Labour Productivity Analysis Using Multi-variable Linear Regression Technique

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Abstract - Labour productivity is a very important element in the process of construction project management especially with regard to the estimation of the duration of the construction activities. The primary goal of this research is to conduct an accurate measurement of labour productivity in selected sites. The data required for the study are to be collected through questionnaire survey. The data analysis are to be conducted by using the statistical software package, SPSS 19.0, for determining the labour productivity. Based on the data analysis results, prepare a Multiple Linear Regression model to predict productivity of the selected work.

Key Words: Homoscedastic, linear regression model, F statistics, statistical software package, inspection frequency

1.1 Methodology

- Literature review was conducted to provide the previous research studies related to the construction productivity and to understand the current construction industry.
- Identification of factors influencing labour productivity
- Selection of area of study
- Data collection through questionnaire survey
- Data analysis using the statistical software package, SPSS 19.0
- Development of Multiple Linear Regression model to predict productivity of a particular work

1.2 Labour Productivity

Productivity can be defined in many ways. In construction, productivity is usually taken to mean labour productivity, that is, units of work placed or produced per man-hour. The inverse of labour productivity, man-hours per unit, is also commonly used.

The labour productivity for this study is estimated using work done in m³, no. of hours worked and no. of labourers using equation 1.

\[
\text{Labour productivity} = \frac{\text{WD}}{\text{LxH}}
\]

Where, WD = Work done in m³
L = No. of labourers

1.2 Factors affecting Labour Productivity

A questionnaire survey was conducted among 76 respondents to identify the major factors which will affect the productivity of labour. The collected data were analysed using SPSS software which is is capable of handling large amounts of data and can perform all of the analyses covered in the text and much more. The main 10 factors which affect labour productivity are listed below.

- Availability of tools and equipments
- Availability of experienced labourers

2. MULTIPLE LINEAR REGRESSION MODEL

In this study labour productivity of column concreting was modelled using multiple linear regression as shown in equation (II). The assumptions of linear regression includes:

- Expected value of Y is a linear function of X
- The error term is homoscedastic i.e., uniform variance
- Error is normally distributed
- Error terms are random

The relationship between dependent and independent variable can be modelled in a multiple regression analysis using the following equation:

\[ y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n + \epsilon \]  

Where,
- \( y \) = Dependent variable
- \( x_1, x_2, \ldots, x_n \) = Independent variable
- \( n \) = No. of predictors
- \( \beta_1, \beta_2, \ldots, \beta_n \) = Estimated coefficients

A total of 12 variables were considered for the analysis. The labour productivity of different sites were considered as the dependent variable and all others are considered as independent variables. The sample size for column concreting analysis was 80 and the model was developed using SPSS software.

![Histogram](image)

**Chart 1: Histogram**

The regression model developed has an R² value of 0.914. The corresponding F statistic was 65.303.

3. CONCLUSIONS

In this thesis, various factors affecting construction labour productivity were studied through questionnaire survey and the major 10 factors were identified which includes tools and equipments availability, availability of experienced labours, material availability, working location, payment delays, use of performance based pay etc. A multivariable linear regression model was developed by using these 10 factors as variables. It is concluded that the model will help to predict the productivity of column concreting with high level of accuracy.
REFERENCES


