments (1992). These questions address to vision's future orientation, its sense of destination and clarity and

<Table 3> Composition of the Measurements

Constructs	Context	Number
Shared Vision	Degree of recognition and sharing of vision	5
Team Learning	Degree of learning team development	6
Mental Models	Degree of change in mental model toward strategic focus	7
Personal Mastery	Degree of organizational empowerment	3
System Thinking	Extension of systematic connection among four constructs	4

members' commitment and involvement on the vision. Specifically speaking, questions such as (1) "To what extent is the new vision clear in terms of goal and destination?", (2) "To what extent does the company has a possibility to be excellent through the new vision ?", (3) "To what extent does the company has a possibility to be a leading engineer contractor in the 21st century ?", (4) "To what extent does the new vision has an impact on personal aspiratrion and participation in carring daily job?", (5) "To what extent does the new vision has an impact on personal growth?" were included.

- Measurements for Team Learning: Six variables are included after modifying Dyer's team building measurements (1987) that originally intended to measure efficiency of team dynamics. Questions such as (1) "To what extent are the conflicts in a team satisfactorily resolved?", (2) "To what extent are the team's plan and operation shared?", (3)

"To what extent are taking team members' opinion into consideration in decision making effective?", (4) "To what extent are the communications among team members effective?", (5) "To what extent are team members acting as a team leader?", (6) "To what extent do team members think themselves belong to a membership?" were adopted.

- Measurements for Mental Models: Seven variables focus on individuals' perceptual change on strategic thinking based on Miller's four strategy dimensions (1986) of innovative differentiation, marketing differentiation, cost leadership, and focus. Items such as (1) "To what extent is enhancing engineering competence important?", (2) "To what extent is increasing investment on R&D important?", (3) "To what extent is ensuring professional engineers important?", (4) "To what extent is developing sales engineers important?", (5) "To what extent is enhancing construction quality important?", (6) "To what extent

is developing the new construction technology and method important?", (7) "To what extent is reinforcing customer service important?" were developed.

● Measurements for Personal Mastery: These variables are derived from empowerment questionnaires developed by Vogt and Murrell (1990), and three variables are developed. Items such as (1) "To what extent is the authority of decision making empowered to first line managers?", (2) "To what extent is the autonomy at construction field in decision making realized?", (3) "To what extent is the speed of team leader's decision making?" are utilized.

● Measurements for System Thinking: Four variables are drawn out of the concept of connection among four constructs of a learning organization model proposed by Senge (1990a, 1990b, 1994).Using the concept of 'connection', we developed items based on the concept of 'connection' such as connection between shared vision and strategic thinking, connection between team learning and individual aspiration, connection between change in shared vision and individual growth. Specifically speaking, questions including (1) "To what extent do the E&C 21 and new strategies have the impact on your commitment level?", (2) "To what extent does the team-based organization structure

has the impact on the achievement level of personal vision?", (3) "To what extent does the organization structure has the impact on your personal aspiration?", (4) "To what extent does the E&C 21 has the impact on your personal growth?" were developed

3.3 Analyses

The unit of analysis in this study is a team with an assumption that individuals' cognitive and behavioral change caused by organizational change can be measured in the team level. The data was collected at an individual level, then it was aggregated to a team level. In case of doing research at team level, researchers, at least, should meet the condition of internal consistency, or agreement of perceptions within groups before aggregating scores on a variable for which the "unit of theory" is the individual (James, 1982; Roberts, Hulin, and Rousseau, 1978).

