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Role of Quantity Surveyors for Waste Reduction in Road Construction Projects in Pakistan

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ABSTRACT

Road construction projects are material intensive and are susceptible to huge quantities of material waste. The existing waste management strategies are mostly based on causes of waste reduction organized in different construction processes and groups, wherein the role of individual project team members has been inadequately studied. Quantity Surveyors play a pivotal role in overall material management and therefore, their responsibilities are required to be incorporated in waste management strategies of construction projects. This study was conducted through Questionnaire Survey to examine the importance of Quantity Surveyors for waste reduction and to evaluate causative factors impacted by their role. The results of this study reinforce the importance of Quantity Surveyors' role in waste reduction in construction projects. The study shows that mistakes, incompetence, and lack of awareness are top waste-causing factors corresponding to the role of Quantity Surveyors. It suggests an action plan for the formulation of a waste reduction strategy through training and technology. This exploratory study fills the gap in the literature regarding examining the role of Quantity Surveyors in waste reduction. The study can be useful to researchers, policymakers, and practitioners in their further study of the role of Quantity Surveyors in waste management.

KEYWORDS: Quantity Surveyor; Waste Management; Road Construction

1 INTRODUCTION

The construction Industry around the globe has been facing a host of challenges including performance, productivity, and sustainability issues[1]. All these issues are adversely affected by material waste generation in construction projects[2]. In road construction, the problem is even more severe primarily because enormous quantities of materials are consumed in these projects which are susceptible to a high rate of wastage [3]. Designers, Project Managers (PM), Quantity Surveyors (QS), and other project staff endeavor to reduce waste as mandated by their respective job responsibilities[4]. Most of the research on waste generation is based on the causing factors in construction processes (design, execution, completion etcetera) and groups (management, people, material etcetera) [5], [6], [7]. However, there is little research available on the role of individual members of the project team in reducing waste generation in construction projects[8]. QS plays a vital role in the overall material management of the project because of the immense amount of responsibility imposed on them[9], [10]. The role of QS in waste reduction in road projects is even

more pronounced as the cost of materials can be between 40 – 60 % of the overall project cost[11]; even incremental reduction in material wastage can enable significant savings[12].
This exploratory study, in the context of Pakistan's construction industry, endeavors to fill the gap in the literature by investigating the role of QS in reducing waste in road construction projects by examining related waste-causing factors.

2 LITERATURE REVIEW

Quantity surveying professionals are an essential part of construction project teams around the world. They have been assigned different names like cost engineers, building economists, cost managers, and QS [13]. Their duties and responsibilities are diversifying due to the ever-changing demands of construction project management in the modern world. QS are required to learn and equip themselves with new competencies and skills. Research suggests that QS with expertise in Claim Management, Contract Administration, BIM Coordination, Cost modelling, Value Management, Life Cycle Costing etcetera have much higher demands in the market[14].
There are only a few studies on the role of individual project team members role in reducing construction waste. A study was conducted in Nigeria on awareness of QS towards material management. It has proposed various waste management strategies incorporating the role of QS in material management[15]. A study conducted in Sri Lanka identifies the importance of QS competencies in sustainable projects. The study discusses material waste management strategies vis-à-vis the role of QS[9]. Another study on the future of the QS profession opines that QS using information technology can reduce construction waste through efficient use of resources to ensure profitability[10]. Research has also been conducted on the role of project team members other than the QS. A study on PM's intentions to control waste in construction projects examines factors influencing the behavior of the PM[16]. Another study examines the behavior/attitude of project designers toward waste[8]. Construction worker's role in waste reduction has also been studied in a recent study[17].
Many studies have investigated factors causing cost and schedule performance issues[18], [19]. In this regard material related factors based on different construction processes/groups have also been highlighted by the researchers [5], [6], [20], [21], [22], however, very few studies have endeavored to underline the assigned responsibility to the members of the project team. There are many causes of waste in the literature that can be attributed to the role of QS. Seven causative factors shortlisted for this study are: (1) taking off errors, and (2) ordering errors. (3) incompetence of workers, (4) mistakes of workers, (5) attitude and behavior issues, (6) lack of awareness, (7) poor working conditions. No worthwhile research on the issue has been found in the context of the construction industry of Pakistan.

