

Research Article

Impact of Plants and Equipment Management in Construction Industry of Iran

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Abstract: During the recent years different people in charge have been considered about different costs of the plants in the construction industry. Usually it seems to be a big challenge for different people in charge and mainly contractors to decrease the costs of the projects through the optimum use of construction plants in order to increase the quality of the project and decrease time and cost. During the current study, researchers have been investigated about the construction plant use in the construction sites and also its effect on the quality and also time of the project. Forty three people in charge with the construction projects have been participated in the current survey. After analyzing the required data through SPSS software and based on the mean index of the scores five items have been identified as the most important issues in the construction management regarding the use if plants namely: The effect of spare parts availability to decrease downtime, the effect of employing expert mechanics to increase the repair quality, impact of gasoline and petrol availability to decrease wasting the time, impact of periodic control and serviceability of plants and equipment to increase productivity, impact of training persons who are involved plants and equipment to increase productivity. It goes without saying that extracted factors have significant role in the construction projects and different contractors should consider them in their projects.

Keywords: Construction plants and equipment management, construction project, productivity

INTRODUCTION

Different parts of the construction industry, such as executive part usually believe that the construction plant has different costs which requires different utilizations in order to make it efficient in the construction sites (Edwards *et al.*, 1998a). During the recent years, different improvements in the construction industry has been happened, different people in charge with construction industry have been done different activities in order to increase the productivity of the construction sites and also decreasing the costs of the projects (Arditi *et al.*, 1997). However, in order to utilize the plant different people in charge with construction projects may have different costs. It usually has different costs like plant ownership and also different costs related to its maintenance. On the other hand it should be noted that plant should be maintained in optimum and suitable situation (Edwards *et al.*, 1998b).

“Equipment” refers to different types of automatic construction related activities and machines like static cranes, concrete pokers, hand-held tools and specialist equipment such as floor polishers. On the other hand, usually the terms plant and equipment could be used interchangeably. For example, it should be noted that an equipment executive is typically in charge with all of the

above mentioned factors. (It should be noted that: usually the plant manager term refers to the construction related activities and works) (Edwards and Holt, 2009).

Zakeri *et al.* (1996) investigated about the lack of using proper tools and equipment and its effect on the productivity of the construction workers. Similarly Haslam *et al.* (2005) mentioned that there is a direct relationship between using equipment and its connection to several construction accidents. Gibb *et al.* (2005) pointed out that it is very essential to use better construction facilities and also equipment in the construction sites.

Usually contractors have different pressures such as budget problems, time constrains, quality of the project and also increasing the safety. Consequently, several equipment uses seems to be a very essential factor to improve the ability of the contractors during the project time (Day and Benjamin, 1991).

Due to the pivotal role of the equipment, several contractors should do several activities in order to manage the equipment in a perfect way and if they cannot do so they may different problems. Different problems and challenges may happen for the contractors during the working procedure with the machine such as life cycle of the machines and different financial risks which may cost a lot for the company (Stewart, 2002).

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Different contactors could not finish their projects without enough financial supports. It has been estimated that 36% of the whole construction project cost refers to the equipment costs (Yeo and Ning, 2006).

Pilcher (1992) mentioned that the main function of the construction managers refers to their problem solving during the project procedure. Accordingly, Walker (2002) mentioned that construction managers have several duties namely planning the project, coordinating and also controlling different steps of the projects. Cooke and Williams (2004) mentioned that seven important duties of the construction managers refer to planning of the project, organizing the project, directing different steps of the project, coordinating different steps of the project, motivating project procedure and different communications during the project procedure. While citing Drucker (1999) and Harris *et al.* (2006) mentioned that the main function of the project managers is to gain optimum resources use but additionally different issues like environmental, social and ethical considerations may affect their management activities.

During the current research, researcher attempted to assess different effects of construction plants and also equipment managements on the construction industry of a developing country namely Iran.

LITERATURE REVIEW

Different studies have been done regarding the equipment management in different countries. Hinze and Ashton (1979) have been suggested several equipment strategies for utility contractors in the context of United States that have been classified into seven different categories namely acquisition of the equipment, financing the projects, project devaluation, maintaining the project, project oldness, expiring life time of the equipment and also disposal. On the other hand, Tavakoli *et al.* (1989) have been reviewed the study of Hinze and Ashton (1979) and of Garies (1979) and they have categorized different equipment management policies into four different categories namely different financing on equipment, analyzing different replacements, different standardizations of the tools and equipment financing, replacement analysis, equipment standardization and miscellaneous. Schexnayder and Hancher (1981) have been examined different industry activities like record keeping, recognition of replacement-decision factors, replacement decision making activities and also equipment retaining phases. Accordingly, Dulaimi and Shan (2002) described the procurement practices of different heavy weight tools referring to bidding decisions of contractors in the context of Singapore.

