A Model for the Communication Maturity Levels of Construction Companies

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Abstract

Communication management systems are vital parts of organizational development and effective communication can increase the level of effectiveness of the organization and the level of the effectiveness of communication system can be assessed by using maturity models. To find out the structure and maturity level of the communication system in a construction company, we developed the Communication Capability Maturity Model (CCMM) and its levels for communication maturity. To define a maturity level for a construction company, some variables of communication are measured as speed, the purpose, spread, clarity, shortness, scope and the other variables. The developed methodology uses a questionnaire survey. The results and analysis show that developed CCMM working properly and while analyzing the results based on key factors that affect organizational communication, it has been found out that the key factor organization has the lowest C-CMM between key factors.

Keywords: Organizational Communication, Construction Companies, Verbal Communication, Capability Maturity Model

1. Introduction

Human organizations have complex characteristics including decision-making, information aggregation, management control, career concerns among others, goal setting and vertical and horizontal communication (Jehiel, 1999). In recent years, it has been found out that communication has an important effect on all these characteristics. Not only in business organizations, in all society communication acts as glue that holds the people together (Bovee and Thill, 1989). Although communication recognized as the major activity of management in a company, many organizations do not specify their communication policies (Greenbaum, 1974). Investigations claimed that there has been important problems about effectiveness in the downward and upward communication and also in horizontal communication. And some researchers stated that most of the organizations have a general lack of awareness about communication in the workplace and that has to be studied. While poor communication in a company can cause misunderstandings and conflicts, an effective communication can decrease the level of effectiveness of the organization (Greenbaum, 1974).

For an effective communication development, organizational communication system must be well defined and functional. A defined organizational communication system is essential for the effectiveness of the organization, to reach a desired maturity level and manage the processes, which enable change, adaptation and innovation. The subject of defining an organizational communication system is limited in the literature. General system definition is based on aim, separated units and interrelation of these units. System theory helps to put together the separated units of communication together and linking the communication activities and elements. So by this approach it is important to visualize the factors as an integrated whole (Blazenaite, 2011).

The level of effectiveness can be assessed by using maturity models. A maturity model describes the activities or processes and they classify the performance or effectiveness from ad hoc level (Level 1) to world class (Level 5). To climb from level 1 to level 5 requires more mature and systematic actions. Generally, maturity models have levels and one more level called level 0 as general lack of awareness. The organization survives in all levels and survival is basic in a hierarchy of organizational needs but if

the company wants to move beyond survivals, it has to move to a new maturity level. So the assessed maturity level of the organization shows us the current position and where aims to be in the future.

In this study, the steps listed above are used for assessing the communication maturity level of a construction company,

- Organizational communication system is analyzed in terms of aim, organizational communication units and interdependencies between the units.
- Units that are called as organizational communication factors are defined for the internal organizational communication.
- A maturity grid approach for organizational communication system by using the Capability Maturity Model. A Communication Capability Maturity Model is defined
- Interdependencies between the factors are analyzed.

A model for assessing the maturity level of a construction company is created within the boundaries of organizational communication system that defined in terms of the aim of the organizational communication process, factors that affect the organizational communication and interdependencies of these factors within the communication system.

1.1. Problem Definition

Communication has become an important topic since 1950's. Communication management system in complex projects, especially in the construction industry has become a major topic since 1970's. Architecture, engineering and construction projects have high complexity that need to meet the financial, social, and environmental goals (Senescu et al., 2013). To manage this complexity, project teams would communicate effectively and collaborate within the projects, understand the information generated and share information between the different phases of complex projects.

Communication is a major factor that affects the performace of a company. Maier et al. (2006) stated that for project success or failure communication has an essential role and communication must be understood and organized affectively. Especially in complex processes communication plays an important role because for a single individual, it is not possible to run all the construction process. Different professionals from related fields participate in the process. According to Mulcahy (2009), communication is the most frequent problem in every project and project managers spend 90 percent of their time communicating. It is important to find the gaps in the communication process.

