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ATTITUDE OF CONSTRUCTION PARTICIPANTS ON BUILDING MATERIALS WASTAGE

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Abstract- *Building materials wastage has been considered to have high impact on construction projects. It affects both environment and economy of a country. India is a developing country which requires a lot of construction materials for its sustainable development. Building materials wastage leads to shortage of materials which causes delay in completion of projects as well as it increases the cost of the projects. This study focused on the attitude of construction participants towards building material wastage. The finding of this study is to identify the attitude related causes of materials wastage, materials most wastage as a result of human attitude and key guidelines to reforms the attitude of construction participants. Questionnaire survey was conducted which mostly target constructional professionals in specific with Project Manager, Site Engineer, Architects, Structural Engineer etc. to achieve the above aim. The data collected was analyze through SPSS version 23. The main technique of data analysis was descriptive statistics comprising of frequency, mean and standard deviation. Ranking of the factors were done with Garrett's Ranking Technique. Lastly it is concluded that construction materials waste is avoidable and this can be achieve through practicing positive attitude which include self-motivation, developing better communication within the organization, providing proper training to construction personnel regarding waste management practices.*

Key Words: **Attitude, Building, Construction waste, participants, SPSS, Garrett's ranking**

1. INTRODUCTION

Construction is a key sector of the Indian national economy after agriculture. The construction industries in India is growing at high rate. Already at 10 percent of the GDP contributed by construction industry and it is growing at a rate of 10 percent over the last 10 years than the global average of 5.5 percent per year. Approximately 70 percent of the building in India is yet to come up. It is assessed that the construction site to swell nearly five times from 21 billion sq. ft. in 2005 to nearly about 104 billion sq. ft. by 2030. This is a huge surge will have side effect. Buildings construction also create waste, these wastes produced in the construction, repair and disposal phases of a building. Materials, as one of the raw materials used in the construction industry, pass through a series of processes before they are finally incorporated in construction. These procedures bring about shortages of the materials such that the end not all the materials procured and delivered to sites are used for the purposes for which they are ordered. This excessive loss in materials what is called Waste. Material wastage is any extra cost the materials used, and their use included in the estimated price for the job. Currently, most of our construction waste ends up in landfills increasing the burden on loading and operation of the landfill. Minimizing practice and transfer of construction waste, demolition debris, and land-clearing debris disposal and diversion resources that can be recycled back into the construction practice is generally referred to as construction waste management (CWM). The construction sector is consuming a significant quantity of resources, with possibly the most common material like sand to the valuable natural resources such as timber.

The majority of construction waste of resources occurs not only because of poor workmanship, inadequate supervision, improper design or poor organization of a site, but because of the pre-notions of the construction participants that wastage is part of the normal procedure. These views often make construction participants show a nonchalant attitude to resources application (Fapohunda, 2011). Waste resources (physical, solid or latent) in nature are non-value added resources (Howell, 1999). That is, construction material waste adds no value to the overall outcome of a product. These wastes occur mainly through inefficient use of construction materials. The existences of these material wastes are both intentionally or unintentionally, which could be avoided during construction production phase through adequate evaluation of attitude and practices of the construction participants.

1.1 OBJECTIVES

I. Identify the attitudes of construction participants on material wastage.

II. Determine factors that encourage construction participants' attitudes towards material wastage.

III. Discover the key aspects of construction projects mostly affected by material wastage.

IV. Identify construction material mostly wasted through attitude of construction participants and

V. Propose guidelines for promoting positive attitudes among construction participants as far as material wastage is concerned.

2. LITERATURE REVIEW

A various research was done on the attitude of construction participants on building material wastage.

According to Sawacha et al. (1999) material wastage on construction projects include ignorance of operatives; nonchalance on the part of operatives; and displeased attitude of operatives towards material management.

Teo and Loosemore (2001) found that waste has been accepted as an unavoidable by-product, with a strong faith that waste lessening activities will not be capable of eliminate the generation of waste wholly also attitude towards waste lessening have turn out to be one of the reasons behind the problems for the management of waste in the construction firm.
Loosemore et al. (2002) and Skoyes et al. (1987) highlight the importance of human factor for the minimization of waste and argue that waste could be prevented by changing the attitudes of the people.

According to Fabrigar (2004) attitude is a positive or negative feeling toward specific objects; it exerts an influence on behavior.

Tam et al. (2007) showed that different types of construction projects have different levels of waste generation.
According to Fapohunda and Stephenson (2011), carelessness is without doubt one of the attitudes of material wastage in construction site operation.