According to Kline (1998) different problems regarding the plants and equipment supervision challenges resulted from Interruption has been categorized to four different portions like achievement situation, working activities, preservation quality and disposal activities.

Bagies and Fortune (2006), mentioned that during the construction activities eight factors should be considered namely Conservation, Productivity of the plan, Optimization of the plan, Robotics/automation, Health and safety issues, Worker capability, controlling the machine and other related factors.

Usually maintenance refers to different activities that refer to the mechanical keeping and also repairing the plants. In this procedure, they try to keep the plants in a productive and safe position. Vorster (2007) mentioned that usually managers should spend high extent of time to manage the costs but they do not apply any activity minimize or vanish it.

Downtime/Productivity usually refers to the utilization of machine; where downtime represents a machine unable to work for any reason (such as from breakdown or preservation) and maximum use tends to be correlated with maximum plant output. Zakeri *et al.* (1996) ranked equipment failure and also shortage of appropriate tools and equipment as third and fifth, in turn, among the top five reasons for loss of construction productivity.

It is very essential to identify suitable construction plants in the construction projects and appropriate equipment management decisions should be implemented in order to optimize the work output. Accordingly, management judgment refers to different types of the tasks that different contractors should apply.

The robotic or automated operation of plant usually refers the health (Rooks, 2005), protection and wellbeing of people in charge with construction projects (Koivo, 1994). Different construction H&S has been generally well identified in the literature (Health and Safety Executive, 2003; Holt, 2005) different researchers have been confirmed that plant operations has significant effect on different plant operations (Edwards and Nicholas, 2002).

This issue directly refers to the competence, ability and skill capability of the project operators. In the context of UK, usually a certificate of competence would be given due to the HSE outstanding schemes in the format of a card which is named Construction Plant Competence Scheme (CITB, 2007).

Different controls of machines concerns with the improving and also controlling the plant, tools and equipment. LeBlond *et al.* (1998) mentioned that if the plant would be controlled well the safety issues of the project would be assured and also productivity of the project would be increased dramatically. To this aim computer aided controlling can improve the construction site activities very well.

METHODOLOGY

Solving research problems in a systematic way called research methodology, the science to study how

Table 1: Assessing criteria according to mean index

1	Not significant	$1.00 \leq \text{average index} < 1.50$
2	Slightly significant	$1.50 \leq \text{average index} < 2.50$
3	Moderately significant	$2.50 \leq \text{average index} < 3.50$
4	Very significant	$3.50 \leq \text{average index} < 4.50$
5	Extremely significant	$4.50 \leq \text{average index} \leq 5.00$

Table 2: Internal consistency table for reliability test

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Table 3: The result of reliability test

Reliability statistics	
Cronbach's alpha	N of items
0.990	20

Table 4: Factor analysis of the questionnaire (Field, 2009)

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.892
Bartlett's test of Sphericity	Approx. chi-square	637.920
	df	36
	Sig.	0.000

a research done in a scientific way. It includes different stages and steps a researcher adopted during the study of his research problem with of course logic behind them. Knowing about research methods and techniques as well as the methodology is important for researcher. Researcher is usually selects a research method, which is required to study the approaches to understand which of them fits to the objective and seems suitable the required information. During this research, researcher has been used quantitative methodology in order to collect his required data from the participants of the study. At first for the quantitative section he has used questionnaire in order to collect the supplementary data. By using latest version of the SPSS software, all of the collected data has been analysed descriptively and at the end of the study some useful conclusions have been extracted from the results and also some suggestions for the future studies have been posed. During this research researcher used simple random sampling, in order to collect the required data. Forty three persons in charge with construction management issues have been participated in the quantitative part of the study.

Reliability and validity of the questionnaire: The reliability and validity of the questionnaire has been analyzed by using the SPSS software. To this aim alpha Cronbach analysis has been used to assess the reliability of the questionnaire and also factor analysis has been run for testing the validity of the questionnaire. The following tables show the data which has been extracted from a sub-sample of 15 participants out of the 43 participants of the main study as the pilot study of the research. Analysis of the data showed that the

validity and also reliability of the questionnaire was acceptable and researcher decided to use this questionnaire for the main study.

In Table 1, a scale of 5 categories by Majid and McCaffer (1997) that has been used for the average index evaluation of this study has been reflected.

As it has been reflected in the above table and based on the Field (2009), idea if the Cronbach Alpha is $\alpha \geq 0.9$, the internal consistency would be Excellent. If the Cronbach Alpha is $0.8 \leq \alpha < 0.9$, the internal consistency is good. If the Cronbach Alpha is $0.7 \leq \alpha < 0.8$, internal consistency would be acceptable. If the Cronbach Alpha is $0.6 \leq \alpha < 0.7$, internal consistency would be questionable. If the Cronbach Alpha is $0.5 \leq \alpha < 0.6$, internal consistency would be poor and if the Cronbach Alpha is $\alpha < 0.5$ the internal consistency would be unacceptable (Table 2).