Organizational communication system defines organizational communication in a systematic way that consists of aim, units and interdependencies. Effective communication is the main goal of the communication activities and the units are defined as the factors that effect communication.

Many organizations conduct maturity assessments for many different subjects (Project management, learning theory etc.). Assessment levels for any subject gives the advantage of the understanding the major opportunities to start an improvement program and measure the effectiveness of the improvement activities. Organizational communication maturity level can help the organization to have knowledge about communication gaps and increase the maturity level of the organization.

The goal of this study is to construct a Communication Capability Maturity Model (CCMM) for construction companies. Furthermore the study aims to analyze the CCMM levels and the interdependencies between the variables.

2. Literature Review

2.1. Communication Effectiveness for the Construction Companies

Communication satisfaction and assessing the satisfaction level of the communication has the earliest example of Herzberg (1966). But one of the most important researches is the communication satisfactory questionnaire of Downs and Hazen (1977).

Communication in construction process has been an important topic since 1960's. In 1965 Higgin and Jessop made a detailed investigation about communication in construction projects (Murray et al., 2000). Their study was on the informal communication because they claimed that most of the uncertainties are occurred based on informal procedures in communication. Besides verbal communication and assessing communication, non-verbal communication and emotions has become an important topic since the end of 1980's.

There are few studies based on communication in construction, which is an important topic since 1970's. Some of them are;

- Goffman (1974) made a study based on the site meetings of the construction industry.

- Kreiner (1976) conducted a research on the Danish construction sites, which analyze the social relationships on the construction site. The study is based on the communication during the construction phase.
- Wallace (1987) researched on the communication during the pre-contract phase between four actors as architects, clients, consulting engineers and quantity surveyor.
- Gameson (1992) investigated the communication between building clients and building professionals,
- Pietroforte (1992) worked on the communication during the construction phase and his study was based on the both formal and informal communication on the site.
- Bowen (1993) has conducted a cost communication questionnaire. This study is related with the cost data and price models.
- Loosemore (1996) studied on the patterns of communication process during the crisis on the construction site.
- Hugill (2001) worked on the team meetings in construction projects during the construction phase.
- Gorse (2002) worked on the real life project meetings in construction.
- Abadi (2005) analyzed the media factor of the communication. The study is based on the use of media in different stages of the construction process.
- Emmitt and Gorse (2007) made an overview about the interpersonal communication in construction and review of the methods used previously also for the other fields.

2.2. Key Factors Affecting the Communication Satisfaction

Before started to work on communnication maturity level of construction companies, the factors that effect communicaiton must be analyzed. In the Literature, there are many classifications about the variables/factors that have an impact on the effectiveness of the organizational communication.

Downs and Hazen (1977) studied on a questionnaire for the communication satisfaction. In the early example of Redding (1972), it has been stated that there are some components of communication satisfaction, which are;

- Explanation of the policies
- Understanding the expected job performance
- Advanced notice of changes
- Freedom to make suggestions
- Adequacy of information about the company
- Which important information can be gathered from the sources or media
- Freedom to make complaints
- Accessibility of superiors
- In which degree the supervisor make an effort to understand feelings
- In which degree the supervisor appreciate to good performance
- In which degree management or supervisor opens to communication (Downs and Hazen, 1977).

The Construction Industry Institute stated that there are six categories of communication variables that are accuracy, procedures, barriers, understanding, timeliness and completeness (Thomas et al, 1999). Also Murray (2000) made a comparative study of US and UK construction industries by using the six critical communication variables of The Construction Industry Institute. Te'eni (2011) suggested a cognitive-affective model to make the organizational communication more effective by changing the medium and attributes of the message itself. The aim of the study of Te'eni is to design a technology to make communicaiton more effective. This model is developed based on the three main factors of the organizational communication that are impact, process and inputs.

In this study, the research of Maier and Eckert (2006;2008;2011) taken as a base when designing the questionnaire for assessing the maturity level of organizational communication, but two questions are added from the study of Murray (2000), which are;

- Do you need to communicate again to complete a task?
- Are the procedures useful for communication process?