In order to ascertain the extent to which perceptions of all variables used in this study were shared by respondents in each team, we employed the ICC(intraclass correlation)(James, 1982). ICC which is the index implying internal consistency among respondents, has been much used in the area of organizational behavior research focused on group or team level(i.e. organi-

zational culture or climate studies). Expressed in terms of a single factor repeated measures analysis of variance, the ICC may be calculated as:

$$ICC(1) = \frac{\theta}{1 + \theta}$$

$$\theta = \frac{MSb.people - mMSw.people}{kmMSw.people}$$

$$m = \frac{n(k-1)}{n(k-1)-2}$$

where, MSb.people is the mean square between people and MSw.people is the mean square within people, k is the number of raters, m is the correction factor to obtain an unbiased estimate of the ICC, and n is the number of objects being rated. Negative coefficients are defined as zero. This form of the ICC is most directly interpreted as the average correlation among any two judges ratings.

ICCs were calculated for 26 variables which designed to measure of five constructs of Senge's learning organization model. The results revealed that the lowest score of ICCs is 0.40, the highest is 0.86 and the average is 0.69 respectively, which were considerably higher than ICCs previously reported in the literature, though we did not have the very comparable ICCs scores - according to Lee & Kim(1993) who had done a research of organizational climate,

the lowest score was 0.00, the highest was 0.50 and the median was 0.12. From the above results, the magnitude of ICCs support the validity of aggregating the data to the organizational level of analysis.

As the next process, Factor analysis with oblique rotation were conducted for all variables to grasp a set of underlying dimensions. A research (Hair et al.,1995) suggests that the number of cases in a sample should be both greater than 50 and four times greater than the number of variables applied in the analysis. Therefore, the number of samples (154 teams after aggregation) satisfies the required number of samples for the factor analysis. The following step taken was to determine the number of factors to be extracted, and the latent root criteria was applied with eigen value greater than 1. Reliability test was also undertaken by computing Cronbach alpha.

Next, cluster analysis identified learning groups. Although cluster analysis is known to be more useful than other multivariate techniques in identifying similar entities (Hambrick, 1984; Harrigan, 1985), there are some limits in using the analysis such as the problem of intercorrelation among variables, different units of measurement, difficulties in determining number of clusters to be formed, and the lack of appropriate ways to test their statistical significance

(Frank & Green, 1968).

Factor analysis with orthogonal rotation can eliminate the problem of intercorrelation by ensuring independence among variables. However, this method is built up with an assumption that there is no correlation between factors in reality. When the assumption is not held, the final factor structure disables to reflect reality. In other words, the final factor loading matrix extracted from fixing correlation coefficient between variables to zero causes biased factor coefficients (Brogden, 1969). Consequently, although factor analysis with orthogonal rotation can yield clear and simple interpretation, it has a potential pitfall of loosing factor structure's conciseness. Therefore, factor analysis undertaken in this study applied oblique rotation instead of orthogonal rotation for ensuring factor structure's conciseness where there were an interrelation among the variables.

To eliminate the problem of different units of measurement, every measurement adopted five point scale consistently. In addition, researchers determined the number of clusters by observing prominent increase in "tightness" of cluster as the clustering moved from one solution to the next (Hambrick, 1984). Then the outcome was double checked by analyzing dendrogram. The study also undertook ANOVA, Duncan multiple range tests and multiple discriminant

analysis to test whether clusters differed significantly.

IV. Results

Table 4 shows the outcome of factor analysis. The factor analysis yielded 7 factors that had eigen value greater than one, and these accounted for 71% of the total variances. However, the seventh factor was omitted in this analysis because it contained only one item. Four variables that represented system thinking showed factor loading value above 0.4 as factor 1. Six variables that represented team learning showed factor loading value above 0.4 as factor 2.

