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ANALYSIS OF CAUSES, EFFECTS AND IMPACTS OF SKILLS SHORTAGE FOR SUSTAINABLE CONSTRUCTION THROUGH ANALYTIC HIERARCHY PROCESS

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Abstract: ***The lack of skilled artisan is a big problem for the construction industry in India. The disadvantage is the consequence of the lack of a structured training program focused on skills within the country's education system. Furthermore, the industry thinks that workers must learn while they work. The performance of artisan is one of the key aspects of productivity that requires adequate attention to the efficient implementation of projects in the construction sector.Improving the skill, efficiency is the most difficult problem in both developed and developing countries. Construction projects are affected by many problems, such as costs, time, quality, safety, etc. Today, the competitive environment of construction forces in construction companies to increase their productivity values to maintain their position in the sector. Therefore, the identification and analysis of the factors that influence the lack of skills in construction becomes a crucial issue.***
This research aims to identify the factors that influence the lack of skills in construction. The questionnaire was designed based on the research method that will be used after the analysis of the literature and the identification of various factors that influence the lack of skills in construction.Data Analysis through excel software has been carried out. Also, all the factors affecting the skill shortage were classified using the Analytic Hierarchy Process (AHP) method. Analysis has been carried out by the pairwise comparison of each factor and criteria for the overall response from stakeholders. After analyzing the data in the questionnaire, the rank was assigned based on the relative importance.

Keywords: Sustainable construction, skill shortages, artisan training, analytic hierarchy process (AHP) method.

1. INTRODUCTION

Skill development acts as a tool to increase overall efficiency and enables a person to work more efficiently. The economy is becoming more productive, more innovative and more competitive due to the existing human potential. The increasing pace of globalization and technological change is also creating problems and expanding opportunities for economic growth and job creation. Countries with higher and better qualifications are more effectively adapting to the challenges and opportunities of globalization.

The construction industry in many developing countries is very concerned about the low productivity of skilled workers due to the economic, social, physical and psychological factors that affect the work of skilled workers. The low productivity of skilled workers is one of the most serious challenges facing the construction industry, especially in developing countries. In today's global economic sense, the productivity of skilled workers is becoming ever higher than ever, due to the poor quality of the work of skilled workers in the construction industry in most developing countries.

2. OBJECTIVES OF THE STUDY

1. To identify causes of skill shortages during the construction phases.
2. To define the effects and impacts of skill shortages on the construction project.
3. To analyze and calculate the relative importance of factors affecting skill shortages by AHP method.
4. To make recommendations to improve skills in construction.

3. ANALYTIC HIERARCHY PROCESS (AHP)

The analytic hierarchy process (AHP) is structured methods of organization and analysis complex solutions. Based on mathematics and psychology, was developed by Thomas L. Saaty the seventies of the last century and was widely studied and since then excellent. This has a special application in the group solution. Products and used widely in the world Different decision-making situations in areas such as government, business, industry, health, and education. Instead of prescribing "right" solution, AHP helps decision makers to find it what best suits their goals and their understanding this problem. It provides a comprehensive and a rational basis for structuring solutions the problem of

representation and quantification elements, to connect these elements in general objectives and evaluate alternative solutions.

3.1 APPLICATION OF ANALYTIC HIERARCHY PROCESS

It is widely used for decision making. Decision situations to which the AHP can be applied include

1. Choice - the choice of an alternative from a given set of alternatives, usually including several decision criteria.
2. Ranking - creating a variety of alternatives to make the most of the least desirable.
3. Prioritization is the determination of the relative merits of the members of a set of alternatives, as opposed to choosing one or only a rating.
4. Resource Allocation - Allocate resources among multiple alternatives.
5. Comparative analysis - comparison of processes in your organization with processes of other leading organizations.
6. Quality management is the solution to the multidimensional aspects of quality and quality improvement.

3.2 PROCESS OF ANALYTICAL HIERARCHY PROCESS TECHNIQUE

The procedure for using AHP can be summarized as follows:

1. Model the problem as a hierarchy containing the goal of solutions, alternatives to its realization and criteria for evaluating alternatives.
2. Set priorities among the elements of the hierarchy, bringing numerous judgments based on a pairing of elements. For example, comparing potential real estate purchases, investors can say they prefer a location in relation to the price and price over time.
3. Synthesize these judgments to get a set of common priorities for the hierarchy.
4. Check the order of the judgments.
5. Make a final decision on the results of this process.