According to Agyekum et al. (2012), Material waste due to Over ordering/excess, wrong storage, wrong handling, overproduction, manufacturing defects, Theft or vandalism further stated the most dominant causes of waste generation are Late Information, Uncompleted design, Inadequate information, Untrained labor, Work not done, Poor technology of equipment, Changes to design, Damage during transportation.

Rao et al. (2014) explored waste minimization in construction firm and came out with findings which are related to attitude of workers on construction projects as far as material wastage is concerned also waste of cement, reinforcement steel and marble/ granite/ tiles/ were identified and ranked high in Indian perspective.

This above fact has been further proven by the study carried out by (Minaxi, Alisha 2016) which shows the waste material generally consists of powerless, inactive and non-biodegradable materials such as Plaster, Plastics, Timber, Broken tiles& bricks, Metals& Steels.

4. RESEARCH METHODOLOGY

After studying various literature review, I have found twenty-five attitude related factors, eighteen factors related to material most wastage as a result of human attitude and Six factors on reforming or improving attitude of construction participants.

After that, questionnaire form was prepared by collecting information from journals, books, articles etc. It has two sections, the first section contains the general information about the respondent and second part contains various number of factors which causes building material wastage. The questionnaire form was filled using five point Likert scale. Total 50 questionnaires were filled by 10 Project Manager, 11 Architect, 2 Contractor, 17 Site Engineer and 10 Others (Assistant Engineer, Billing Engineer, Electrical Engineer, Quality Engineer, Senior Engineer, Supervisor and Structural Engineer.

5. DATA ANALYSIS

I. Likert scales are commonly used in attitudinal measurements. Since this research is also focused on ascertaining the attitudes of the construction participants, the questionnaires are prepared based on the five point Likert scale ranging from not significant, less significant, moderately significant, significant, very significant. Data is analysed using mean, standard deviation and coefficient of variation.

II. Coefficient of Variation tells us about consistency in the data. The lower the coefficient of variation is the higher will be the consistency in the data.

$$C.V = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100\%$$

III. Garrett's ranking technique: Ranking of various factors were done through Garrett's ranking. This technique is used to determine the most important factors which are causing building material wastage.

$$\text{Percent position} = \frac{100(Rij - 0.5)}{Nj}$$

Where,

Rij = Rank given for the ith variable by jth respondents

Nj = Number of variable ranked by jth respondents

6. RESULTS

Table 1: Attitude related causes of material wastage on construction projects

Attitude Related Causes	N	Mean	S.D	C.V
1.Determination of types and dimensions of material without considering waste	50	2.52	0.953	37.187
2.Lack of attention to dimensions of products available in market	50	3.20	1.125	35.156
3.Mistakes, and changes in specifications	50	4.14	0.756	18.621
4.Slow decision making processes	50	3.30	0.953	28.879
5.Provision of Insufficient information to project participants	50	3.16	0.842	26.646
6.Poor communication among the parties involved in a project	50	3.14	0.881	26.815
7. Rework due to worker's mistakes/Poor workmanship	50	3.56	1.072	30.112
8. Improper Interaction between engineers and workers	50	3.66	0.939	25.656
9. Using wrong Equipment/Tool for execution	50	2.72	1.051	38.640
10. Using damaged Equipment/Tools which leads to rework	50	3.10	0.953	30.742
11.Unnecessary cutting of bars instead of using short pieces	50	3.50	1.074	30.686
12.Using excessive thickness of plaster	50	3.66	1.022	27.923
13.Using excessive quantities of materials more than the required	50	3.66	0.745	20.355
14. Not reusing fallen mortar	50	2.54	0.973	38.307
15. Cutting unnecessarily instead of using small pieces	50	2.84	0.889	31.303
16. Human error and carelessness	50	4.02	1.020	25.373
17. Belief of operatives that material wastage is inevitable	50	3.48	0.995	28.592
18. The pre-notion that allowance is made for wastage	50	3.08	0.944	30.649
19. Ignorance of operatives	50	3.80	1.069	28.132
20. Selection of low quality products	50	2.82	1.137	40.319
21. Displeased attitude of operatives towards material management	50	3.28	0.809	24.665
22. Lack of supervision and delay of inspections	50	4.34	0.823	18.963
23. Wrong storage of materials while execution	50	3.26	0.899	27.577
24. Improper materials storing methods	50	3.06	0.935	30.556
25. Unfriendly attitudes of labor	50	3.46	1.129	32.630

