

Construction Labour Productivity Based on Fitness Model Using Fuzzy Logic and Artificial Neural Network

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Abstract— Overall competency of the working personal is often observe to ultimately affect the productivity of an organization. The globalized competitive atmosphere coupled with technological improvements demands for efficient and specialized manpower for the industrial operations. a set of typical technological skill and attitudes is thus demanded for every job profiles .most often ,these skills and attitudes are expressed impressively and hence necessitating the support of fuzzy sets for their effective understanding and further processing. In this project, a method based on fuzzy axiomatic design principles is applied for solving the personal selection problem. Selecting a middle management staff of a service department for a large scale organization is demonstrated here as a real life example. Five shortlist candidates are assessed with respect to a set of 18 evaluation criteria, and the selection committee with experts from the related fields also realizes the outcome of the adopted approach to be quite.

Keywords: Construction Labour, Fitness Model, Fuzzy Logic, Artificial Neural Network

I. INTRODUCTION

The construction industry is not only the process of building. It involves many other types of work aside from the building process, such as painting, landscaping, electrical supply, plastering, paving and many more. All these types of work make up one industry, but each of them involves different exposure and thus differing health hazards .The two broad categories of construction projects are building and civil engineering. Building applies to projects involving houses, offices, shops, factories, schools, hospitals, power plants, railway stations, and so on. Civil engineering applies to all the other built structures in our environment, including roads, tunnels, bridges, railways, dams, canals, and docks. Construction workers are exposed to a wide variety of health hazards at work. The exposure differs from job to job.

Anant V. Khandekar [4] (2016) This paper has studied the Overall competency of the working personnel that ultimately affect the productivity of an organization. It also states that the globalised competitive atmosphere coupled with technological improvements demands for efficient and specialized manpower for the industrial operations. A set of typical technological skills and attitudes is thus demanded for every job profile. Most often, these skills and attitudes are expressed imprecisely and hence, necessitating the support of fuzzy sets for their effective understanding and further processing. In this paper, a method based on fuzzy axiomatic design principles was also applied for solving the personnel selection problems. Five shortlisted candidates were assessed with respect to a set of 18 evaluation criteria, and the selection committee with experts from the related fields also realized that the outcome of the adopted approach to be quite

appropriate, befitting and in agreement with their expectations.

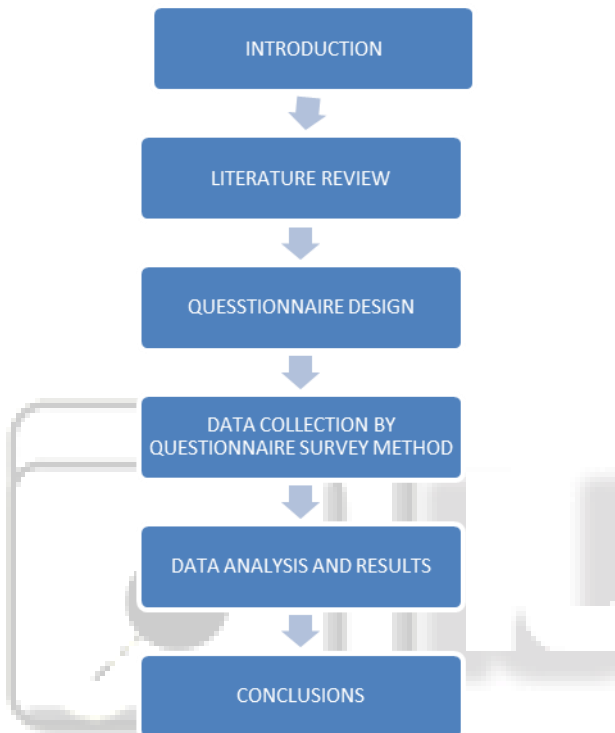
Hyunhee Park et.al [17] (2016) The objective of this study was to evaluate the exposure levels of total volatile organic compounds (TVOCs) for painters in the construction industry. Activity- specific personal air samplings were carried out in three waterproofing activities [polyurethane (PU), asphalt, and cement mortar] and three painting activities (epoxy, oil based, and water based) by using organic-vapor-monitor passive-sampling devices. Gas chromatograph with flame ionization detector could be used for identifying and quantifying individual organic chemicals. From this study, it was recognized that the construction painters are exposed to various solvents, including carcinogens and reproductive toxins, and the levels of TVOC concentration in many of the painting tasks exceeded the exposure limits. Thus the construction workers need to be protected from chemical agents during their painting works by using personal protective evicesand/orworkpractice measures.