3.3 ADVANTAGES OF ANALYTIC HIERARCHY PROCESS

Some advantages of AHP are as follows,

1. It illustrates how possible changes in priority at the upper levels have an effect on the priority of criteria at lower levels.
2. The method is able to rank criteria according to the needs of the buyer which also leads to more precise decisions concerning supplier selection.
3. It provides the buyer with an overview of criteria, their function at the lower levels and goals at the higher levels.

Table 1: Fundamental Scale of Absolute Numbers for AHP

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or Demonstrated importance	An activity is favoured very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
A reciprocal of above 1-9		A reasonable assumption

(Source: Saaty, T.L., "Decision making with the analytic hierarchy process", Int. J.Services Sciences, 2008, Vol. 1, No. 1, Pg.83–98, Pittsburgh, PA 15260, USA.)

4. RESEARCH METHODOLOGY

In the study, the following steps are taken in the given methodology

4.1 DEVELOPMENT OF FRAME WORK OF CRITERIA'S

From the study of past research work and with the help of expert opinion, skill shortage criteria's were identified for the sustainable construction. The factors of skill shortages are divided into 3 major groups as: contractor related factors, personal factors and other factors. These 3 criteria's are further broen into 18 sub criteria. So, the criteria makes comprehensive coverage of all factors affecting skill shortages. The next work of the research is to assign the relative importance in the form of numeric values. Analytical Hierarchy Process (AHP) technique is selected for this Research work. A Survey questionnaire is prepared based on AHP technique.