Factor 3 and 6 were initially designed to measure mental models and expected to be as one factor; however, the result of factor analysis divided it into two independent factors. Factor 3 represented "engineering oriented strategic mental models" while factor 6 signifies the importance of "strategic mind for quality construction." This outcome may reflect Company D's twenty first century vision "E&C 21" which emphasizes two dimensions: gaining competitive advantage on both engineering and construction area in value adding chain of construction industry. Factor 4 and 5 represented personal

〈Table 4〉 The Result of Factor Analysis

Factors Extracted / Variables	Factor 1 System Thinking	Factor 2 Team Learning	Factor 3 Mental Models(E)	Factor 4 Personal Mastery	Factor 5 Shared Vision	Factor 6 Mental Models(C)
E&C 21 and new strategies impact on the commitment level	.864					
Team based organization structures impact on personal vision achievement level	.860					
Team based organization structures impact on personal aspiration	.829					
E&C 21s impact on personal growth	.808					
The degree of conflict resolution in a team		.820				
The extension of sharing teams plan and operation		.800				
The effectiveness of taking team members opinion in decision making		.753				
The communication effectiveness among team members		.721				
Team members acting level as a team leader		.709				
The extension of team members membership		.555				
The importance of enhancing engineering competence			.814			
The importance of increasing investment on R&D			.777			
The importance of ensuring professional engineers			.731			
The importance of developing sales engineers			.631			
The degree of empowering decision making authority to first line managers				.830		
The level of construction sites autonomy in decision making related to the site				.809		
The speed of team leaders decision making				.680		
The degree of the new visions clarity in terms of goal and destination					.819	
The possibility of becoming an excellent company through the new vision					.818	
The possibility of becoming a leading engineer contractor in the 21st century					.811	
The new visions impact on encouraging personal aspiration and participation in carrying daily job					.745	
The new vision's impact on personal growth					.698	
The importance of enhancing construction quality						.871
The importance of developing the new construction technology and method						.786
The importance of reinforcing customer service						.750
Eigen Value	8.26	2.96	2.21	1.55	1.25	1.22
Cumulative Percentage of Variance	31.8	43.1	51.6	57.6	62.4	67.0

⟨Table 5⟩ Mean, Standard Deviation & Correlation

	Mean	SD	1	2	3	4	5	6
1. System Thinking	3.23	.49	(.89)					
2. Team Learning	3.61	.45	.46**	(.84)				
3. Mental Models(E)	3.28	.45	.34**	.15	(.74)			
4. Mental Models(C)	3.45	.51	.50**	.31**	.46**	(.78)		
5. Personal Mastery	3.30	.51	.49**	.48**	.40**	.41**	(.79)	
6. Shared Vision	3.45	.46	.57**	.21**	.30**	.38**	.41**	(.85)

1. $* < .01$, $** < .001$

2. (   ): Reliability Coefficient

mastery and shared vision, respectively.

Table 5 shows each variable's value for mean and standard deviation, and correlation between variables. In general, correlation between variables are fairly high, so is each variable's mean value.

Subsequently, a cluster analysis was conducted to develop a taxonomy of learning groups based on the six dimensions that were previously identified in factor analysis. The validity were examined for the outcome of cluster analysis. First, Duncan multiple range tests and ANOVA tested differences in factors' mean score, and results were satisfactory and supported differences between the total factor mean and the mean in each cell. Secondly, multiple discriminant analysis was undertaken, and the classification accuracy was 94%. Table 6 summarizes the above discussion.

Teams in Group 1 showed generally high scores on every dimensions, and their characteristics were somewhat similar to teams in Group 4. Group 1's relatively high scores in every dimensions implies that building blocks of a learning organization are well adopted and begin to stabilize in Group 1. For this reason, we may call Group 1 as "learning-supporting" teams.

Teams in Group 2 showed a very low mean score on system thinking. They perceived a low score of team learning as well as personal mastery and shared vision. Therefore, this group is named as "learning-retarded teams." Group 2 appeared to have relatively stronger learning competency than Group 3, yet learning were delayed due to the low team learning.