As it has been reflected in Table 3, in order to check the reliability of the study, Cronbach's Alpha analysis has been run, the Cronbach alpha result was 0.990, which indicates that, this questionnaire was reliable enough for conducting the study based on the Field (2009), schedule that has been discussed in the earlier part.

Additionally factor analysis was run to see the validity of the questionnaire, as it has been shown in Table 4, Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.8. Usually as this measure goes closer to 1 the validity of the test seems better. When the KMO is near 1, a factor or factors can probably be extracted, since the opposite pattern is visible. Therefore, KMO "values between 0.5 and 0.7 are mediocre, values between 0.7 and 0.8 are good, values between 0.892 and 0.9 are great and values above 0.9 are superb" (Field, 2009). So our questionnaire's KMO is 0.80 which seems to be good and researcher decided to use the questionnaire in order to collect his required data as it seems to be valid based on the factor analysis.

DATA COLLECTION AND ANALYSIS

As it has been discussed in this part of this research; researcher attempted to extract participants' ideas and perceptions regarding the implementation of construction plants and equipment management and its effect on their performance on different projects. According to the elicited data from the questionnaire, most of the participants believed that using construction plants and equipment management has significant effect on the construction sites and it has positive effect on minimizing the time and cost and also increasing the quality. According to the represented data in Table 4 and based on the mean index, five main items regarding the implementation of the construction plant is as follows: The effect of spare parts availability to decrease downtime, the effect of employing expert mechanics to increase the repair quality, impact of

Table 5: Results of questionnaire

Items	Percentage				
	Unimportant	Moderate	Important	Very important	M.I
Impact of maintenance and repair of plants and equipment	0	9.3	41.9	48.8	3.40
Using different kinds of methods to prevent downtime of plants and equipment	4.7	18.6	46.5	30.2	3.02
Effect of operator competence and capability to increase project performance	2.3	4.7	46.5	46.5	3.37
Identifying most favorable situation and decision making to increase plants productivity	4.7	18.6	41.9	34.9	3.07
Impact of using automation and robotic plants and equipment	7.0	14.0	37.2	41.9	3.14
Effect of operator health and safety to increase productivity	0	23.3	39.5	37.2	3.14
Impact of collecting data to increase plants and equipment performance	4.7	11.6	48.8	34.9	3.14
Influence of operators high motivation to rise productivity	0	11.6	39.5	48.8	3.37
Effect of good quality repairing parts of plants and equipment to decrease downtime	0	23.3	37.2	39.5	3.16
Influence of using different kinds of software to better controlling plants and equipment	0	16.3	37.2	46.5	3.30
Impact of periodic control and serviceability of plants and equipment to increase productivity	0	9.3	27.9	62.8	3.53
Impact of training persons who are involved plants and equipment to increase productivity	0	18.6	16.3	65.1	3.46
Impact of reward to operators to increase the productivity	0	16.3	32.6	51.2	3.34
Effect of financial situation to purchase modern machinery	0	7.0	46.5	46.5	3.39
The influence of operator situation such as air condition to raise the productivity	0	14.0	51.2	34.9	3.20
The effect of spare parts availability to decrease downtime	0	4.7	18.6	76.7	3.72
The effect of choosing plants according to work area situation and the layers of earth	0	18.6	27.9	53.5	3.34
Impact of gasoline and petrol availability to decrease wasting the time	0	0	32.6	67.4	3.67
The effect of employing expert mechanics to increase the repair quality	0	4.7	18.6	76.7	3.72
The effect of living situation of operators in the work place to increase the productivity	0	20.9	41.9	37.2	3.16

gasoline and petrol availability to decrease wasting the time, impact of periodic control and serviceability of plants and equipment to increase productivity, impact of training persons who are involved plants and equipment to increase productivity. Based on the importance of the mentioned factors different people in charge should consider the five mentioned factors in order to increase amount of quality of the construction projects as well as decreasing time and also cost of the projects (Table 5).

CONCLUSION

The aim of this research was lack of plants and equipment managements in construction industry in Iran. After collecting the data and analyzing the required data, researcher became to some conclusions that has been reported in this research. Generally speaking managing plants and equipment in the construction industry in Iran was beneficial for different aspect of a construction project and especially it had significant positive effects on decreasing the time and cost of the projects and also increasing the quality of the project. Additionally most of the participants believe that considering construction plants and equipment need enough knowledge and expertise and lack of knowledge can affect their performance in the construction projects negatively. As a conclusion engineer it should be noted that using this method is

essential and needed for the constructions sites in Iran and it can decrease time, money and cost significantly. Hopefully the results of the study seem to be beneficial for different people in charge with the construction projects of Iran and also developing countries and they can benefit the results like people in charge in ministry of way as well as different contractors and subcontractors.

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