3 RESEARCH METHODOLOGY

This exploratory study has been based on quantitative and qualitative data acquired through a Questionnaire Survey. The survey was distributed to road construction professionals through the Google Forms platform. The Questionnaire Survey has been conducted to examine the importance of QS for waste reduction and to evaluate waste causative factors impacted by QS's role. The Questionnaire was designed in three sections: the first section inquires profile of the participants;

the second section examines the perceived importance of QS's role in waste reduction and the third section evaluates waste-causing factors (shortlisted from the literature) through statistical analysis (Relative Importance Index) of Likert Scale data using Eq (1) in MS Excel.

$$RII = \Sigma W/(A \times N) \quad (1)$$

"RII" is the Relative Importance Index, "W" is the weightage awarded to each factor, "A" is the Highest Weightage, and "N" is number of respondents.

4 RESPONDENTS PROFILE

Section 1 of the Questionnaire Survey was regarding the profile of respondents. A total of 250 Questionnaires were circulated to construction professionals, out of which 120 responses were received and 115 were accepted for the study. Responses that were not accepted were found incomplete. The response rate of the survey was 46%. Professionals working with clients (22%), contractors (51%), consultants (20%), and other/academic (6%) organizations contributed to the Questionnaire Survey. Out of them those holding BE Civil (60%) were the largest in number followed by MS-qualified professionals (36%) while the remaining were Ph.D., B Tech, and DAE holders. Most of the respondents were with 20 years and above experience (45%) while the remaining were distributed among other experience groups ranging from 0-5 to 16-20 years.

5 FINDINGS AND DISCUSSION

Four questions (discussed in paras 5.1 – 5.4) were inquired in Section 2 of the Questionnaire Survey to examine respondents' perceptions regarding the role of QS in Waste Reduction. This was followed by Section 3 (discussed in para 5.5) regarding waste causing factors in road projects relating to QS role.

5.1 Responsibility of QS to Reduce Wastage

50 % of respondents believed that the responsibility of QS to reduce wastage is very high, 31 % opined that it's high, 16 % said that it's moderate while less than 2 % believed that it's low and very low (See Figure 1). From these results, it can be concluded that most construction industry professionals believe that QS has a vital role in material waste reduction.

5.2 Maintenance of wastage Record

45 % of respondents opined that wastage record is rarely prepared by construction firms and only a small percentage of 7 % believed that it's always prepared (See Figure 2). It can be deduced that most firms do not maintain wastage records and therefore do not use them in the estimation of material consumption and wastage.

5.3 Accuracy of Estimates

Almost 35 % of the respondents perceived that the material estimates prepared by the QS at the start of the road project are rarely accurate, 26 % believed that the estimates are sometimes accurate and 24 % believed they are often accurate, while the least number of respondents (5%) believed

that the estimates are always accurate (See Figure 3). This reveals that estimates prepared by the QS are generally inaccurate.

5.4 Wastage Allowance for Estimation

There is significant variation seen in the wastage allowance reported by the professionals. However, most of the respondents believed that it is assumed between 3-5% (40%). 6-10% (33%) and 11-16% (14%) (See Figure 4). This implies that wastage allowance is not standardized by the firms.

