

EFFECTIVENESS OF CONSTRUCTION COMMUNICATION USING  
INFORMATION TECHNOLOGY

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To my truly beloved parents,  
Yahya bin Seman and Paridah bt Mustapha,  
families, and friends.

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## **ABSTRACT**

The efficiency and effectiveness of the construction process strongly depend on the quality of communications among construction team members. A good effort in achieving the effective communications normally will bring the project to the successfully completion at a target quality of build. Hence, to convey all the information, it is requires an assistance from the information communication technology to fulfil the end project satisfaction. The aim of the study is to evaluate the effectiveness of the use of communication technology during construction phase. The aim is achieved by determining the frequency of different types of information communication received during construction and by evaluating the effectiveness of information communication technology (ICT) during construction phase. Furthermore, the literature reviews are focused on the frequency and types of construction information that being receive by construction personnel via several of methods and formats. Addition to that, the survey is evaluated the level of usage of PMBOK as a guideline to control of communication. The findings of this research are reinforced by the literature review and data collection. The outcomes of the thesis are the construction players have a basic knowledge of ICT and normally collect and transfer the construction information from project manager via textual format and hand-held document method. Construction players are not practicing the guideline on the PMBOK and look for recommendations to improve the clarity of information given during construction period.

## ABSTRAK

Kecekapan dan keberkesanan proses pembinaan sangat bergantung kepada kualiti komunikasi antara ahli pembinaan. Usaha yang baik dalam mencapai komunikasi yang berkesan akan membawa kepada kejayaan sesuatu projek berserta dengan tahap kualiti yang disasarkan. Oleh itu, untuk mencapai semua maklumat, ia memerlukan sokongan daripada teknologi maklumat dan komunikasi untuk memenuhi keperluan hasil projek kelak. Tujuan kajian ini adalah untuk menilai keberkesanan penggunaan teknologi komunikasi semasa fasa pembinaan. Matlamat ini dicapai dengan menentukan kekerapan jenis maklumat komunikasi yang diterima semasa pembinaan dan dengan menilai keberkesanan teknologi maklumat dan komunikasi (ICT) semasa fasa pembinaan. Tambahan pula, ulasan sastera memberi tumpuan kepada kekerapan dan jenis maklumat pembinaan yang diterima oleh personel binaan melalui beberapa kaedah dan format. Selain itu, kajian itu menilai tahap penggunaan PMBOK sebagai panduan untuk mengawal komunikasi. Hasil kajian ini diperkukuhkan lagi dengan kajian literatur dan pengumpulan data. Hasil tesis ini adalah ahli pembinaan hanya mempunyai pengetahuan asas ICT dan biasanya mengumpul dan memindahkan maklumat pembinaan daripada pengurus projek melalui format teks dan kaedah dokumen penyerahan. Ahli pembinaan tidak mengamalkan garis panduan mengenai PMBOK dan perlu mencari langkah lain untuk meningkatkan tahap keberkesanan maklumat yang diberikan dalam tempoh pembinaan.

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**LIST OF ABBREVIATIONS/SYMBOLS**

CAD	-	Computer Aided Drafting
ICT	-	Information Communication Technology
PMBOK	-	Project Management Body of Knowledge
PMI	-	Project Management Institute
RAD	-	Rapid Application Development
SOP	-	Standard Operating System