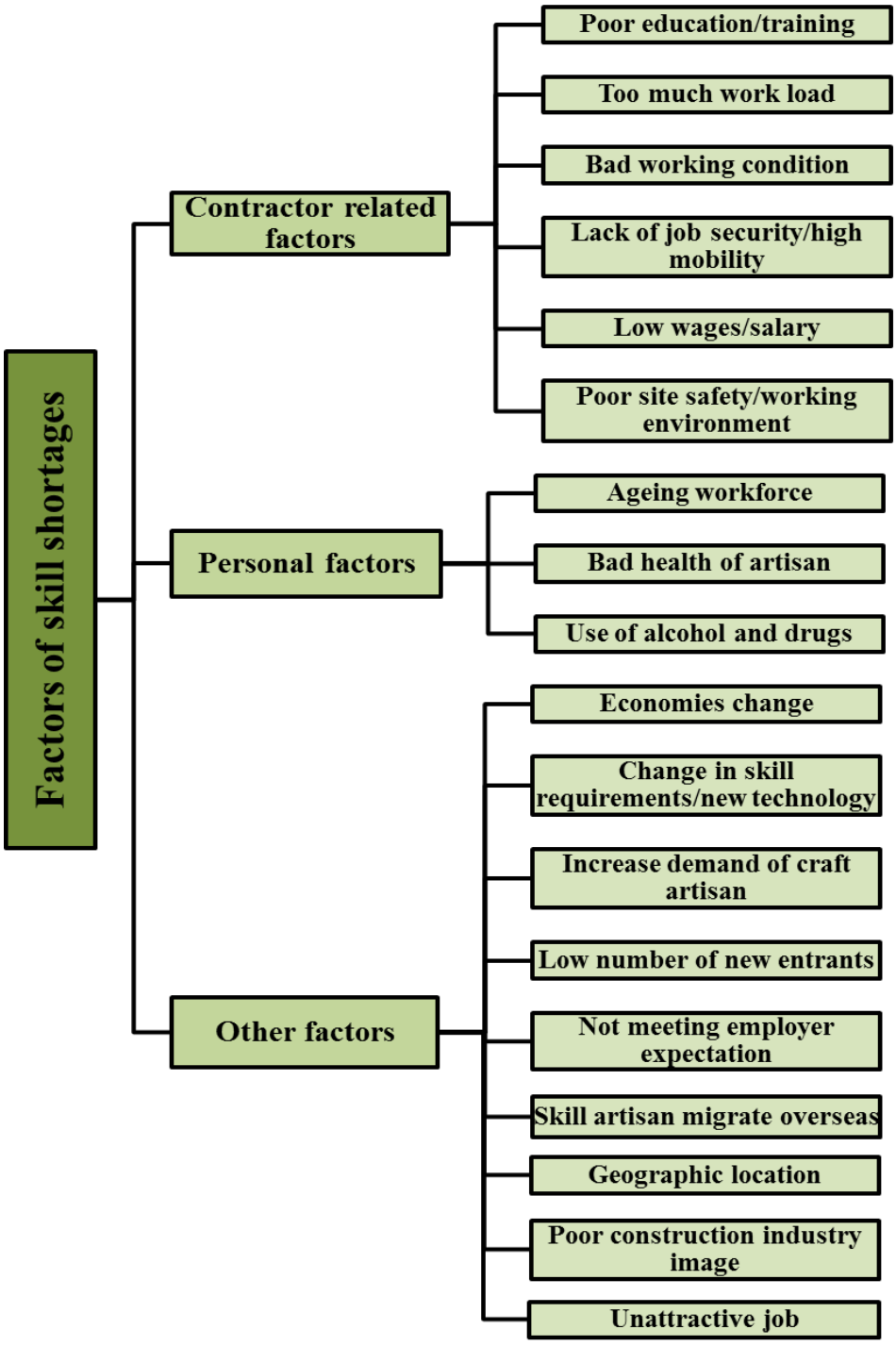

Figure: 1 Factors affecting for skill shortages

4.2 QUESTIONNAIRE DISTRIBUTION AND COLLECTION

The questionnaire was distributed to various stakeholders by informing them regarding the purpose of the research and asking them about their willingness to participate in the research. Once the initial willingness was shown by the respondents, a questionnaire was given to them.

Total 80 questionnaires were distributed to different respondents in Ahmedabad. Total 75 respondents provided their response for this research work. Table 2 represents the distribution of responses throughout the area of the study.

Table 2: Distribution of Respondent

Client	13
Consultant	27
Contractor	26
Others	9

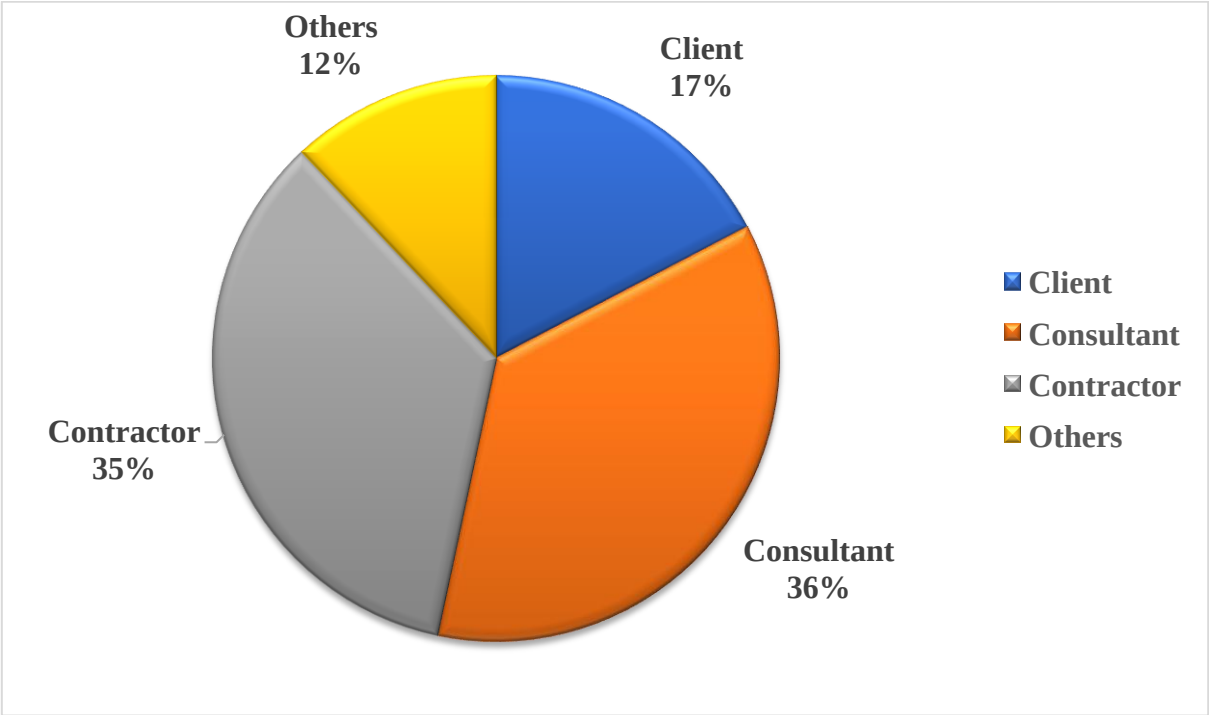

Figure 2: Percentage of Response Received by Stakeholders

The Response rate is calculated based on number of questionnaires distributed and response received. A total of 80 questionnaires was targeted to be collected and out of these 75 which is 93.75% are successfully responded, and it is believed to be adequate for this study.