Maier and Eckert et al. (2006; 2008; 2011) developed a maturity-grid approach for communication effectiveness. In developing this method some items have to be decided which are key factors, subheadings of the key factors and maturity levels/scale points. In researches based on the factors of Maier and Eckert et al. (2006; 2008; 2011), four or five key categories are used. Maier et al. (2008) used

five levels of influence in their research that are product, information, individual team member, project team, and organization that are subdivided into 11 areas of influence.

Similarly in the other study of Maier et al. (2006), five influence levels are used. The aim of this study was to assess the current communication maturity level and desired communication maturity level. In this study, a maturity grid approach is applied to assess communication. Before analyzing the maturity grid, key factors or key process areas have to be found.

Table 1. Categorization of the factors (Maier et al., 2008)

Level of Influence	Areas of Influence
Organization	Organizational Structure
	Organizational Culture
Project Team	Teamwork
	Reflection within the project team
Individual Team Member	Personal Development
	Awareness
Information	Information Transmission
	Availability of Information
Product	Media of Communication
	Expression of the product
	Product Requirements

The questionnaire in this study is designed based on the key factors derived from the literature and some questions are added according to the interviews with the experts as listed in Table 2.2.

Table 2.The References of the Questions of the Organizationa Communication System

KEY FACTOR	QUESTION	REFERANCE
Information	Availability of information about competitors	Maier and Eckert (2011)
Information	Availability of information about organization	Maier and Eckert (2011)
Information	Availability of information about procedures	Maier and Eckert (2011)
Information	Availability of information about product specifications	Maier and Eckert (2011)
Information	Do you know what information does the other party need?	Maier et al. (2006)

Information	Does the other party know what information do you need?	Maier et al. (2006)
Information	Do you know in what format does the other party need information?	Maier et al. (2006)
Information	Does the other party know in what format do you need information?	Maier et al. (2006)
Information	Is the information clear?	Downs and Hazen (1977)
Information	Is the size of the message appropriate for the subject?	Downs and Hazen (1977)
Information	Do you know how the other party uses the information?	Maier et al. (2006)
Information	Do you need extra information for completing the task?	Murray (2000)
Information	Do you know the source of the information?	From the Interviews
Information	Do you know how to reach the information?	From the Interviews
Organization	How the hierarchy affects the communication process?	Maier and Eckert (2011)
Organization	Are there any efforts for developing the procedures?	Maier and Eckert (2011)
Organization	Do you know the roles and responsibilities?	Maier and Eckert (2011)
Organization	How often technical conflicts are solved?	Maier and Eckert (2011)
Organization	What do you think about the transparency of the decision-making process?	Maier and Eckert (2011)
Organization	Do you have knowledge about application of corporate vision and values?	Maier and Eckert (2011)
Organization	Do you have knowledge about common goals and objectives?	Maier and Eckert (2011)
Organization	What is the level of mutual trust in the organization?	Maier and Eckert (2011)
Organization	Do you trust the accuracy of the information given?	Te'eni, 2001
Team	How often lessons learned are shared?	Maier and Eckert (2011)
Team	How is collaboration and level of collaboration?	Maier and Eckert (2011)
Team	How is the level of team identity?	Maier and Eckert (2011)
Team	What is the level of formal and informal reviews?	Maier and Eckert (2011)
Team	How often best practices are shared?	Maier and Eckert (2011)
Individual	Availability of information about the work flow	Maier and Eckert (2011)
Individual	Availability of information about who involved in which step	Maier and Eckert (2011)
Individual	How is the level of information flow in the organization?	Maier and Eckert (2011)

Individual	How is the distribution of information about the organizational changes?	Maier and Eckert (2011)
Individual	How is the level of generation of innovative ideas?	Maier and Eckert (2011)
Individual	Application of training plans and schedules	Maier and Eckert (2011)
Individual	How is the level of best use of capabilities?	Maier and Eckert (2011)
Individual	Do you have a rewarding system?	From the Interviews
Product/Action	How is the level of understanding the representation system?	Maier and Eckert (2011)
Product/Action	How is the level of understanding the terminology	Maier and Eckert (2011)
Product/Action	Do the media you are using offers immediate answer?	Te'eni, 2001
Product/Action	Do the capacity of media important?	Te'eni, 2001
Product/Action	Are the communication media adaptable?	Te'eni, 2001
Product/Action	How is the level of protecting and archiving the product?	From the Interviews