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## **CHAPTER 1**

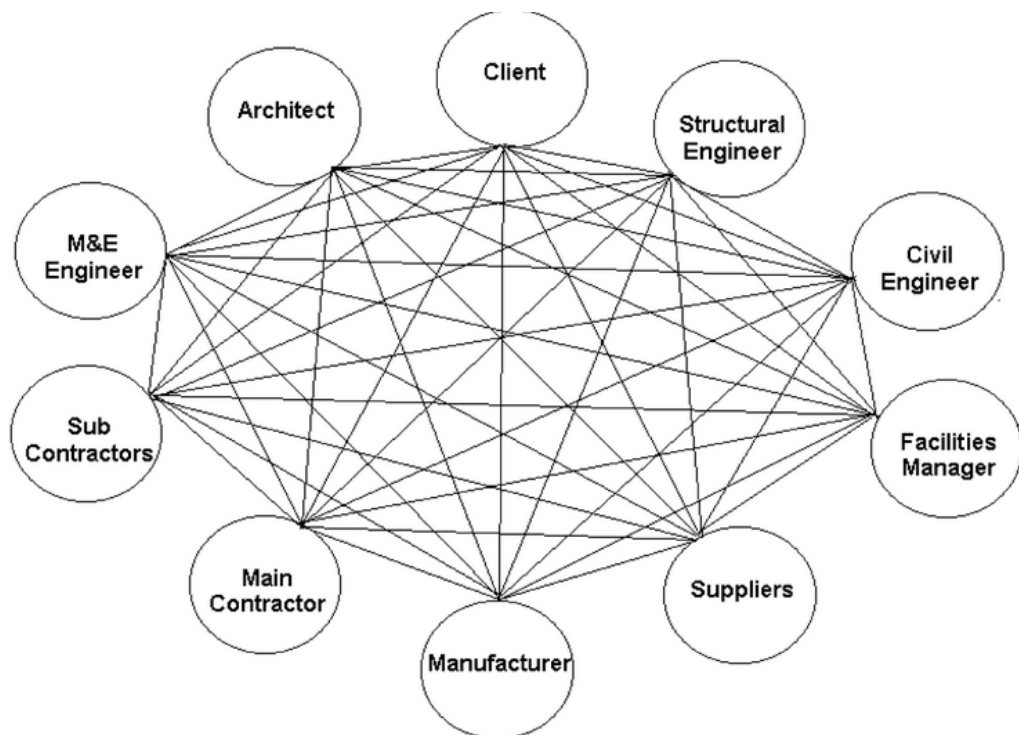
### **INTRODUCTION**

#### **1.1 Introduction**

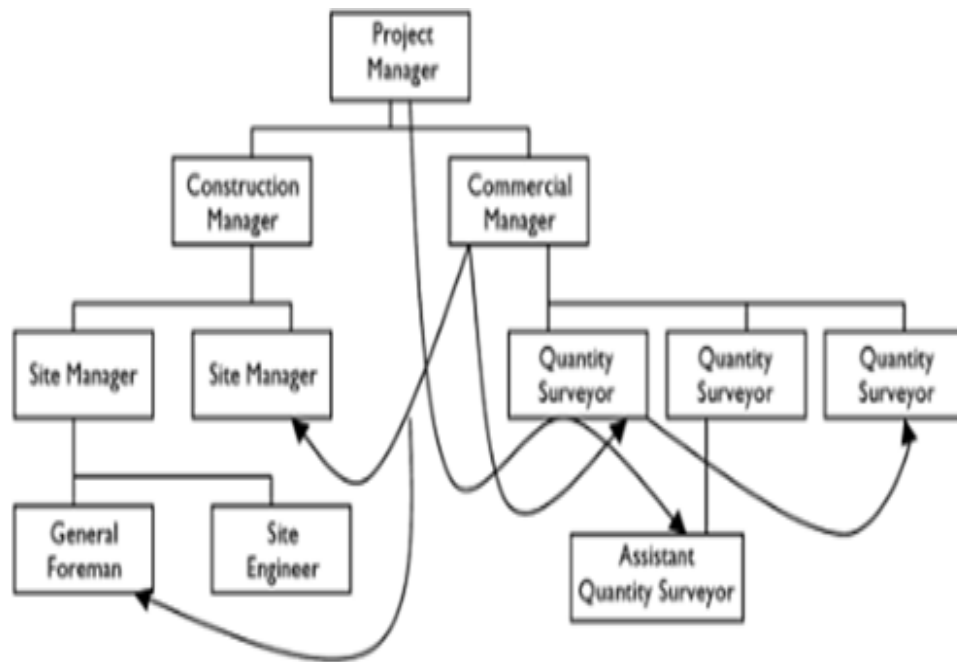
Communication management is an important area in construction project. It is a process of exchanging information. Information is conveyed as words, voice and diagram. To be effective communicators, team members must be aware and know the barriers to the communications process. Communication is the process in which information is encoded and imparted by a sender to a receiver via channel or medium (Perumal et al. 2011).