Group 3 reported the lowest scores in every dimensions with an exception of team learning. Teams in Group 3 seemed to have no willingness for learning because it showed unsystematic learning characteristics for most building blocks of a learning organi-

〈Table 6〉 Characteristics of Learning Groups [A]

Learning Groups Dimensions	Group 1 Learning- Supporting Teams	Group 2 Learning- Retarded Teams	Group 3 Learning- Resisting Teams	Group 4 Learning-D riving Teams	Duncan multiple range test						FC
					1-2	1-3	1-4	2-3	2-4	3-4	
System Thinking	3.35**B (.32)	2.90** (.29)	2.90** (.53)	4.11** (.22)	**	**	**	ns	**	**	51.96**
Team Learning	3.79** (.32)	3.22** (.33)	3.49 (.46)	4.21** (.26)	**	**	**	**	**	**	39.73**
Mental Models(E)	3.35 (.41)	3.31 (.31)	2.72** (.28)	3.80 (.34)	ns	**	**	**	**	**	26.98**
Mental Models(C)	3.59* (.34)	3.36 (.43)	2.75** (.34)	4.19** (.30)	**	**	**	**	**	**	49.12**
Personal Mastery	3.52** (.38)	2.95** (.33)	2.80** (.39)	4.01** (.26)	**	**	**	ns	**	**	54.16**
Shared Vision	3.61** (.33)	3.28** (.37)	3.01** (.57)	3.81** (.48)	**	**	ns	**	**	**	18.80**
Cases	73	44	22	13							

1. A: Means are reported, and standard deviations are in ( ).
2. B: Differences between total sample mean and mean in each cell tested using t-tests.
3. C: based on ANOVA results
4. p value: * 〈 .05, ** 〈 .01

zation. Therefore, Group 3 is named as "learning-resisting teams" which are groups that need Company D's intervention for improving learning competency more than any other groups.

Group 4 consists of teams that drive Company D's learning activity. These teams showed very high mean scores in all factors, and Group 4 has a strong evidence that it is the most similar group to the concept of Senge's Learning Organization Model. It showed high system thinking with energizing team learning. Individuals' aspiration for personal mastery was high as well as shared vision and mental models close to the company's vision E&C 21.

March(1991) describes organizational adaptation process as exploration and exploitation. In-depth interview revealed that the adaptation style of Group 4 and Group 1 is

similar to the concept of exploration while Group 2 and Group 3's adaptation styles are close to the concept of exploitation. Distinctive characteristics of Group 1 and Group 4 are an effective information flow that facilitates internal learning actively (Simon, 1991), double-loop learning that seeks for fundamental change on reference frame related organizational norms and rules (Argyris & Schon, 1978), and familiar use of exploration oriented languages such as searching, change, risk taking, experimentation, flexibility and innovation. However, Group 3 and Group 2's adaptation style is more close to the exploitation than the exploration (March, 1991). For instance, widely used languages are accuracy, choice, production, efficiency and implementation while single-loop learning is frequently happening to maintain acceptable level of performance given goals.

Duncan multiple range test also confirmed each group's characteristics. In case of Group 2, for example, system thinking and personal mastery showed no significant difference compared to those of Group 3, but Group 4 and Group 1. Consequently, "Company D" showed similar characteristics of Senge's learning organization model in order of Group 4, Group 1, Group 2 and Group 3.

Discriminant analysis also provided another useful information. The result showed that discriminant function 1 and 2 explained 97.5% of the total variance. So only two discriminant functions were used to discriminate groups. There are generally two ways in determining each discriminant function's contribution to classifying groups: the use of standardized discriminant function coefficients and the use of discriminant loading. In this study the latter is adopted to maximize the stability of discriminant power (Hair et al., 1995). Thus, Using discriminant loading , variables increasing discriminant power were selected. The result showed that in the first discriminant function, the personal mastery had the strongest discriminant power for Group 1 and Group 4 among four learning groups, and in the second discriminant function, team learning had the strongest discriminant power for discriminating Group 2 and Group 3 (see Figure 2). Concludingly, we can know that according to the results of discriminant analysis, personal mastery and team learning as two most important factors in building a learning organization in "Company D" were derived from two discriminant functions.

