IMPROVEMENT OF MATERIALS MANAGEMENT FOR BUILDING CONSTRUCTION

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Abstract: ***The study shows that most of contracting companies are still managing construction materials manually. Shortage of user-friendly construction materials software packages and lack of qualified personnel in using computer-based materials management systems are considered the main obstacles in using computer in construction materials management.***
The researcher explores Microsoft Excel capabilities and utilizes these capabilities in developing a Construction Materials Management. Microsoft Excel is used in developing CMMS, as most companies in Afghanistan are familiar with it. Full description of CMMS has been given with detailed implementation procedures. CMMS has been evaluated to test its suitability to local practice. Evaluation of CMMS has addressed both conceptual and practical issues. One of the main recommendations of this research is to encourage local contracting companies' to have a construction materials management software package and use it in determining the required quantities of construction materials in order to get materials in time and required quantities, save time and minimize error.

Keywords: Contractor, CMMS Software, Materials, Management

I. INTRODUCTION

An important problem that adversely affects the performance of construction projects is the improper handling of materials during site activities. The inappropriate handling and management of materials on construction sites has the potential to severely hamper project performance (Ogunlana et A, 1996). There are major issues which affect materials management activities such as constraints on storage areas, site logistics with regards to materials handling and distribution, and also ordering and delivery of materials to the construction site. Construction projects can be accomplished utilizing management processes. These processes include planning, organizing, executing, monitoring, and controlling (Ahuja et al 1994). During any construction project the three inter-related factors of time, money, and quality need to be controlled and managed. Materials management is considered as a means to achieve better productivity, which should be translated into cost reduction. In this research, the existing construction materials management practices of Afghanistan contracting companies are investigated, and an attempt to improve it is conducted. The proposed improvements are formulated in development of a computerized materials management system. In this chapter, the rationale, research aim, research objectives, and outline methodology of the research are explained. The contents of this thesis are also summarized. Construction projects can be accomplished utilizing management processes. These processes include planning, organizing, executing, monitoring, and controlling (Ahuja et al 1994). During any construction project the three inter-related factors of time, money, and quality need to be controlled and managed. The aim of this research paper is to explore the existing common practices in construction material management for the building construction projects in Afghanistan. Also the research aims at developing a computerized materials management system that suites and, hopefully, improves the local practices.

- To review literature related to the construction material management, and also to review the relevant software packages.
- To investigate the local practices of construction material management in contracting companies in Afghanistan.
- To assess the impact of computerization on construction materials management.
- To develop a computerized system in construction materials management to improve the common existing practices.
- To evaluate the system by experienced contractors.
- To explore the influence of the war on material prices, materials availability, and materials management.

In this chapter, the results of the field survey are presented and discussed. The chapter illustrates and discusses the characteristics of the study population, application of construction materials management tools and techniques in construction projects.

II. STUDY POPULATION CHARACTERISTICS

The general characteristics of the study population were investigated. They include the field of work, classification of contractors, number of employees and their qualifications, number of executed projects and their values during the last five years.

2.1 Year of Establishment

Fig. 2.1 shows that only (11.2%) of the contracting companies were established before 1995. (18.9%) of companies were established from 1995 to 2000, while (69.9%) of them were established after 2000. This indicates that most of companies are relatively newly established having less than 17 years of experience.

Variable		Contractors	
		Frequency	*Percentage%*
Year of establishment	Before 1995	12	11.2
	1995 to 2000	19	18.9
	After 2000	41	69.9

Figure 2.1: Year of Establishment of contracting companies

2.2 Field of Work

Fig. 2.2 demonstrates that all respondents are involved, in a way or another, in building works, (94.9%) are involved in Building Constructing works,(23%) are involved in sewage and waste water work and (65%) are involved in roads works. This show how important is the building construction to the construction industry in Afghanistan.

Company work field		Main	Secondary	Unspecialized
Building work field	*Frequency*	75	6	0
	Percentage%	94.9	7.4	0
Water and sewerage works	*Frequency*	44	30	4
	Percentage%	23	38.5	5.1
Roads works	*Frequency*	44	32	4
	Percentage%	65	40.0	5.0

Figure 2.2: Field of company specialization

2.3 Classification of Contractors

Fig. 2.3 illustrates that about half of contractors (43%) are classified as first class in building works. (22.6 %) of them are classified in first class in sewage and water works and (19.0 %) of the respondents are classified in first class in roads works.