The successful in communication management can be an indicator for contributing to the best quality of product by the sign of change of current situation. Construction can be viewed as a process of putting together all the materials and

information in an orderly and timely manner. It utilizes relevant resources to complete a structure as per designed specifications and quality standards (Hossain, 2008). From point of view, the effectiveness of delivery the instructions is being crucial in managing a project. This is how a project manager should put highly attention in the way they communicate among stakeholders. Jeyachandran (2012) also stated that the efficiency and effectiveness of the construction process strongly depend on the quality of oral or written communication among construction team members and other stakeholders. Figure 1.1 and Figure 1.2 represent the intercorrelation among stakeholders in the construction project.



**Figure 1.1:** The Chaotic Intercorrelation among Stakeholders in the Construction Project (Ruikar et al, 2003)



**Figure 1.2:** A Regimented Communication between Professionals within a Construction Project (Dainty et al. 2006)

Furthermore, communication is a part of studies area in construction project and that can be driven to create quality by the end of its completion. A well planned from the preliminary stage by project manager can determine the successful achievement for all activities involve. It is requires a guideline or standard to approach the needs for communication in constructions.

On the other hand, project managers have the responsibility to fulfil the needs of communication in constructions. This is especially true within the construction industry, where interaction tends to be characterised by unfamiliar groups of people coming together for short periods before disbanding to work on other endeavours (Dainty et al., 2006). PMBOK Guide Fifth Edition stated three (3) classifications of needs which are task needs, team needs and individual needs for communication in construction. The project manager normally becoming the link between the strategy and the teams.

A standard is used as a guide for every activity in the construction project. In project management, one of the guidelines that is being suggested is *A Guide to the Project Management Body of Knowledge (PMBOK Guide Fifth Edition, 2013)*. It provides a guideline for managing individual projects and defines project management in the construction processes. It also describes the project management life cycle and its related processes, as well as the construction project life cycle.

PMBOK Guide (2013), defines the project management as the application of knowledge, skills, tools and techniques to project activities to meet the project requirements. Project management is accomplished through the appropriate application and integration of logically grouped project management processes, which are categorized into five (5) process groups which are initiating, planning, executing, monitoring and controlling, and closing.

In PMBOK Guide (2013), there are ten (10) areas of knowledge that include Project Communication Management and Project Quality Management. Both areas of knowledge are likely to affect each other. Project teams need to be informed and should be able to deliver the efficient information among them. It is necessary to maintain proactive communication with stakeholders in order to deliver a success of any projects (PMBOK Guide, 2013).

Communications among the project team need to be controlled throughout the project. Controlling communications is the process of monitoring and controlling communications throughout the entire project life cycle to ensure the information needs of the project stakeholders are met (PMBOK Guide, 2013).

According to Perumal et al. (2011), construction is a fragmented and dynamic sector with a project-based nature. Thus, many stakeholders operate in frequently changing relationships, which are contractually driven. Necessarily, a success



construction project management must have strategic communication plan throughout the project.

## **1.2 Problem Statement**

The problems to many construction projects can be detected to due to a failure to communicate. Coordination in communication among all project team is important area that needs to manage wisely. The process of construction depending on the complexity of the finished structure requires a high level of coordination among all the professionals and trade persons from design office to the construction site until the project is completed (Hossain, 2008).

Moreover, construction's professional and project team must be able to communicate effectively to serve their customer's need. However, not all products meet end user's satisfaction. Problems may arise at beginning stage, during construction or after completion of the project. As problem occurred, it is absolutely brings to low the quality of the product itself. Furthermore, good effort in achieving the effective communications bring the project to the successfully completion. Many times on troubled projects, project team members feel that if the communication had been better, the project would have run smoother (Culo et al., 2010).