The outcome of discriminant analysis also implies that Company D's learning organization building process showed a serial progression started from personal mastery and developed further to team learning. This interpretation supports Seneg's following claim:

"It is difficult to practice all five disciplines – or more than two – at once. We recommend serial progression. Worked on system thinking leads naturally to work with mental models. From there, you may step easily to team learning. That may lead you to a shared vision effort, which in turn reminds you of the need for work on personal vision. Thinking about current reality, you return to system thinking, and start the cycle over, or move to a different cycle...There is no specific road map(Senge et.al., 1994: 77-78)."

However, the procedure of building a learning organization varies to each organization, and it depends on given situation, major tasks and problems. Furthermore, teams that show a dramatic progress on personal mastery and team learning can also has a great potential of developing competence in system thinking, mental models and shared vision toward contributing to the company effort to build a learning organization. Senge's five disciplines of a learning organization do not necessarily happen at once but progressively. The process may begin with a certain discipline that may easier to implement than other disciplines. Then the process leads to the enhancement of other disciplines incrementally (Quinn, 1980). It also suggests that research
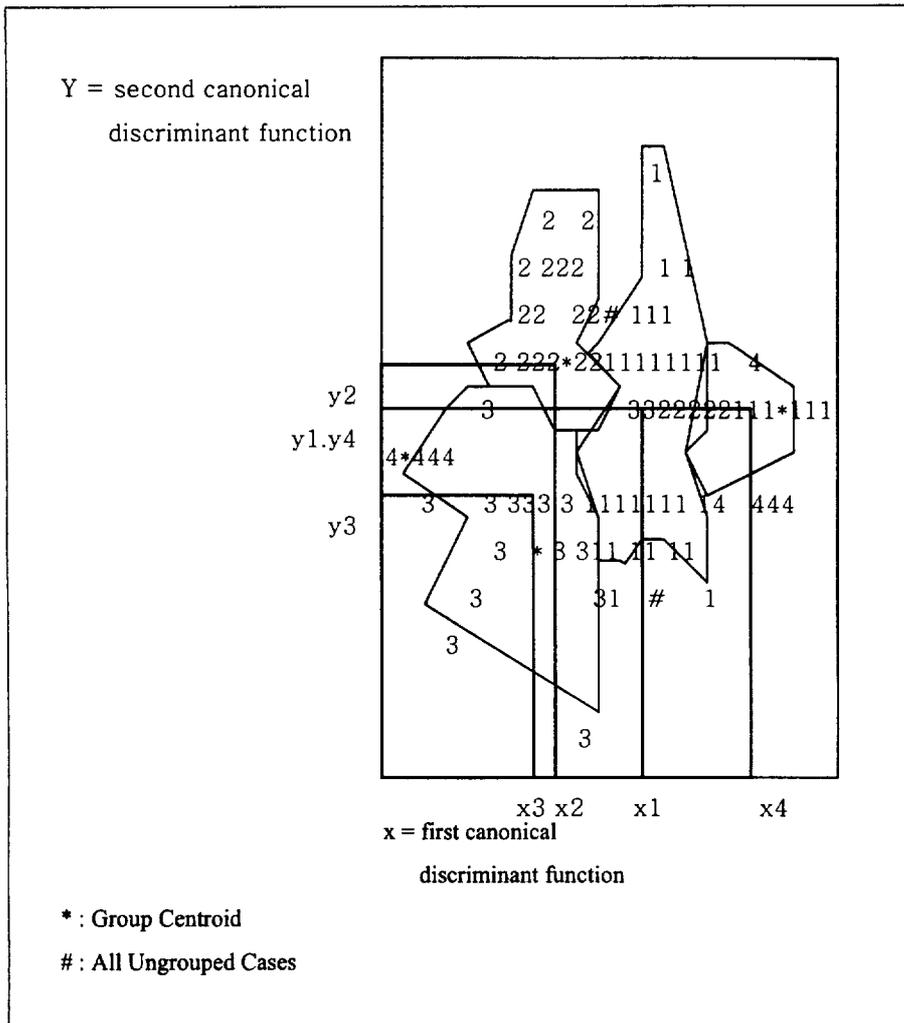
in the field of a learning organization must adopt dynamic research method on the basis of process research.