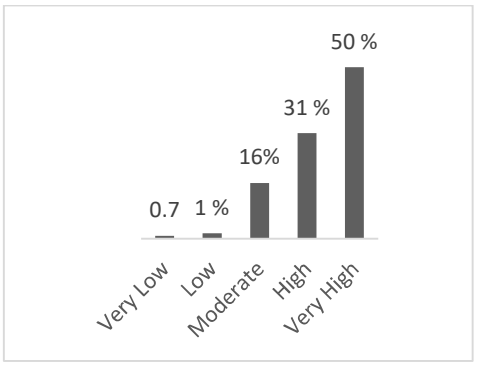

Figure 1: Responsibility of QS to Reduce Wastage

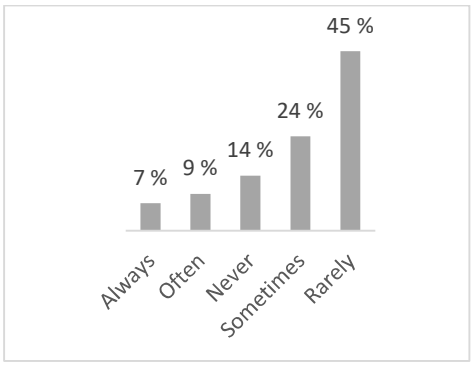

Figure 2: Proper Record of Wastage

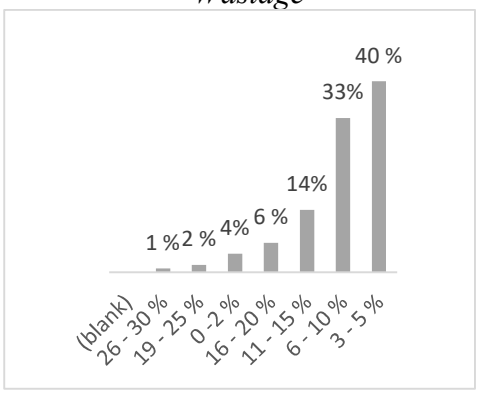

Figure 3 Wastage Allowance for Estimation

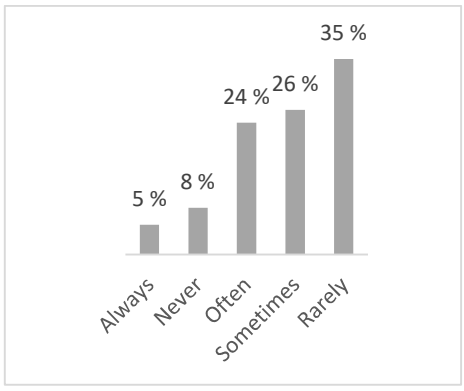

Figure 4 Accuracy of Estimates

5.5 QS-related Factors Causing Waste in Road Projects

Section 3 of the Questionnaire was regarding QS-related waste-causing factors in road projects. Firstly, a reliability analysis of the questionnaire was conducted on SPSS®. Cronbach's alpha value, for the data of seven variables, was computed as 0.831 which indicates good internal consistency of the Questionnaire ($0.9 > \alpha \geq 0.8$). Whereafter, analysis of Likert Scale data based on Relative Importance Index (RII) was calculated using MS Excel®. It showed that the top three causes of wastage related to QS are Mistakes of QS, Incompetence of QS, and Lack of awareness about wastage (See Table 1). This implies that the estimation work of QS requires more

meticulousness and competence to avoid mistakes. The incompetence of QS also points to their knowledge skills and abilities acquired through education and experience. Lack of awareness about wastage hints at participation and responsibility of all team members towards wastage.

Table 1: QS-Related Waste Causing Factors in Road Projects

ID	Factors	RII	Ranking
Q1	Mistakes of QS	0.76	1
Q2	Incompetence of QS	0.74	2
Q3	Lack of Awareness about wastage	0.73	3
Q4	Poor Working Conditions for QS *(salary/working hours)*	0.68	4
Q5	Attitude and Behaviour issues of QS	0.66	5
Q6	Taking Off Errors	0.62	6
Q7	Ordering Errors	0.60	7

5.6 Action Plan for Waste Reduction Specific to QS Role

An action plan specific to each waste-causing factor (Table 1 above) is required for the formulation of a waste reduction strategy by concerned stakeholders. Table 2 shows suggested actions that need to be incorporated into the waste reduction strategy specific to QS role. Training of QS is foremost for improving their technical competence, which will include formal courses, workshops, and on-the-job training[9], [23]. Errors and mistakes of QS can be reduced/eliminated with the use of digital technologies like Building Information Modeling (BIM) which integrates multiple software[24]. Construction firms also need to improve the behavior and attitude of QS through the provision of training and a better working environment[25].

Table 2: Action Plan for Waste Reduction in Road Projects

ID	Factors	Suggested Action Plan
Q1	Mistakes of QS	Technology, Training
Q2	Incompetence of QS	Training
Q3	Lack of Awareness about wastage	Training
Q4	Poor Working Conditions for QS	Management
Q5	Attitude and Behaviour issues of QS	Management/Training
Q6	Taking Off Errors	Technology
Q7	Ordering Errors	Technology

6 CONCLUSION

Road projects consume enormous quantities of material which generate huge amounts of waste. Material waste can be reduced significantly by the implementation of waste reduction strategies in

material-intensive road projects incorporating the role of individual project team members. Quantity Surveyors (QS) play a pivotal role in overall material management which also encompasses waste reduction. The results of this study emphasize the important role of QS in waste reduction in road construction projects, keeping in view the requirement of accurate estimates and standardization of wastage allowances. The study also reveals that a lack of record-keeping in most projects can lead to inaccurate estimation. The results of the study show that mistakes, incompetence, and lack of awareness are top waste-causing factors related to the role of QS. The study suggests an action plan for the formulation of a waste reduction strategy which includes the provision of training to the QS and use of the latest software incorporating Building Information Modeling (BIM). It is recommended that thorough research be conducted on the role of different project team members, especially QS in waste management.

This exploratory study fills the gap in the literature regarding examining the role of QS in waste reduction. The study can be very useful to researchers, policymakers, and practitioners in incorporating the role of Quantity Surveyors in waste management in construction projects. It gives insight to the researchers, policymakers, and practitioners to assist them in further studying the competence of all project team members to handle waste management in construction projects as per their assigned responsibilities.

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