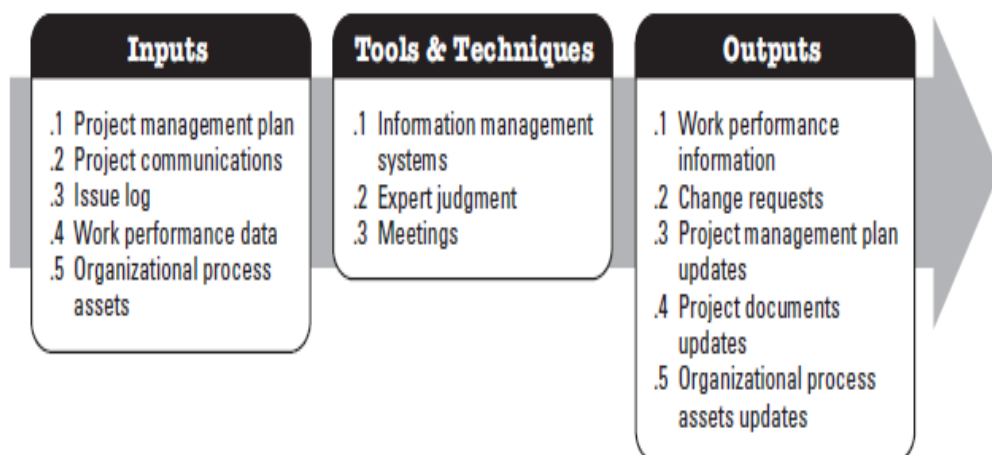
Furthermore, planning, design and construction are different stages in construction project. Design is the link between client requirements and the actual realisation of those requirements into a constructed facility (Chen et al., 2008). Thus, to convey the client requirement to the construction site requires the communication approaches. In order to satisfy client's needs and ensure that the design is constructable, the design stage must not only have the client's requirements as input, but also information about construction and the operation and maintenance of the

facility (Kamara et al., 1996). Therefore, the design stage must be integrated with information about construction and require clear response to the evolving of customer needs.

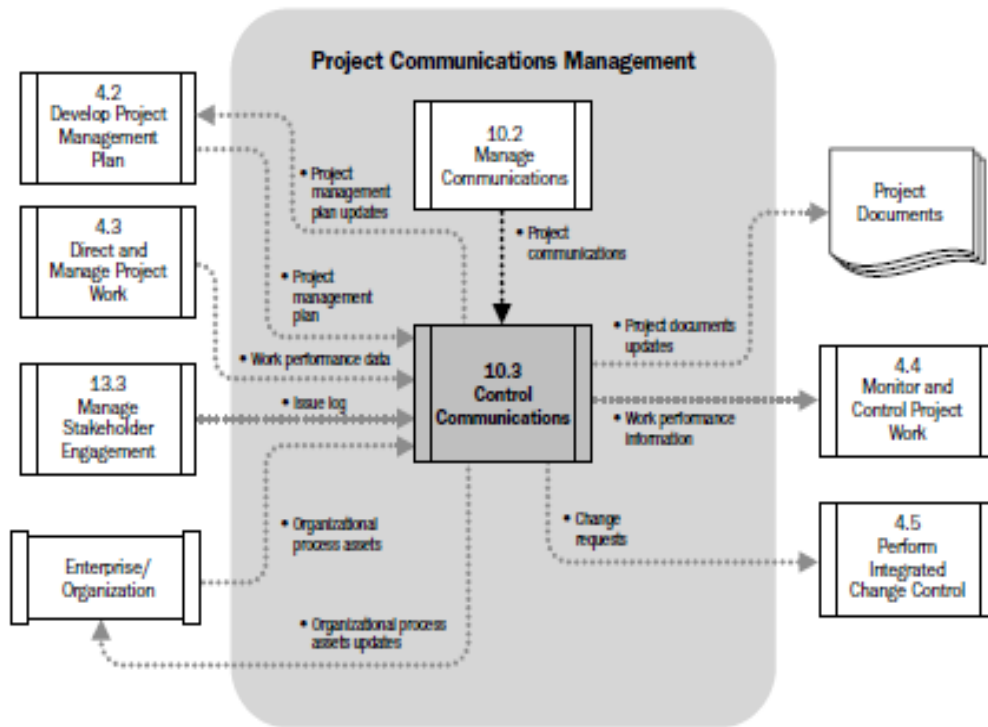
In construction project, the processes need to be updates include stakeholder notifications, project reports, project presentations, project records, feedback from stakeholders and lesson learned from project documentation. All the updates are listed in the PMBOK Guide (2013).

