Efficient Workforce Management

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Abstract-*There are three main constituents of any standard construction site steel (reinforcement), concrete (binder) and labor i.e. workforce now over the past few decade we have almost perfected the use concrete and steel, but the third and the most integral part of the industry has seen very little development. This the reason why the productivity of the workforce still proves to be a challenging issue of efficiency. Mostly in the developing countries across the globe specially the ones which are still dependent upon manual labor for most of the tasks. The aim of this paper is to analyze the key factors affecting the workforce efficiency in the Delhi ncr area. The analysis was done by distributing personalized questionnaires designed according to the experience, qualification and rank of the recipient. After analysis the prevalent issues were sorted and discussed and the actions which could be taken to improve them were provided***.**

Key words: - Labour, Efficiency, Productivity, Improvement, Workforce

1. Introduction

1.1 General Improving the efficiency of workforce can sometimes proof to be a monumental task. Although one might disagree on the above mentioned notion that there have been no or very little development in the manual aspects of the construction industry as most of the structures are being constructed through automated machinery and most of the laborious tasks have been reduced. This fact although true provides very little aspect of the whole notion and as a conclusion any construction site irrespective of the scale is heavily dependent on the assigned workforce. Hence the efficiency of the work force proves to be the decisive factor in the profit earned by the contactor in a particular project.

In general the labor efficiency is directly proportional to factors like time, cost and quality and the allocation of these resources depends upon the construction manager in charge. So, as a construction manager it his duty to get the maximum output possible from the workforce with the current resources which have been allocated to him. This type of efficient management will simultaneously lead to better income from the project.

1.2 Objective

The objective is to study the practical data gathered from different sources on the basis of this study categorizing the issues, sorting them according to their importance and provide a feasible solution for them if possible. Hence summarizing the aim is to

- Collection and analysis the factors which affect the labour productivity.
- Sorting of the persistent and the prevalent issues relevant for discussion.
- Providing a feasible solution for most of the issues.

1.3 Work Force Efficiency

In pure technical terms efficiency can be defined as the ratio of useful work performed to the total energy expanded. Now in civil engineering terms it can rather be simply defined as units of work placed per man hours. In simple terms it is the ratio of output to the resources allocated for achieving the task. Where resources can comprise of labor, capital, energy, raw material etc.

$$\text{Work Force efficiency} = \frac{\text{Work done}}{\text{Cost incurred}}$$

Hence, there are two major ways to increase efficiency: increase the numerator (Work done) or decrease the denominator (Cost incurred). Of course, a similar effect would be seen if both input and output increased, but output increased faster than input; or if input and output decreased, but input decreased faster than output.

Efficiency is an objective concept. As an objective concept it can be measured, ideally against a universal standard. As such, contractors can monitor efficiency for strategic reasons such as corporate planning, self-improvement, or comparison to competitors. It can also be used for tactical reasons such as project control or controlling performance to budget.

Efficiency is also a scientific concept, and hence can be logically defined and empirically observed. It can also be measured in quantitative terms, which qualifies it as a variable. Therefore, it can be defined and measured in absolute or relative terms. However, an absolute definition of efficiency is not very useful; it is much more useful as a concept dealing with relative efficiency or as efficiency factor.

Productivity is useful as a relative measure of actual output of production compared to the actual input of resources, measured across time or against common entities. As output increases for a level of input, or as the amount of input decreases for a constant level of output, an increase in productivity occurs. Therefore, a "productivity measure" describes how well the resources of an organization are being used to produce input. Productivity is usually expressed in one of three forms: partial factor productivity, multifactor productivity, and total productivity

In **partial factor productivity** only a single input is considered with the pertaining output obtained. Partial factor productivity is rather frequently used by personals as the data is readily available .Also, since the total of multifactor measures provides an aggregate perspective, partial factor productivity measures are easier to relate to specific processes Labor-based hours (generally, readily available information) is a frequently used input variable in the equation.

Other partial factor measure options could appear as output/labor, output/capital. Terms applied to some other partial factor measures include capital productivity and materials productivity.

A **multifactor productivity** measure utilizes more than a single factor, for example, both labor and capital. Hence, multifactor productivity is the ratio of total output to a subset of inputs.

A subset of inputs might consist of only labour and materials or it could include capital.