4.3 DATA ANALYSIS

It is important to identify the degree to how much the respondents agree or disagree on the severity of these causes based on their own experience and knowledge. The data Analysis is done with the help of AHP concept over the qualitative data that is converted to a quantitative form. The data collected from experts were analysed using the Microsoft Excel sheet. Final data obtained after analysis will help to prepare a ranking of various skill shortage factors affecting to the construction projects.

4.4 LOCAL WEIGHT AND GLOBAL WEIGHT

Local Weight: It represents the relative weights of the nodes within a group of siblings with respect to their parent node.

Global Weight: It is obtained by the multiplying the local weights of the siblings by their parent's global weight. The sum of all criteria's Global weight must be equal to 1.

For example: If criteria and sub criteria's local weights are known.

1. For sub criteria: Poor education/Training

Global Weight = local weight of Contractor * local weight of Poor education/Training

i. = 0.6 * 0.3032 = 0.18192

2. For sub criteria: Delay In Too much work load

Global Weight = local weight of Contractor * local weight of Too much work load

i. = 0.6 * 0.0950= 0.05698

3. For sub criteria: Bad working Condition

Global Weight = local weight of Contractor * Bad working condition

i. = 0.6 * 0.1516= 0.09099

4. For sub criteria: Lack of Job Security/High Mobility

Global Weight = local weight of Contractor * Lack of Job Security/High Mobility

i. = 0.6 * 0.0774= 0.04646

5. For sub criteria: Low wages/salary

Global Weight = local weight of Contractor * Low wages/salary

i. = 0.6 * 0.25119= 0.15115

6. For sub criteria: Poor site safety/working environment

Global Weight = local weight of Contractor * Poor site safety/working environment

i. = 0.6 * 0.1208= 0.07250

Table: 3 Local Weight and Global Weight Criteria (Contractor Factor)

Criteria	Global Weight	Sub Criteria	Local Weight	Global Weight	Rank
Contractor	0.6	**Poor Education/Training**	0.3032	0.18192	**1**
	0.6	**Too Much Work Load**	0.0950	0.05698	**7**
	0.6	**Bad Working Condition**	0.1516	0.09099	**4**
	0.6	**Lack of Job Security/High Mobility**	0.0774	0.04646	**8**
	0.6	**Low Wages/Salary**	0.2519	0.15115	**2**
	0.6	**Poor Site Safety/Working Environment**	0.1208	0.07250	**5**

Global Weights of the criteria for each respondent were calculated by the Eigenvector method of AHP. An Aggregation of all global weights was done by Arithmetic Mean Method (AMM). Vargas (1997) demonstrated that additive aggregation is the only way to retrieve exact weights of known objects.

Final global weights of each factor of overall respondent are calculated and the analysis is done in following Table: 4.

Top 10 critical Factors which affect the skill shortages in sustainable construction calculated from AHP process are as follows:

1. Poor Education/Training
2. Low Wages/Salary
3. Ageing Workforce
4. Bad Working Condition
5. Poor Site Safety/Working Environment
6. Bad Health of Artisan
7. Too Much Work Load
8. Lack of Job Security/High Mobility
9. Use of Alcohol and Drugs
10. Change in Skill Requirements

Table: 4 Overall Local Weight and Global Weight

Criteria	Global Weight	Sub Criteria	Local Weight	Global Weight	Rank
Contractor	0.6	**Poor Education/Training**	0.3032	0.18192	1
		Too Much Work Load	0.0950	0.05698	7
		Bad Working Condition	0.1516	0.09099	4
		Lack of Job Security/High Mobility	0.0774	0.04646	8
		Low Wages/Salary	0.2519	0.15115	2
		Poor Site Safety/Working Environment	0.1208	0.07250	5
Personal	0.21	**Ageing Workforce**	0.5324	0.11180	3
		Bad Health of Artisan	0.2723	0.05718	6
		Use of Alcohol and Drugs	0.1954	0.04102	9
Others	0.19	**Economy Change**	0.1203	0.02286	13
		Change in Skill Requirements	0.1993	0.03787	10
		Increase Demand of Craft Artisan	0.1963	0.03730	11
		Low Number of New Entrants	0.1672	0.03177	12
		Not Meeting of Employer Expectation	0.0538	0.01022	16
		Skill Artisan Migrate Overseas	0.1105	0.02099	14
		Geographic Location	0.0418	0.00794	18
		Poor Construction Industry Image	0.0625	0.01188	15
		Unattractive Job	0.0482	0.00916	17