3. Methodology

A questionnaire is designed for assessing communication maturity level of construction companies. Maturity grid approach of Maier et al. (2006) is taken as a base for its maturity grid approach but the levels of maturity are changed according to Capability Maturity Model that the levels are defined again for Communication Capability Maturity Levels. Questions are from the literature, which defines the factors, and key factors that affect the communication process of the organization.   Maturity literally means notion of development from an initial to a more advanced state (Maier et al., 2006). In order to improve the maturity level of an organization, the current maturity level must be analyzed. Assessing the maturity level should have a structured way starting with deciding the maturity levels and structurally apply that maturity level to the scales of the questionnaire. Maier et al. (2006) focused on a maturity-grid approach which both captures the current and the desired state. This maturity model is structured around a matrix by using a series of cells describing the maturity levels against the key factors of communication. In the maturity-grid approach cells contains text descriptions of performance at the levels of defined maturity level.

There are many maturity levels defined in the literature for the areas as project management, learning theory, product development, quality and capability models for assessing people. In the study of Maier et al. (2006) learning theory maturity levels of Argyris and Shön (1978, 1996) is used at the maturity grid. Maturity grids are originated to the quality management maturity grid of Crosby. In order to improve product quality Crosby defined a five level quality grid which the levels are range from uncertainty, awakening, enlightenment, wisdom and certainty (Maier et al., 2006). In this study, Capability Maturity Model is adapted. Most commonly used and adapted maturity level is Capability Maturity Level, which has roots on Crosby's quality management maturity grid. Capability maturity Model has five stages as follows,

Level 1. Getting started/ awareness/ initial

Level 2. Developing/ focusing/ repeatable/ knowledge

Level 3. Computing/ practising/ competence/defined

Level 4. Sustaining/ managed/ excellence

Level 5. Advocating/transforming/ optimized

3.1. Adaptation of CMM to C-CMM

To Develop a Maturity Model Based on CMM;

1.   Identify key processes and goals
2.   Define maturity levels
3.   Develop a Scoring System
4.   Identify Characteristics that Define Maturity
5.   Develop Improvement Steps (Strutt et al., 2006).

To develop a maturity model based on Capability Maturity Model, the steps above are applied one by one as follows.

Key processes in communication process are defined which are key factors and the factors that define key factors. The literature is used for defining them as the studies of Maier et al. (2006; 2011), Downs and Hazen (1977) and Murray (2000). At the final questionnaire there are 42 factors with definitions.

There are already defined Capability Maturity Levels in the literature but also there are more than one meaning of every level. The important point was to understand the meaning of each maturity level and adapt it to the organizational communication questionnaire. The levels of communication maturity are defined by the terms data, information, knowledge, understanding, applicable and improving.

- **Level 1/Uncontrolled Level**: No knowledge and no understanding about the factor. At the uncontrolled level the process can be defined as "Having no knowledge about it/ never heard it/ there is nothing about it in the organization. So this level can be summarized as "No knowledge". For example in the question "How often do you get information about competitors?" the first level communication capability maturity model is "No knowledge about competitors". Communication process has no standards.

- **Level 2/Relatively Controlled Level**: At the relatively controlled level, the processes can be repeated if experienced before or by the effort of the individual. Data and information is included in this level and there is partly knowledge and understanding but knowledge is not applicable and there is no improvement in the process. There is no defined and fully controlled procedure or the usage of the procedures depends on the individual.

- **Level 3/Controlled Level:** At the controlled level, there are defined processes and people are mostly using them. Data, information, knowledge and understanding are included in this level but they are partly applicable. No improvement about the process. For example in the question "How often do you get information about competitors?" the third level of communication capability maturity model is "Information is distributed but not regularly".