V. Conclusion

5.1 Summary and Discussion

The result of this study and theoretical implications can be summarized as following:

- A construction company in Korea showed some strong evidences of five building blocks of a learning organization suggested by Senge, and these constructs also reflected the industry's unique characteristics such as mental models' distinction between engineer oriented strategic thinking and construction oriented strategic thinking (Research object 1).

- Learning groups that show similar learning patterns are existing in an organization. Further, there are four distinctive learning groups that are classified on the basis of six factors of a learning organization concept (Research object 2). Furthermore, discriminant analysis showed that the process of building a learning organization in Company D is led by personal mastery in individual level and team learning in organizational level. In addition, other disciplines may requires additional learning

(Figure 2) Scatterplot of Learning Groups

and/or disciplining periods since these are conceptually more abstract than personal mastery and team learning. Therefore, the company needs to develop various learning programs to enhance learning competence on system thinking, mental models and shared vision.

This study also suggests a couple of managerial implications. First, there is a need for different organizational intervention according to the classification of learning groups. With the fact that learning groups can exist in the same organization, it may possible that different learning groups may

require different kinds of human resource management practices such as personal appraisal, education and training program, and rewards systems etc. Especially, when any trial to building the learning culture is developed, any serious effort to alter the existant culture of organization toward learning culture requires planned interventions in the leadership selection, development, and retention process(Ott, 1989, p. 195; Schein, 1992)

Secondly, this study presents an alternative for building process of a learning organization in the construction industry. Although this study is limited to "Company D," it is highly possible to apply the concept of building a learning organization to other construction companies, particularly to those companies called as Gene-cone(general contractor).

5.2 Limitations and Future Research Direction

There are several limits to this study. First of all, the findings of this study is difficult to generalize because the study was undertaken on only a construction company. Therefore, future research should consider of expanding samples to other companies not only within construction industry but also other industries. The second shortcoming of this research is that the research results stems from a six-

month period of organizational innovation project. Due to the time limit, it is questionable whether measurements accurately reflected the concept of learning organization model proposed by Senge. Particularly measurements regarding system thinking and mental models require the level of general acceptance. For example, measurements for system thinking may need to develop concepts related to aspiration, commitment and change along the connection among variables.

The high correlation showed between variables could happen due to the close relationship among five constructs of a learning organization proposed by Senge; however, it could also happen because of "common method bias" that caused by measuring variables from the same respondents. Therefore, future research also needs to adopt "criss-cross" research design that separates respondents according to the concept of measurements (Avolio & Yammarino, 1988).

Further research should also consider of performance-oriented dependent variables such as frequency of technological and administrative innovation. So that learning outcome can be measured at the tone of more general information rather than subjective response to the questionnaire. In addition, inclusion of dependent variables will allow to examine performance differences

among learning groups. Recently ASTD (American Society of for Training and Development, 1996) has introduced 18 measurements for evaluating a learning organization, and these can be a useful reference for developing a systematic and inclusive measurements for dependent variables, or performance of a learning organization.

Finally, researchers should take other organizational factors such as environment, strategy, leadership, culture and structure into consideration of designing further re-search. Further, longitudinal study should be also employed for better understanding of dynamics among variables from various factors.

Bibliographies

Adler, P. S., & R. E. Cole (1993), Designed for learning: A tale of two auto plants. *Sloan Management Review*, Spring, 85-94.

Argyris, C., & D. A. Schon (1978), *Organizational Learning: A Theory of Action Perspective*. Reading, Mass:Addison-Wesley.