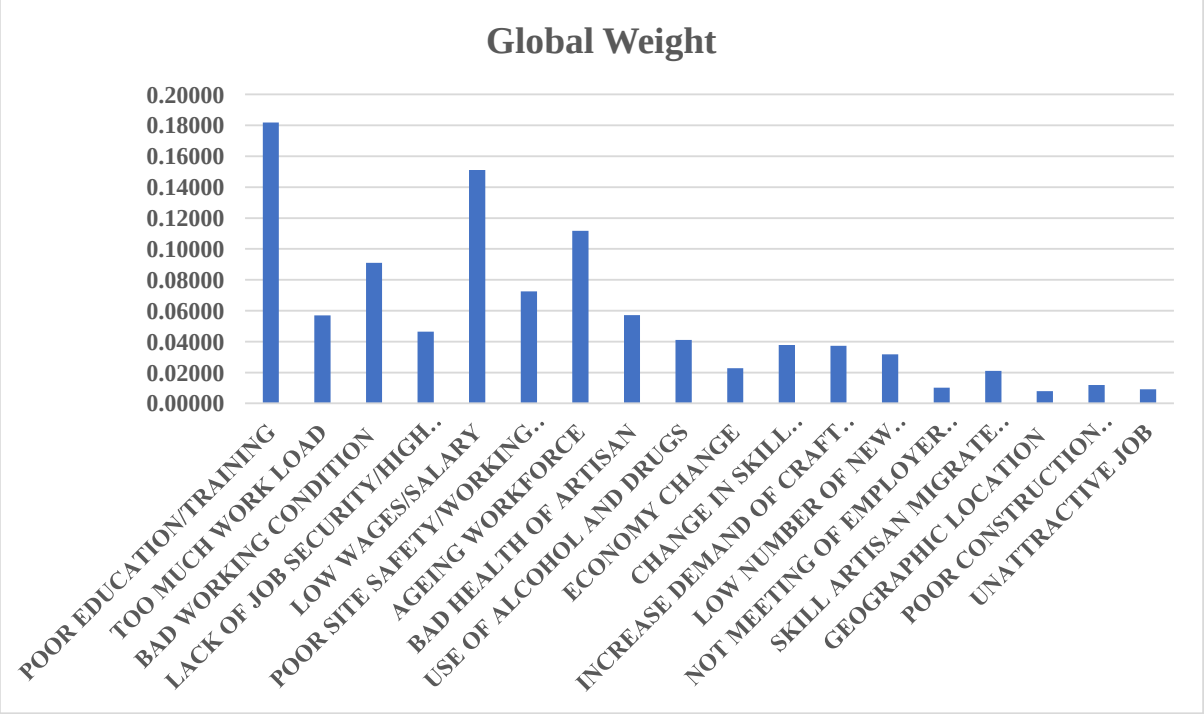

Figure: 3 Overall Local Weight and Global Weight

5. CONCLUSION

The results of the study found that the effects of skill shortages, which may be caused by the lack of qualified people in construction projects, have a negative impact on the overall performance of the project. Therefore, it was important to examine the impact of skill shortages the effects of the lack of skilled artisan on project results in construction projects.

The findings of the study revealed that the lack of formal training to the artisans, performance recognition of artisans and the lack of motivation were the major factors contributing to the shortages of skilled artisans.

Respondents stated that the low-skilled artisan employed by the cooperatives resulted in prosecution. Indirectly, there is a lack of support structures for human resources, such as education, training, motivation and a better level of skills provided by employee organizations so that they can perform their jobs more efficiently and productively. In addition, the lack of appropriate skills is one of the key problems facing the construction industry.

6. RECOMMENDATIONS

Reducing the impact of the causes and consequences of the lack of skilled artisans can only be developed if a clear distinction is made between what creates the shortcomings of experienced artisan and what is not. In addition, the construction industry must adjust their thinking that lack of skills is inevitable. The lack of experienced craftsmen would be solved only if the construction industry could launch marketing methods that would attract young people to join the industry.

Young people would prefer to work with computers than in engineering and related professions. If the country wants to increase the supply of artisans, some measures will have to be taken to encourage people to become artisans. A similar process may have to happen if the students are taken seriously. The question that arises is whether the marketing of the final product is suitable for the student. Therefore, efforts should be made to improve skills and knowledge; otherwise, the loss of reputation, the ruptures and disadvantages of construction and the loss of profits will become products of on-site processing.

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