Company classification according the contracting union for the following fields		First class	Second class	Third class	Others
Building works	*Frequency*	34	21	29	0
	Percentage%	43.0	26.6	30.4	0.0
Water and sewerage works	*Frequency*	19	20	36	9
	Percentage%	22.6	23.8	42.8	10.7
Roads works	*Frequency*	16	26	35	7
	Percentage%	19.0	30.9	41.7	8.4

Figure 2.3: Degree of Classification

2.4 Number of Employees and Their Qualifications

From Fig. 2.4 it has been found that (97.6%) of respondents employ civil engineers, while (76.2%) of them employ architects, (55.9%) of them employ electrical engineers, and (59.5%)of contracting companies employ mechanical engineers.

Variable	*No.*	*Percentage%*
Civil engineer	82	97.6
Architect	64	76.2
Electrical engineer	47	55.9
Mechanical engineer	50	59.5
other specialist engineer	14	16.5
Technician	75	89.3

Figure 2.4: Qualification of employees in the contracting companies

Fig. 2.5 demonstrates that (45.2%) of respondents have 10 employees or less, whilst (3.6%) of contractors have more than 40 employees. The other (51.2%) of contracting companies has from 11 to 40 employees.

Number of employees	*Frequency*	*Percentage%*
10 and below	38	45.2
11-20	29	34.5
21-30	11	13.1
31-40	3	3.6
More than 40	3	3.6
total	**84**	**100.0**

Figure 2.5: Distribution of Respondents no. of employee

These results reveal how small the organization size of contracting companies in Afghanistan is generally. This means that most contractors execute their projects mainly using subcontractors. In fact, subcontracting is an essential component of almost any project.

2.5 The Number and Value of Executed Projects during The Last Five Years

Fig. 2.6 shows that (42.9%) of contractors executed less than 10 projects during the last five years and only 3 contractors executed more than 40 projects. The majority of contracting companies (53.6%) executed from 20 to 40 big and small projects in the same period.

Number of executed projects during the last five years	*Frequency*	*Percentage%*
10 and below	36	42.9
11-20	31	36.9
21-30	10	11.9
31-40	4	4.8
More than 40	3	3.6
total	**84**	**100.0**

Figure 2.6: Distribution of number of executed projects

Fig. 2.7 shows that (53.5%) of respondents executed projects with a value of less than 3 million dollars, during the last five years. (27.3%) of contracting companies executed projects with a value between 3 and 6 million dollars, and (19%) of contractors executed projects with a value of more than 6 million dollars. This indicates that most of executed projects are of small size.

Total amount of executed projects during the last five years (in million dollars)	*Frequency*	*Percentage%*
1.5 and lesser	27	32.1
1.6-3	18	21.4
3.1-4.5	17	20.2
4.6-6	6	7.1
6.1-7.5	6	7.1
More than 7.5	10	11.9
Total	**84**	**100.0**

Figure 2.7: Distribution of value of executed projects

III. APPLICATION OF CONSTRUCTION MATERIALS MANAGEMENT TECHNIQUES IN CONSTRUCTION PROJECTS

The results show general consistency between the necessity and usage degree of establishing database techniques and the necessity and usage degree of corresponding updating database techniques. The results show also consistency between the necessity and usage degree of each of these techniques.

Also Table 3.1 shows that the most important technique in establishing data base group is "creating materials price database" (72.8%), and the most important technique in updating database group is "updating the database for materials price when change occur" (69.5%). It is noticed that the most important tool in establishing database group and updating database group is the tool that related to the prices of materials. This results may referred to the fact that in Afghanistan materials cost has the lion's share of the project cost.

Table 3.1: Technique necessity and usage in managing construction materials

	No.	Techniques	Necessity degree			Usage degree		
			Necessary %	Somehow Necessary %	Unnecessary %	Usually%	Occasionally%	Rarely
Establishing Data base	1	Establishing categorized materials database	61.3	35.0	3.7	50.0	44.4	5.6
	2	Creating local suppliers database.	65.4	32.1	2.5	56.9	40.3	2.8
	3	Creating international suppliers database.	38.5	47.4	14.1	33.8	48.6	17.6
	4	Creating materials price database.	72.8	23.5	3.7	60.3	36.8	2.9
Updating database	5	Updating the database of local suppliers.	60.8	32.9	6.3	57.5	32.9	9.6
	6	Updating the database of international suppliers.	39.2	41.8	19.0	36.0	38.7	25.3
	7	Updating the database for materials price when change occurs.	69.5	22.0	8.5	64.7	29.4	5.9
	8	Using internet for knowing the new materials and their prices.	50.9	35.3	13.8	49.3	29.6	21.1

IV. USING SOFTWARE FOR SUPPORTING THE CONSTRUCTION MATERIALS MANAGEMENT

Table 4.1 shows that (28.6%) of the respondents do not use computer applications in material management systems in construction projects and (61.9%) use spread sheet based software like (Ms Excel) because it is a familiar application for all construction companies. On the other hand (9.5%) of them Use specialized software and this is some how strange as the researcher did not get any evidence from interviewees of these software that they claimed they had used.