- **Level 4/Controlled and Conservatively Improving Level:** At the controlled and conservatively improving level, the processes are defined and managed and every individual in the organization knows them and use the processes. Data, information and knowledge are included in this level. They are fully applicable but the process is partly and consevatively improving. According to the same question "How often do you get information about competitors?" the fourth level of communication capability maturity model is "Information is distributed regularly".

- **Level 5/Innovative Level**: At the innovative level, processes are defined managed and there must be an effort for optimizing it. According to the same question "How often do you get information about competitors?" the fifth level of communication capability maturity model is "Information is distributed regularly and there is an effort for optimizing the process". The most important characteristic of this level is knowledge and understanding is fully applicable besides that the process is improving.

5 levels of capability are defined for the organizational communication maturity. Strutt et al. (2006) stated that it is not appropriate to analyze each process by its level. It would be more useful to analyze the system as a whole. Strutt et al. (2006) stated that to identify a maturity level, it is important to define how the organizations act for each level of every process. So a maturity grid approach is used which all levels of maturity have a description that can be in the original questionnaire. Identification of the improvement steps depends on filling the requirements of the previous step.
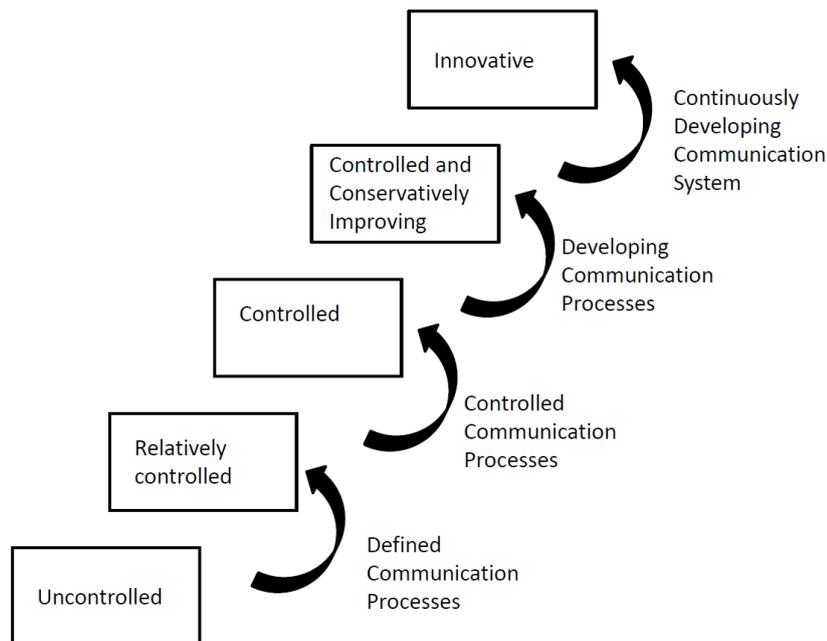
Figure 1.Improvement Steps of CCMM

4. Findings and Analysis

The reliability of the questionnaire is tested and Cronbah's alpha of the organizational communication system is 0.9464, which means that the questionnaire is reliable. Communication Maturity Level Questionnaire is sent to nearly 100 people but only 45 of them responded which 5 of them are not completed. The ages of the participants are between 24 and 63 mostly centered at the ages 30 and 35. 63 percent of the participants named under 'Architects' that are architects and interior designers and 37 percent of the participants named under 'Engineers' that are civil engineers, electrical engineers and mechnanical engineers.

Factors affecting the organizational communication system are numbered as questions and the answers are analyzed. The results can be analyzed as,

- The averages of the key factors and found out which key factor is the most
problematic one. According to the results the averages can be seen from the Table 4.1.