From point of view, not all construction project management will consider all the requirements stated as in PMBOK. The key benefit of the control communications process is that it ensures an optimal information flow among all communicated participants. In this process, it is requires three (3) items which are the inputs, tools and techniques and outputs. So that, as project runs, they need to follow the data flow diagram from input to output to supervise the communication control.

Figures 1.3 and 1.4 represent the input, tools and technique and outputs and the data flow diagram of communication stated by PMBOK Guide (2013) respectively.



**Figure 1.3:** Control of Communications for Input, Tools & Techniques and Outputs



**Figure 1.4:** Control of Communications for Data Flow Diagram

Construction industry is not homogenous industry. It varies and depends on the scope of the activity and project. The enlargement of the activity in such project will increase the complexity of the project. Here, a project manager's roles are seen to be critical in managing not for construction activities only but also managing the supply and demand of resources, labours and machinery.

Apart from that, the quality of the end product of project; is not only depends on project manager. Project team include contractor should also give full commitment in maintaining the performance from initial stage of project until the completion of the project. According to Mehta (2005), face to face initial communications within the project team to establish the team dynamics and learning as to the customer's expectations are the keys to success when initiating for a projects. Contractor is a person or company who are responsible to deliver instruction by project manager of the project to workers. Therefore, communication shall takes place.

Hence, construction project need a tool and technique to enhance the quality of product by improving the communication skills during the project cycle. As project manager or contractors, both are responsible to deal with effective communication skills among stakeholders include the workers. The construction industry is known as its adversarial behaviours and it is questionable as to whether there is ever a real “team effort” when it comes to planning, designing and producing a building (Jeyachandran, 2012).

### **1.3 Aim and Objectives**

The aim of the project is to evaluate the effectiveness of the use of information communication technology during construction phase. In order to achieve the aims, several objectives are:

- i. To determine the level of skill and frequency of different types of information communication received during construction phase.
- ii. To measure the level of use of A Guide to the Project Management Body of Knowledge (PMBOK Guide Fifth Edition, 2013) as a guideline for controlling the communication process, monitoring and controlling of communications.
- iii. To evaluate the level of effectiveness of information communication technology during construction phase.

## 1.4 Scope of Work

PMBOK is the recognized as a standard of project management activity (Siegelub, 2004). It provides the processes and knowledge area that practiced within project management. There are ten (10) areas of knowledge which include project communication management. PMBOK lists out the guidelines how to control communications throughout the entire project life cycle.

Thus, the research scope of work expose to the construction project management environment is to determine how they are going to control their communications plan from project manager perspective to the contractor and workers. The communications plan is based on PMBOK Guide Fifth Edition, (2013).

Moreover, as communication is under best controlling and monitoring, the correlation to the quality of the end product is predicted to be materialised. A well planned communication management will drive to fulfil end user's need. Each construction project should therefore have the needs of its end users in mind throughout the whole construction process (Dewulf and Van Meel, 2002; Pemsel et al. 2010).

The methods to achieve the aim and objectives are via questionnaires and analysing the results from the previous research. The study involves the project team and participants across the state of the construction site and it is distribute randomly to various company.