Total factor productivity is measured by combining the output of all the resources used in the project or task (labor, capital, raw material, energy, etc.) and dividing it into the output

one example, is a ratio computed by adding standard hours of labor actually consumed by the task to the amount of cost incurred in the task i.e. including material and the hourly wage procured. Total output must be expressed in the same unit of measure and total input must be expressed in the same unit of measure. However, total output and total input need not be expressed in the same unit of measure. As a result total productivity can rather be used as an effective comparison tools between similar projects but cannot be used as a tool for self-improvement as it has a much broader perspective rather than comparing simultaneous task with their respective inputs.

1.4 Labor Performance

Efficiency is directly proportional to the performance of labour and better efficiency results the increase in contractor's profit. There are several factors which affect labor performance they can be categorized into two categories direct factors, indirect factors

Direct Factors are those factors which are directly linked to the labor performance they can be listed as

1. Age- The capacity to perform several tasks diminishes as the person reaches the threshold age. Generally the age considered as the most fruitful age for a productive labor is between the ages of 20-35. In older age however the experience of the person can counteract the age effect only when it comes to tasks which require skill rather than brute force.
2. Nutrition- This is a major problem for most of the construction labor in India as most of the working class is undernourished due to which the expected work capacity is not achieved. The laborious tasks require food intake of higher calorific value. So, talks about nutrition should be arranged and if possible high calorie food should be provided to the labor.
3. Temperature and Humidity- India being a hot and humid country makes even difficult to maintain the working capacity of the labor to remain uniform during the whole day. As a result it was found that the work performed between 1:00 PM to 4:00 PM was minimum when compared to rest of the working hours. Also the chances of heat stroke are also increased which can result to hamper the work. So as to avoid these conditions certain effective and advanced measures should be taken to avoid this problem as much as possible.
4. Health and Hygiene- As mentioned above the labor class suffers through malnutrition and as a result the immunity of the body is reduced leaving them vulnerable to several diseases. To prevent this strict enforcement of hygiene issues should be ensured and awareness should be spread as much as possible.
5. Site management - The efficiency of the labor is also decreased by substandard site management as the labor needs proper guidance and supervision for

most of the tasks if the person in charge itself is unclear about the task then this would result in disastrous issues for the overall project. The several issues that could result from an incompetent management could be use of wrong methods resulting in increase of the assigned time to the particular task. Unbalanced work gangs resulting in stagnation of the workflow.

Indirect factors are those factors which are not directly linked to the labor performance but still make a considerable contribution to it .They can be listed as:-

1. Motivation - Proper motivation can do wonders for the task at hand if a labor lacks motivation then his capacity to achieve the designated efficiency will be hampered .Motivation can come through in many ways it might be due to fear. The fear to lose ones job if task is not performed in the allotted time with the acceptable standards.
2. Financial incentives –Although giving financial incentives to the workforce for a particular task will increase the capital cost involved in the task resulting in the overall decrement of the efficiency but if the manager at hand can strike a balance between the output procured and the input involved. For example if the labor performing a task X is getting paid Y for it. He is offered 25% more than what he usually gets but in return he would have to perform the task X with an efficiency of 50% higher i.e. by taking half the amount of time that he usually takes. This would result in an increase of 20% of the overall efficiency of the task.
3. Design – If the design of the structure is more complex than what the work force is used to. Then it will increase the amount of time involved to complete such a task resulting in the decrement of the amount of productive hours as much more time would be consumed in understanding the design criteria of the structure rather than performing them. This is the reason why complex deign are rather avoided in small and medium scale projects as they might be efficient in saving the amount of total materials involved in the construction but they end up increasing the amount of skilled labor involved which would rather nullify the cost saved whereas increasing the time taken to complete it.
4. Planning – Proper planning is of utmost importance for any project in any field and the same goes for any construction related activity. The management of the workforce should be such that there should be balance of the work gangs involved for the particular tasks. If imbalance is there between the work gangs there would rather result in stagnation of work and as a result the capital involved would be wasted and the project itself would be delayed. This is why simultaneous planning of the several tasks at hand is preferred rather than completing a particular task first and then moving on to the second.
5. Quality-Achieving higher quality of work requires a great amount of precision in the smaller tasks that are being performed to achieve it. As a result the time ends up being increased resulting in the drop of efficiency. But same might not be true when the task is accomplished by a skilled person as a skilled individual will be able to achieve higher quality of work without wasting much time hence stabilizing the efficiency while achieving a much higher quality which is a complaint raised by the clients while reviewing the work of the contractor. During the study it was particularly observed that large and medium scale projects had much higher quality control than the smaller ones.

2. Methodology

This research has been done on the basis of questionnaire. Data have collected by asking questions from regular and experienced staff. Responses then monitored and bifurcated on the basis of importance with the help of RII method. Data were collected from literature reviews from books, journals, articles and websites which emphasize on labour productivity.