Table 2: Ranking of attitude related causes of material wastage on construction projects

S. N	Attitudinal factor encouraging material wastage	1	2	3	4	5	Total score	Average	Rank
1	Displeased attitude of operatives towards material management	0	8	23	16	3	2345	46.9	I
2	Using excessive quantities of materials more than the required	0	3	16	26	5	2145	42.9	II
3	Human error and carelessness	1	4	7	19	19	1900	38.0	III
4	Mistakes and changes in specifications	0	0	11	21	18	1840	36.8	IV
5	Lack of supervision and delay of inspections	1	1	2	22	24	1715	34.3	V

During questionnaire survey the respondents were requested to scale the factors related to the materials which were mostly wasted as a result of human attitude on five point Likert scale where 1= not significant, 2= less significant, 3= moderately significant, 4= significant, 5= very significant. Table 1 shows the descripted statistics of the factors. In descripted statistics mean, standard deviation, coefficient of variation was calculated. Low coefficient of variation shows high consistency according to this factors were scaled.

Now top five critical factor which was scaled according to low coefficient of variation was ranked according to Garrett's ranking technique. Table 2 shows ranking of the factor according to highest average value. Displeased attitude of operatives towards material management has average value of 46.1 which was ranked first similarly using excessive quantities of materials more than the requirement has average value of 42.9 which was ranked second, human error and carelessness has average value of 38.0 which was ranked third, mistakes and changes in specification has average value of 36.8 which was ranked fourth and lack of supervision and delay of inspection has average value of 34.3 which was ranked fifth. All the variables were highly significant which revealed that displeased attitude of operative, using of excessive material, human error, change in specification and delay in inspection can result in material wastage.

Table: 3 Materials most wastage as a result of human attitude

1. Materials most wasted as a result of human attitude	N	Mean	S.D	C.V
2. Steel bars	50	2.70	0.931	34.481
3. Plasterboard	50	2.92	0.966	33.082
4. Bricks and Blocks	50	2.18	0.873	40.046
5. Tiles	50	3.80	0.926	24.368
6. Concrete	50	3.36	1.156	34.405
7. Mortar	50	3.46	0.676	19.538
8. Cement	50	3.36	0.802	23.869
9. Coarse aggregate	50	3.38	0.753	22.278
10. Sand	50	3.40	0.700	20.588
11. Paint	50	2.42	0.992	40.992
12. Pipes	50	2.70	0.863	31.963
13. Metal	50	2.68	0.868	32.388
14. Insulation	50	2.06	0.890	43.204
15. Plastic	50	2.44	0.837	34.303
16. Plumbing and electrical fixture	50	2.24	1.001	44.688
17. Chipping	50	2.92	0.804	27.534
18. Glass	50	2.12	0.918	43.302

Table: 4 Ranking of materials most wasted as a result of human attitude

S. N	Materials most wasted through attitude	1	2	3	4	5	Total score	Average	Rank
1	Cement	1	3	27	15	4	2305	46.1	I
2	Coarse Aggregate	0	6	21	21	2	2300	46.0	II
3	Sand	0	3	27	17	3	2285	45.7	III
4	Mortar	1	1	25	20	3	2260	45.2	IV
5	Concrete	0	2	26	19	3	2255	45.1	V

During questionnaire survey respondents were further requested to scale the materials which were mostly wasted as a result of human attitude. Table 3 shows the descriptive statistics of these materials were scale. The factor with low coefficient of variation was observed for ranking.

Table 4 shows ranking of the factor according to highest average value. The material cement with highest average value of 46.1 was ranked first similarly coarse aggregate with average value of 46 was ranked second. The next material sand which has average value of 45.7 was ranked third, mortar was ranked fourth with average value of 45.2 and concrete was ranked fifth whose average value was 45.1.

Table 5: Ways of reforming attitude of construction participants towards material wastage

Proposed Guidelines	N	Mean	S.D	C.V
Legislation in favor of waste control	50	2.86	1.125	39.336
Financial rewards and punishment	50	3.18	1.024	32.201
Waste management policy in place	50	3.50	1.129	32.257
Training of workers	50	3.80	1.212	31.895
Conducting waste audit	50	3.88	0.718	18.505
Bar-code system for material management for delivery and return	50	3.22	1.200	37.267

Table: 6 Ranking of ways to reforming attitude of construction participants towards material wastage.