The study involves the communication of construction information such as technical drawing, supply and demand material and equipment, contractual matter, progress, safety, activities of sub-contractor, design clarification, construction method, specification, labour and the target quality. The construction information is

clarified by the sending and receiving the information to and the from construction personnel such as supervisor, client, consultant, design team, sub-contractor, engineer, supplier, project manager and quantity surveyor.

In addition to that, the format of receiving is categorized as text, image, graphic, form or verbal. In efficiency of conveying all of the construction information may be measured by different methods includes phone call, memory, notebook and hand-held document through benchmarking its effectiveness using survey on the respondents.

All the data collected is analyse to determine the most used type of construction information from the various construction players via a specific format and method. The survey are also record its clearness of the construction information received together with the highlighted problem that arises. It also further discussion on how to improve the effectiveness of the information communication technology (ICT) during construction phase. Besides that, the data also focused on the level of experience of the respondents in dealing with PMBOK as a guideline to control of communication during construction

## **1.5 Significant of Research**

The significant of the study is to determine the level of computer skill of the construction team. The study also able to identify the most frequent construction information received from construction personnel through various types of format and method.

Apart from that, the study is significant in measuring the level of usage of the PMBOK. It will check the state of the construction member the use of the PMBOK to provide a guideline for controlling the communications process, monitoring and controlling of communications and to ensure an optimal information flow among all communication participants.

Furthermore, the study is significant to encounter the problem arises during conveying of the construction information and able to identify the clarity of the construction information received. Besides that, on the survey, it is further introducing the suggestions in improving the ICT use during the construction period.

## **1.6 Chapter Outline**

There are five chapters that include on introduction of the background of the communication issues, introducing the PMBOK, the project communications management and the correlation to the quality of the end product. On the other hand, introduction also consist of the method and guideline standard that being use in construction.

Besides that, discussion on existing studies done on communications at construction site, the best practice towards the success project communications management by PMBOK and the correlation to the quality of the project product are discussed more under literature review of Chapter 2. Meanwhile, the chapter of methodology, it consists of the process of method to carry out the study and it is based on the guidelines provide by PMBOK Guide Fifth Edition, (2013).

Chapter 4 elaborate more on results. The data obtained will be analyse and discuss to justify from the literature review as evidence. Last but not least, the last Chapter 5 is conclusion and recommendations. Conclusion is related to the results with a few recommendations for further study.



## REFERENCES

- Au, J. C. W., & Yu, W. W. M. (1999). Quality management for an infrastructure construction project in Hong Kong. *Logistic Information Management*. Vol. 12. No. 4. pp. 309-314.
- Aksenova, S. S. (2004). Machine Learning with WEKA - WEKA Explorer Tutorial. *School of Engineering and Computer Science, Department of Computer Science, California State University, Sacramento, California*.
- Awati. (2003). Obstacles to Project Communication Retrieved 7th June, 2014, from [www.projectsart.co.uk](http://www.projectsart.co.uk)
- Aiyewalehinmi, E. O. (2013). Factor Analysis of Communication in the Construction Industry. *The International Journal of Engineering and Science (IJES)*, 2(10), 49-57.
- Basu, R. (2013). Managing quality in projects: An empirical study. *International Journal of Project Management* 32(2014) 178-187.
- Bryant, M. (1990). The Anatomy of Theory and its Relationship to Teaching Business Education University of Western Sydney.
- Battikha, M. G. (2003). Quality Management Practice in Highway Construction. *International Journal of Quality & Reliability Management* Vol 20 No 5, 2003.