2.1 Data collection

For the collection of data two primary methods were adopted first was through the distribution of questionnaires second was by conducting personalized interviews. Personal interview being a time consuming process was generally avoided by the busy individuals .So, most of the people involved preferred filling the online questionnaire sent to them through mail due to its ease and availability according to them. However as the approach of sending questionnaires lacked the human touch the success rate of replies received were rather low and sometimes intermittent some of them were even filled partially so there data could not considered for statistical purposes. So, a combination of both P.I and

questionnaire were considers resulting in a well-built amalgamate of data.

2.2 Site selection

The area of Delhi ncr is booming with construction projects .The main aim was to diversify the site selection as much as possible so no two same sites with similar conditions were involved .The concerned site supervisors were also assured that none of the data collected from them would be published along with their names. As confidentiality was their prime concerns when they agreed to share the information regarding their performance on behalf of their organizations. To ensure his online storage was the only preferred mode of data storage without any downloading capability .Guidelines were provided to the recipients to ensure smooth and error free operation.

2.3 Questionnaire Design

The primary questionnaire design was kept simple and constructive so that any related to the field of civil could understand it. It was divide into two sections the first section involving the profile the recipient involving details such as designation, work experience, type of project currently working on and location. The second section consisted of the general factors that affected the productivity of the labor in question type form with each question having four or more choices and each having an "others" option with a statement blank given below .The question were based on the various studies performed earlier which were related to the productivity.

2.4 Preliminary survey and improvised questionnaire

To check the credibility of the initial questionnaires designed and to iron out the nicks in them it was essential to conduct a preliminary survey by distributing the questionnaires to the local construction sites .Through the local survey of various construction site it was found that the questionnaire was not viable for the experienced but the uneducated supervisors. Whereas it was completely neglected by higher ranked officials. For some of them the reason for neglect being the first section and for others it was the type of the questions asked as they were mostly field related rather than management related. So, as a result three forms of questionnaires were designed the first one was the primary questionnaire that was initially made. The second one was the translation of the primary questionnaire to the local dialect of the area i.e. Hindi. The third one was for the higher ranked individuals of the field in which the profile section was altered and the questionnaire design was improvised to include the factors affecting productivity due to the managerial aspects of the field.

Table-1: The details of the questionnaires sent and received according to the scale of the project and the respective organizations were as follows

	No.	Percentage
Total questionnaires sent	44	100%
Questionnaires received	35	79.5%
Used for study	35	79.5%

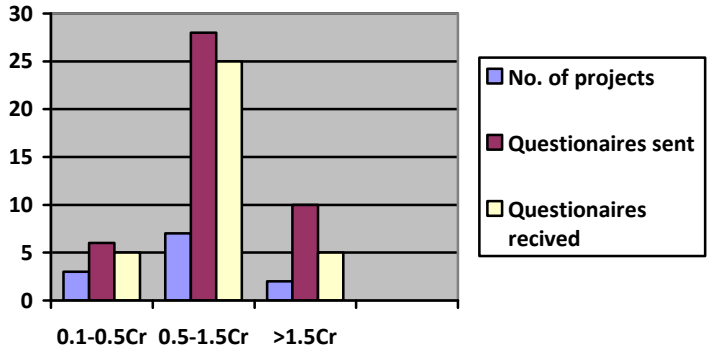

Chart-1: Details of questionnaires sent

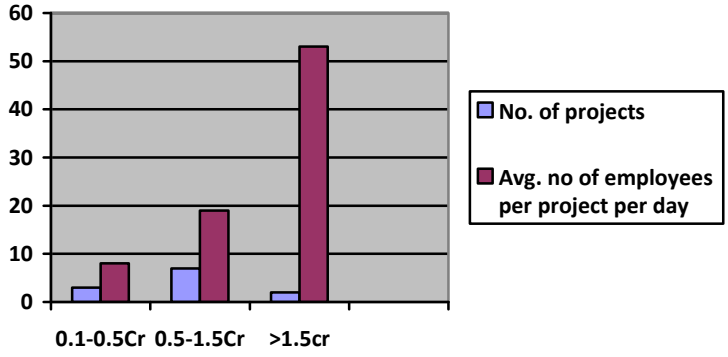

Chart-2: Average amount of labor employed in the projects

3. Basis of categorization

To monitor the factors which affect the labour productivity needs to categorize the sites which were surveyed so that bifurcated observations can be observed and proper understanding can be achieved for different types of construction sites.