Table 4.1: Using software for supporting the construction materials management

Using software for supporting the construction materials management	*Frequency*	*Percentage%*
Not use	24	28.6
Use spreadsheet-based software (Ms Excel)	52	61.9
Use specialized software.	8	9.5
total	84	100.0

V. CMMS SOFTWARE

This Chapter presents the computerized system which the researcher developed tohelp the Afghanistan contractors to improve their practice in construction materials management. The author named this software Construction Materials Management Software (CMMS). It also discusses the general concepts on which the development of software was based. The chapter describes the software components, and the method of use. The software evaluation and limitations are also discussed.

5.1 Concepts

The researcher reviewed the current situation of construction materials management in Afghanistan by interviewing eleven contractors. He found out that the construction materials management practices are generally inadequate and in the first stages. In addition, he concluded that construction materials management practices are not done in a systematic way. The researcher aims, by introducing CMMS, at improving the common practices of local contractors.

Ahuja et al. (1994) summarize the criteria for selection a software system as follows:

- The software must be relatively easy to install and operate. The input data must be easy to prepare, and the output reports must be understandable.
- Data sorting is one of the base uses of computers.
- It must be a fully tested system and should have a proven record.
- The program should be flexible and have capacity for handling many types of application.
- The database must contain all the necessary elements so it can be managed to generate the desired information reports.
- The program should be compatible with other programs and systems in use in the company.
- The system must be economical in terms of installation, operation, and maintenance.

The author tries his best to accommodate, as much as possible, the above mentioned criteria in development of CMMS.

5.2. Computerized System

Figure 5.1 illustrates a schematic diagram for CMMS. The software consists of four parts. Part one (input data and basic calculations), part two (materials purchase decisions), part three (materials cards), and part four (waste control).They are detailed as follows:

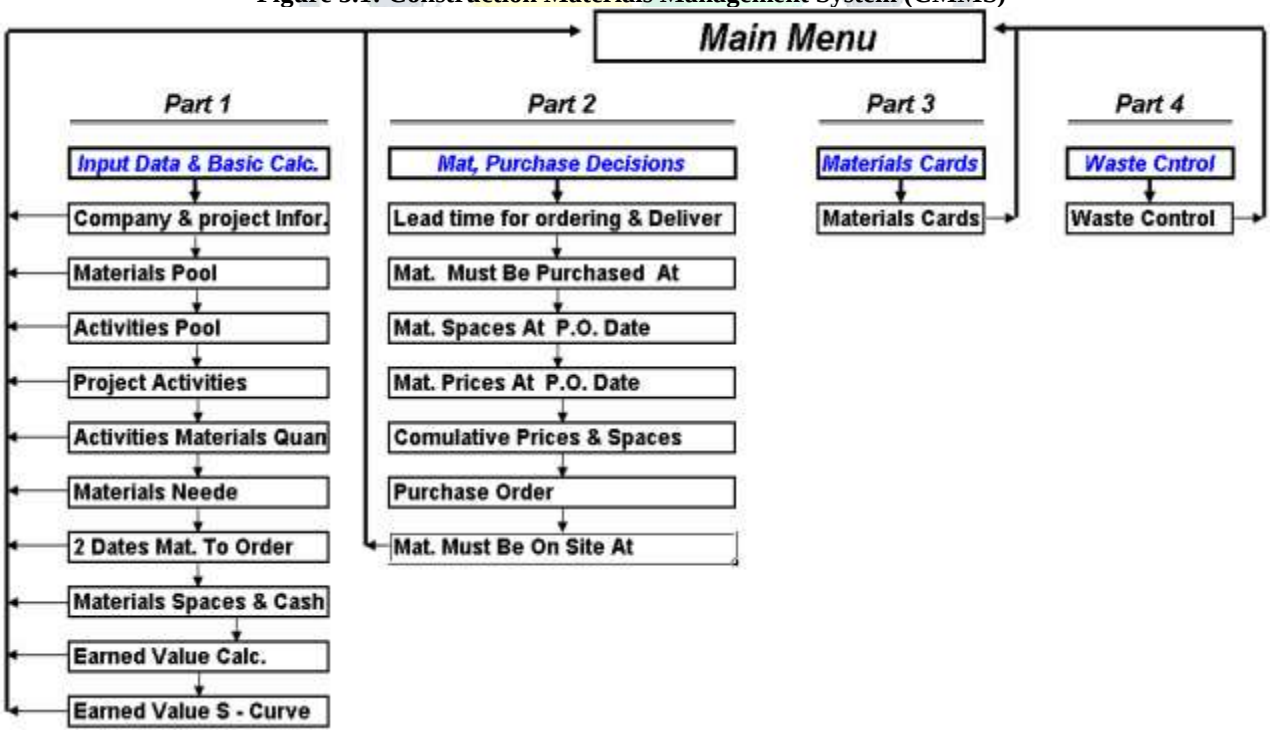
Part 1 (Input data and basic calculations): The input data and basic calculations can be classified into company and project information; materials pool; activity pool; projectactivities; activities materials quantities; materials needed; "2 dates materials to order"; materials spaces and cash requirements; earned value calculations and earned value S-curve.