- Bou, E., & Sauquet, A. (2004). Reflecting on quality practices through knowledge management theory: uncovering grey zones and new possibilities of process manuals, flowcharts and procedures. *Knowledge Management Research & Practice* (2004) 2, 35-47.
- Chan, A. P. C., & Tam, C. M. (2000). Factors affecting the quality of building projects in Hong Kong. *International Journal of Quality & Reliability Management*. Vol 17. Nos 4/5, pp.423-441.
- Chen, Y., & Kamara, J. (2008). The Mechanisms of Information Communication on Construction Sites. *FORUM Ejournal Newcastle University*.
- CMS. (2005). Selecting a development approach. *Department of Health & Human Services - USA*.
- Culo, K., & Skendrovic, V. (2010). Communication Management is Critical for Project Success.
- Dainty, A., Murray, M., & Moore, D. (2006). *Communication in Construction: Theory and Practice*: Taylor and Francis.
- d'Armagnac, S. (2013). Issues in the management of embedded knowledge in project-based organizations: the project actor's role. *Knowledge Management Research & Practice* (2014), 1-17.
- Drummond, H. (1992). The Quality Movement: What Total Quality Management is All About. *Kogan Page/Nichols Publishing, London/East Brunswick. NJ*.
- Grunig, J. E. (2000). Collectivism, Collaboration, and Societal Corporation: A Core Professional Corporatism as Core Professional Values in Public Relations. *Journal of Public Relations Research*, Vol. 12 No.1, pp. 23-48.
- Hossain, L. (2009). Communication and Coordination in Construction Projects. *Construction Management and Economics* 27, 25-39.

- Ilies, L., Crisan, E., & Muresan, I. N. (2010). Best Practices in Project Management. *International Comparative Management. Vol. 11. issue 1.*
- Institute, P. M. (2013). A Guide to the Project Management Body of Knowledge (PMBOK Guide) Fifth Edition: Project Management Institute.
- Kamara, J. M., Anumba, C. J., & Evbuomwan. (1996). Intergration design & construction: A review of existing approaches. *School of Science & Technology, University of Teesside.*
- Karna, S., Junnonen, J.-M., & Sorvala, V.-M. (2009). Modelling Structure of Customer satisfaction with Construction. *Journal of Facilities Management Vol.7 No. 2 2009.*
- Mintzberg, H. (1973). The Nature of Managerial Work. *New York: Haper and Row.*
- Onyegiri, I., Nwachukwu, C. C., & Jamike, O. (2011). Information and communication technology in the construction industry. *American Journal of Scientific and Industrial Research.*
- Parker, D., & Charlton, J. (2013). Integration of project-based management and change management. *International Journal of Productivity and Performance Management. Vol. 62, No. 5, 2013. pp. 534-544.*
- Parker, H. W. (1980). Communication: Key to Productive Construction. *Issues in Engineering. ASCE, Volome 106:173-180.*
- Pemsel, S., Widen, K., & Hansson, B. (2010). Managing the Needs of End-users in the Design and Delivery of Construction Projects. *Division of Construction Management, Lund University, Lind, Sweden, Vol. 28 No 1/2, 2010.*

- Perumal, V. R., & Bakar, A. H. A. (2011). The Needs for Standardization of Document Towards an Efficient Communication in the Construction Industry. *World Applied Sciences Journal* 13(9): 1998-1995, 2011.
- Pheng, L. S. (2007). Managing building projects in ancient China. *Journal of Management History* Vol. 13. No. 2.
- Poole. (2003). A Failure to Communicate. *A Loss Prevention Publication for the Design Professional Community*.
- Sachs, I. (2014). Environmental quality management and development planning. *Economic and Political Weekly*. Vol. 6. No. 30/32. Special Number (Jul. 1971), pp. 1635-1640.
- Siegalaub, J. M. (2004). How PRINCE2 Can Complement PMBOK and Your PMP. *PMI Global Congress Proceedings - Anaheim, California*
- Vardaman, G. T., & Halterman, C. C. (1968). Managerial Control through Communication. *New York: John Wiley & Sons, INC*.
- Wirth, I., & Tryloff, D. E. (1995). Preliminary comparison of six efforts to document the project-management body of knowledge. *International Journal of Project Management* Vol 12. No 2. pp. 109-118.
- Yeng, S. X., G.X.Lou, & Tam, V. W. Y. (2007). Managing information flows for quality improvement of projects. *Measuring Business Excellence* Vol.11 No. 3. pp.30-40.