ASTD'S Guide to Learning Organization Assessment Instruments. 1996. *American Society for Training and Development*.

Bandura, A. (1977), *Social Learning Theory*, Englewood Cliffs, NJ : Prentice-Hall.

Bateson, G. (1973), *Steps to an Ecology of Mind*, Paladin.

Brogden, H. E. (1969), Pattern, Structure, and the Interpretation of Factors. *Psychological Bulletin*, 72, 375-378.

Campbell, J. P. (1977), On the Nature of Organizational Effectiveness. In P.S. Goodman, J.M. Pennings and associates(Ed). *New Perspectives on Organizational Effectiveness. 13-55*. San Francisco: Jossey-Bass.

Carper, W. B., & W. E. Snizek (1980), The Nature and Types of Organizational Taxonomies: An Overview. *Academy of Management Review*, 5,1: 66-75.

Cook, J. & T. Wall (1980), New Work Attitude Measures of Trust, Organizational Commitment and Personal Need Nonfulfillment. *Journal of Occupational Psychology*, 53, 39-52.

Cyert, R. M. & J. G. March (1963), *A Behavioral Theory of the Firm*, Englewood Cliffs, NJ: Prentice-Hall.

Dalton, D. R., W. D. Todor, M. J. Spendolini,, & L. W. Porter (1980), Organization Structure and Performance: A critical review. *Academy of Management Review*, 5, 49-64.

de Geus, A. (1988), Planning as learning, *Harvard Business Review*, November- December.

Dodgson, M. (1993), Organizational Learning: A Review of Some Literatures. *Organization Studies*, 14, 375-394.

Dyer, W. G. (1987), *Team Building: Issues and Alternatives*(2nd Ed.). Wokingham, England: Addisan-Wesley.

Lee, B. H. & Y. B. Kim (1993), The Climate of R & D Project Teams and Team Performance : Multidimensional Approach. Research in Korea Management, 23, 3 : 357-390.

Fahey, L., & H. K. Christensen (1986), Evaluating the Research on Strategy Content. *Journal of Management*, 12,2: 167-183.

Gardner, J. W. (1963), *Self-renewal: The Individual and the Innovative Society*, Harper & Row.

Garratt, R. (1987), *The Learning Organization*, Fontata.

Garvin, D. A, (1993), Building a Learning Organization. *Harvard Business Review*, July-August, 78-91.

Hair, J. F., Jr., R. E. Anderson, R. L Tatham,. & B. J. Grablowsky (1995), *Multivariate Data Analysis* (2nd Ed.). Oklahoma: Petroleum Publishing Company.

Hambrick, D. D. (1984), Taxonomic Approaches to Studying Strategy: Some Conceptual and Metodological Issues. *Journal of Management*, 10,1: 27-41.

Hedberg, B. (1981), How organizations learn and unlearn in Nystrom, P. C. and Starbuck, W. H.(eds), *Handbook of Organizational Design*, London, 8-27.

James, L. R. (1982), Aggregating bias in estimates of perceptual agreement. *Journal of Applied Psychology*, 67, 219-229

Kiechel, W. (1990), The organizations that learns, *Fortune*, March 12, 133-136.

Kim, D. H. (1993), The Link between Individual and Organizational Learning. *Sloan Management Review*, Fall, 37-50.

Kim, L. & Lim, Y. (1988), Environment, Generic Strategies, and Performance in a Rapidly Developing Country: A Taxonomic Approach. *Academy of Management Journal*, 31,4: 802-827.

Kolb, D. A. (1984), *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice-Hall.

Levitt, B. L., & J. G. March (1988), Organizational Learning. *Annual Review of Sociology*, 14, 319-340.

Lindblom, C. E. (1959), The "Science" of muddling through. *Public Administration Review*,19, 79-88.

Lippitt, G. L. (1969), *Organization Renewal*, Appleton-Century-Crofts.