Table 3. Averages of the Key Factors

	Key Factor	**Average**
1	Information	3,025
2	Organization	2,797
3	Team	2,997
4	Individual	2,940
5	Product/Action	3,166

When the correlations between the key factors of the verbal communication are analyzed, the interpretation of correlation coefficient is done according to literature as follows;

- High correlation if correlation coefficient is between 0.8 and 0.6
- Moderate high correlation if correlation coefficient is between 0.6 and 0.5
- Moderate high correlation if correlation coefficient is between 0.5 and 0.4

The results can be interpreted as follows;

- There is a correlation between information and organization which is 0, 72 and can be called as high correlation.
- The correlation between information and team is 0, 56 and this correlation can be classified as moderate high. It cannot be said that there is an exact correlation between the key factor information and team.
- The correlation between information and individual is 0, 70 which can be defined as high correlation.
- The correlation between information and product/action is 0, 56 and this correlation can be classified as moderate high.
- The correlation between organization and team is 0, 74 which can be classified as high correlation.
- The correlation between organization and Individual is 0, 62 which can be classified as high correlation.
- The correlation between organization and product / action is 0, 58 which can be classified as moderate high correlation.
- The correlation between individual and team is 0, 57 which can be classified as moderate high correlation.
- The correlation between product/action and team is 0, 62, which can be, classified as high correlation.
- The correlation between product action and individual is 0, 75, which can be, classified as high correlation.

Table 4. Correlation Matrix of Key Factors of Organizational Communication

	Information	Organization	Individual	Team	Product/Action
Information		0,72	0,7	0,56	0,56
Organization	0,72		0,62	0,74	0,58
Individual	0,7	0,62		0,57	0,75
Team	0,56	0,74	0,57		0,62
Product/Action	0,56	0,58	0,75	0,62	

5. Conclusion

The first goal of this study is to define an assessment model to analyze the maturity level of the organizational communication system. Organizational communication system is analyzed based on goal, units and interdependencies. The aim of organizational communicaiton system is defined as effectiveness and to reach common goals of the organization. The factors or variables of the organizational communication that affect the communication process are taken from the literature. The interdependencies between these factors are analyzed.

Maturity Grid method is taken as a base for the CCMM (Communication Capability Maturity Model) which has different maturity level definitions in each maturity level of factors. Capability Maturity Model is redefined to define CCMM. Results of the assessment process provide a general knowledge about the maturity level of CCMM and the organizational communication system. And besides that having knowledge about the maturity level the results of the questionnaire give the advantage to know how to go up a level.

Although assessing the Organizational Communication Maturity Level of an organization is a new idea for construction companies, because of the complexity of the job and people involved in the construction process it is highly important to have knowledge about the Organizational Communication Maturity Level. Problematic points and gaps can be found out by the questionnaire and the company can take action to increase the CCMM of the organization. Generally, the CCMM of the companies is very close to Level 3 which is the defined level. This level can be defined as the knowledge is sufficient but there are gaps at the application process of the factors, they are not managed.

While analyzing the results based on key factors that affect organizational communication, it has been found out that the key factor organization has the lowest CCMM between key factors. The highest CCMM is at the product/action and information key factors. When the factors are analyzed one by one, it can be clearly seen that there are many problematic areas. The most problematic areas for the key factor information are knowledge abot competitors, knowledge about how the other party uses the information, need of extra information for completing the task, and knowledge about the source of the information. Solving technical conflicts, transparency of the decision-making process and application of the common goals and objectives are the problematic areas of the key factor organization. The other problematic areas are number of formal and informal reviews, application of training plans and schedules and knowledge about rewarding system. The averages of the factors of product /action are very close to each other.

One of the main contributions of this study is analyzing the interdependencies between the factors that affect communication. When the interdependencies of the key factors are analyzed, it can be seen that there is high or moderate high correlation between all key factors. High interdependencies are between information and organization, information and individual, organization and team, organization and individual, product/action and team, product/action and individual. And moderate high correlations between information and team, product/action and information, product/action and organization and individual and team.

Interdependencies can be used for finding out the deep causes of the problematic points of the factors. This assessment it required for taking the organization to the next level in the effectiveness of organizational communication and also for the other areas such as productivity and organizational effectiveness which are affected by the level of organizational communication.

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