Part 2 (Materials purchase decisions): The materials purchase decisions can be classified into lead time for delivery and ordering; "materials must be purchased at";materials spaces at (purchase order) P.O. date; materials prices at P.O. date; cumulative prices and spaces; "purchase order and materials must be on the site at".

Part 3 (Materials card): It has one sheet called materials card.

Part 4 (waste control): It has one sheet called waste control.

Figure 5.1: Construction Materials Management System (CMMS)



5.3 Excel Environment

The software is built within Excel environment. It includes spreadsheets processed by number of functions which automate repetitive steps. Spreadsheets have many advantages such as:

- They are inexpensive.

- They are easy to use.
- They can customize to your style of doing business.
- They are powerful.
- They provide a clear and complete picture of inputs and outputs(Christ of ferson 1999).

The field survey illustrated that most companies use Excel more than other programs such as MS word, MS project, and Access. For this reason and for the previous mentioned advantages, the researcher has chosen Excel environment for developing CMMS. This will make the user more comfortable and confident in using CMMS.

VI. CONCLUSION

Construction Materials Management Software (CMMS) was developed to satisfy some needs of Afghanistan contracting companies in managing construction materials. This chapter introduces the research conclusions and recommendations for many parties involved in the construction process to improve the local practices in construction materials management.

The survey results show that contactors, in general, are interested in using many tools of managing construction materials. However, Most contractors did not actually apply some tools and techniques of construction materials management such as:

- Creating database for materials categories, local suppliers, international suppliers, and materials cost.
- Updating database for local suppliers, international suppliers, materials cost when change, and using internet for knowing the new materials and its prices.
- Providing a list of materials in project, providing material cards at site store, and recording the received materials on site.

References

[1]. Boudet, H., Jayasundera, D. and Davis, J. (2011). Drivers of Conflict in Developing Country Infrastructure Projects: Experience from the Water and Pipeline Sectors. Journal of Construction Engineering and Management, 137(7), 498–511.

[2]. Bygballe, L.E., Dewulf, G. and Levitt, R.E. (2015) The interplay between formal and Informal contracting in integrated project delivery. Engineering Project Organization Journal, 5:1, 22-35.

[3]. Cheng, E. W. and Li, H. (2004) Contractor selection using the analytic network process. Construction management and Economics, 22(10), 1021-1032.

[4]. FaqireAmanullah., 2014. A Review of the AfghanistanReconstruction Industry. MMA research Paper, 01 June, pp. 75-104.

[5]. Gunduz, M., Nielsen, Y. &Ozsdemir, M., 2013. Quantification of Delay Factors Using Relative Importance Index Method for construction projects in Turkey. Journal of Management in Engineering, 29(2), pp. 133-139.

[6]. Kasim, N. B., Anumba, C. J. & Dainty, A. R., 2005. Improving materials management practices on fast-track construction projects. London, Association of Researchers in Construction, pp. 793-802.

[7]. Kasim, N. B., Anumba, C. J. & Dainty, A. R., 2005. Improving materials management practices on fast-track construction projects. London, Association of Researchers in Construction, pp. 793-802

[8]. Manteau, E. K., 2007. The development of an information management system for materials management in large construction companies operating in the Ghanian construction industry, Kumasi: Kwame Nkrumah University of Science and Technology.

[9]. Ministry of Urban Development and Housing, 2016 [Online] Available at: http://www.Mudh.gov.af/.(Accessed 28 Feb 2018).

[10]. Zanen, P. (2008). *Improving cost control at a residential project.* San Pedro Sula.