March, J. (1991), Exploraton and Exploitation in Organiational Learning. *Organization Science*, 2,1: 71-87.

Marquardt, M., & A. Reynolds (1994), *The Global Learning Organization: Gaining Competitive Advantage through Continuous Learning*. New York, NY:IRWIN.

Miller, D. (1986), Configurations of Strategy and Structure: Towards a Synthesis. *Strategic Management Journal*, 7, 233-249.

Miller, D., & P. H. Frisen (1984), *Organizations: A Quantum View*. Englewood Cliffs, NJ: Prentice-Hall.

Morgan, G. (1986), *Images of Organization*, Sage, Newbury Park/London.

Mowday, R. & R. M. Steers (1979), The Measurement of Organizational Commitment. *Journal of Vocational Behavior*, 14, 224-247.

Nanus, B. (1992), *Visionary Leadership*, Jossey-Bass Inc., Publishers.

Nelson, R. R. & S. G. Winter (1982), *An Evolutionary theory of Economic Change*. Cambridge , MA: Harvard University.

Nonaka, I. (1995), *The Knowledge-creating Company*, Oxford University Press.

Ott, J. S. (1989). *The Organizational Culture Perspective*, Chicago: The Dorsey Press.

Pedler, M., J. Burgoyne, & Boydell, T. (1991), *The Learning Company*, McGraw-Hill Book Co.

Pfeffer, J., & G. R. Salancik, (1978). *The External Control of Organizations: A Resource Dependence Perspective*. NY: Harper & Row.

Porter, M. E. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York: Free Press.

Probst, G. J. B., and B. S. T. Buchel (1997), *Organizational Learning*, Prentice Hall.

Revans, R. W. (1982). The Enterprise as a Learning System in R. W. Revans *The Origins and Growth of Action Learning*, Chartwell-Bratt.

Roberts, K. H., C. L. Hulin & D. M. Rousseau (1978), *Developing interdisciplinary organizations*. San Francisco: Jossey-Bass.

Schein, E. H. (1992). *Organizational Culture and Leadership(2nd Ed.)*, San Francisco: Jossey-Bass

Schon, D. A. (1971), *Beyond the Stable State*, Random House.

Senge, P. M., R. B. C. Roberts, J. Smith & A. Kleiner (1994), *The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization*, New York: Doubleday.

Senge, P. M. (1992), Building Learning Organizations. *Journal for Quality & Participation*, Mar, 30-38.

_____ (1990a), *The Fifth Discipline: The Art and Practice of Building Learning Organization*, New York: Doubleday.

_____ (1990b), The Leader's New Work: Building Learning Organizations. *Sloan Management Review*, Fall, 1-17.

Simon, H. A. (1991), Bounded Rationality and Organizational Learning. *Organization Science*, 2,1: 125-134.

Simon, H. A. (1957), *Models of Man*, New York: John Wiley.

Sohn, T. W, W. S. Shim & J. J, Kim (1996), An Application of Learning Organization Perspectives to Restructuring a Korean Construction Company. *The First Korea - Japan Joint Symposium on Organization Studies*, April, Japan: Hosei University.

Solomon, C. M. (1994), HR Facilitates the Learning Organization Concept. *Personnel Journal*, November, 56-66.

Stata, R. (1989), Organizational Learning - The key to management innovation, *Sloan Management Review*, Spring, 63-74.

Tsang, Eric W. K. (1997), Organizational learning and the learning organization: A dichotomy between descriptive and prescriptive research. *Human Relations*, 50(1), 73-89.

Ulrich, D., M. A., Von Glinow & T. Jick (1993), High impact learning: Building and Diffusing learning capability. *Organizational Dynamics*, 22(2), 52-66.

Vogt, J. F., & K. L. Murrell (1990), *Empowerment in organizations: How to Spark Exceptional Performance*. University Associates, Inc.