3.1 On the basis of cost

In total 13 sites were selected for the collection of information these sites were categorized according to their projected cost. The estimated cost of the project did not include any of the finishing work. Only building constructions site were considered due to the abundance of the data availability. According to their budget they were categorized into small, medium and large scale projects.

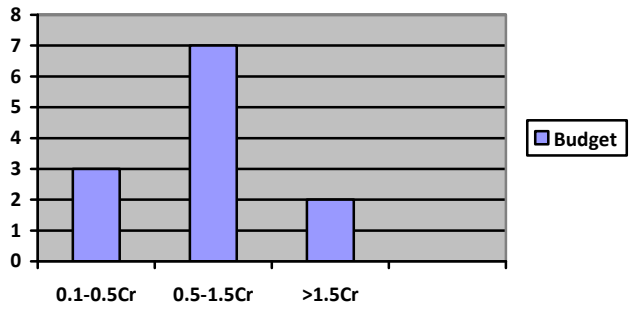

Chart 3: Budget based characterization

3.2 On the basis of type of project

The 13 sites selected were totally different In the type of structure that was being constructed so further classifications of the project can be done on the basis of type of structure that was being constructed whether it was a residential complex, shopping complex ,office building etc.

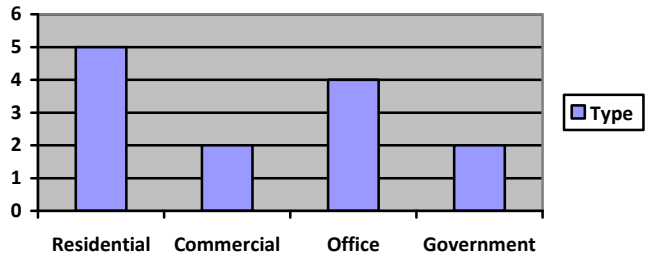

Chart-4: Type of projects

4. Other issues affecting productivity

Apart from labour inefficiency, productivity also hampered by other reasons. Different types of construction sites have different types of issues which affect productivity. It is being observed that small and medium type of sites have nearly same issues and large sites have a bit different issues.

4.1 Issues arise in small and medium scale:-The small and medium scale projects were usually budget constricted so they usually face issues which are linked directly to the capital involved. This generally includes,

- Material related
  - Delay in the arrival of the required materials
  - Wrong estimation of the material required for the particular task
  - Inability of the contractor to make purchase of the required material
- Management related
  - Unclear instructions provided by the supervisor
  - Poor planning of the tasks at hand
  - Lack of knowledge of the methodology
- Labor related
  - Ignorance for site safety and rules
  - Consumption of alcohol and drugs during the working hours
  - Unwillingness to work with and showing disagreement with the supervisor
  - Absenteeism and coming late to work

4.2 Issues arise in large scale:-Large scale projects had the same issues as the small and medium scale projects but due to the larger scale of the project they usually end up being neglected .On the other hand the major issues arising in the large scale projects were

- Labor strikes
- Wastage of material
- Unbalanced work gangs
- Major changes in the design
- Payment of the contractor being blocked

5. Conclusion

Through the study it was concluded that although the construction standards followed by the contractors were more or less up to par with those that were laid by the concerned authorities. But the emphasis on proper management of workforce was rather undermined by most

of them. As a result many problems which were (directly or indirectly) related to the management took place and caused a decrement in the overall efficiency of the workforce. The major issues that were found persistent irrespective of the type of project were execution plan factors, design factors, coordination factors, working time factors, equipment factors, leadership, health and safety, overall indiscipline and ignoring of the site rules.

The aim of this research is to find out the reasons behind labour inefficiency and the extent up to which these reasons affect. We have seen that age factor affects the productivity, nutrition is one of the major cause of low productivity and other reasons also like hygiene, site management, weather and climate, motivation and incentives are the reasons which we can avoid by adopting new and path breaking steps in the construction industry. It has been seen that by improving or by paying a little attention towards labour and their current situation we can increase our productivity and profit. Following steps can be undertaken to avoid above reasons:-

1. More manpower work should be given to labour aged between 20-35 and skilled work should be given to above 35 labour.

2. High calorie food should be given as incentive to the labour as a reward for performing quality controlled work in a given time. This would work as a motivational factor and encourage the labours to perform the task by considering all parameters in a given time.

3. Proper site management and labour management should be done so that required amount of labour would be implemented as work demands.

4. In hot and humid weather, regular drinking of water should be advised to labour and make them aware about the precautions they should take. Their accommodation should be constructed carefully by considering the ventilation and sanitory facilities to prevent them from diseases.

6. Reference

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