S. N	Proposed Guidelines	1	2	3	4	5	Total score	Average	Rank
1	Financial rewards and	3	10	15	19	3	2410	48.2	I
2	Bar-code system for	6	7	13	18	6	2390	47.8	II
3	Waste management	2	8	14	15	11	2205	44.1	III
4	Training of workers	4	4	6	20	16	2040	40.8	IV
5	Conducting waste audit	0	1	13	27	9	2015	40.3	V

During questionnaire survey responded were requested to indicate the effectiveness of the guidelines for improving the attitude of construction participants to reduce material wastage. Table 5 shows the descriptive statistics of ways to improve attitude of construction participants. The factors with low coefficient of variation was observed.

Table 6 shows ranking of factors according to highest average value. Financial rewards and punishment has average value of 48.2 which was ranked first similarly bar-code system for material management for delivery and return has average value of 47.8which was ranked second, waste management policy in place has average value of 44.1 which was ranked as third, training of workers has average value of 40.8 which was ranked fourth and conducting waste audit has average value of 40.3 which was ranked fifth. This implies that motivating workers through financial rewards, material management for delivery and return through bar code system, waste management policy of construction industry, training of construction personnel and conducting waste audit can reduce the material wastage on construction projects.

7. CONCLUSIONS

Construction waste minimization will certainly play an essential role in achieving the sustainable construction. Since the construction industries are labor-intensive, the attitude of the workers affects the growth and minimization of waste. Therefore, this study has focused on detecting the different factors related to the attitude which causes material wastage during construction. After conducting the study, it has revealed that material waste is avoidable especially which are done by construction participants like using excessive quantities of materials more than the required, human error and carelessness; and Lack of supervision and delay of inspections. Though construction materials waste is avoidable, it can only be achieved through practising positive attitude which includes self-motivation, developing better communication within the organization rdun b , providing proper training to construction personnel regarding waste management practices.

REFERENCES

[1] Agyekum, K., Ayarkwa, J and Adinyira, E. (2012).Consultants" Perspectives on Materials Waste Reduction in Ghana, Engineering Management Research, Vol. 1, No. 1, pp. 138-150.

[2] E.Garrett's statistics in Psychology and Education, Feffer and Simans Private Limited, 21969, p.329.

[3] Fabrigar L. Social influence; PSYC 399-2004; 2004, Retrieved April 28, from http://www.psyc.queensu.ca/courses/psyc399/.

[4] Fapohunda, J.A and Stephenson, P. (2011). Knowledge, attitude, and perception (KAP) of construction participants towards resource waste in the construction industry, The Pacific Journal of Science and Technology, Volume 12. Number 2. Pp. 284-299.

[5] Gandaa, Felix Suntaa Kuufaanaa (2015) Attitude of Construction workers towards Building Material Wastage. http://hdl.handle.net/123456789/6785

[6] Howell, G.A. (1999). What is lean construction, California, USA.

[7] Kulatunga U, Amaratunga D, Haigh R, Rameezdeen R.(2006). Attitudes and perceptions of construction workforce on construction waste in Sri Lanka. Management of Environmental Quality: An International Journal; 17:57–72.

[8] Management of construction and demolition waste in India – Delhi Govt. (2009). http://www.delhi.gov.in/wps/wcm/connect/10d653804eed80b0abaabbfe99daf05a/C%26D_waste_16.04.09.pdf?MOD=AJPERES&CACHEID=10d653804eed80b0abaabbfe99daf05a

[9] Minaxi & Alisha (2016) CONSTRUCTION WASTE MANAGEMENT IN INDIA. International journal of science technology and managements, Vol.5 issue no. 06

[10] Rao, B.P, Shivakumar, B and Suresh, H.S. (2014). Waste Minimization in Construction Industry, Indian Journal of Applied Research, Volume : 4, Iss. 6, pp. 174-177.

[11] Sawacha, E., Naoum, S., and Daniel Fong, D. (1999). Factors affecting safety performance on construction sites, International Journal of Project Management, Vol. 17, No. 5, pp. 309-315.

[12] Skoyles, E.R and Skoyles, J.R.(1987). Waste prevention on site. London: Mitchell Publishing.

[13] Tam, V.W.Y and Tam, C. M. (2006). Waste Levels Reduction by using Stepwise Incentive System: A Hong Kong Study. Griffith School of Engineering, Gold Coast Campus, Griffith University, Australia.

[14] Teo, M. M. M. and Loosemore, M. (2001). A theory of waste behaviour in the construction industry, Construction Management and Economics, Vol. 19, No. 7, pp.741-751.