Kerstin G. Reeuwijk et al. [21] (2015) This paper made use of work ability index (WAI) which is a frequently used tool in occupational health to identify workers at risk for a reduced work performance and for work-related disability. The aim of this study was to investigate the prognostic value of the WAI for sickness absence, and to check whether the discriminative ability differs across demographic subgroups. The WAI (score 7-49) were assessed among 1,331 office workers from a Dutch financial service company. Sickness absence was registered during 12-months follow-up and categorised as 0 days, 0-5days, 5-15 days, and >15 days in one year. Associations between WAI and sickness absence were also estimated by multinomial regression analyses. Additional analyses were performed for separate WAI dimensions, and subgroup analyses for demographic groups. Amalestaftyet .al [3] (2012) The study investigated the benefits of focusing on the occupational health in the construction field in Egypt and USA. The study indicated the positive impact of implementing safety programs on significantly reducing the recordable injuries. It also showed the benefits of focusing on occupational health and wellness, training, and education of workers. The paper also mentions that the responsibility for injuries may be attributed to a variety of individuals including owners, contractors or subcontractors, engineers, equipment manufacturers, and architects. This mandates a new safety culture to rise to result in a decline in the incidence rate of all recordable nonfatal injury and illness for construction workers

Balkrishna B Adsulet .al [6] (2011) the study reviewed socio demographic profile and morbidity pattern of construction workers. A cross-sectional study at construction site Vidyavihar (West), Mumbai, was carried out over the period of May to November 2010. A medical team provided

comprehensive on-site health care services, and a Health Card was devised to maintain the record of socio-demographic, occupational details, and complete physical examination findings of the workers who participated in the study. Statistical analysis was done using SPSS 15.0. Results showed that of the 1337 workers (all males) examined, 1289 (96.4%) belonged to 15-45 years age group. The mean age of the workers was 26.25 ± 8.49 years. A third of the migrants belonged to West Bengal. The average number of health problems in the workers was 1.41.

II. METHODOLOGY



III. OBJECTIVES

The models-developed using Fuzzy Logic and Artificial Neural Network can be used for accurate assessment of the fitness level of construction workers and then estimating the target per work day of each individual from the identified category of construction occupation respectively. This can allow the construction industry to hire the most productive workers to be involved in the completion of the project

The objective of the research is to study the health problems of the workers in the construction industry in their occupational environment. The specific objectives are Exploring the various occupational diseases likely to occur.

- Identifying the category of construction occupations with increased risk to occupational diseases.
- Studying the source and impact on these particular category of construction identified.

Suggesting a fitness scale to assess the workers level of productivity and suitability to appoint for a particular work.

The impacts of lean construction principle

IV. QUESTIONNAIRE DESIGN

The research data was obtained mainly through interviews and questionnaires. Field observations through site visits were also employed to collect data on the study. The questionnaire, which consisted of 3 major sets of closed-ended questions, was designed to obtain data on estimating the impact of lean construction practices on project duration and cost. Interviews were also used to obtain more specific information about this study. The data needed to apply proposed methodology is collected from the experts by means of the questionnaire. Therefore, this section clearly explains all compulsory information regarding the questionnaire.

The primary data is collected through two stages, firstly the prevailing conditions of construction workers were examined through a detailed investigation on the hospital medical history. The primary data is collected from the medical history records of the construction workers for the last five years from public sector hospitals. For this study the data was collected from the data obtained from a 30 day medical camp conducted by the government medical college, Kozhikode and from the hospital records of cases of construction workers. This helped widely to understand the types of illness and the effected construction trade. Further with the help of this data the workers performing the identified category of construction occupation were approached so that a field examining could be done and their responses could be collected directly on regard of the various health hazards they are subjected to face as a result of their working condition. A sample set 70 was taken. The survey was done on workers performing painting, concrete workers, quarry workers, bar benders, carpenters, masons or plasterers and road construction workers. On the light of information obtained from the questionnaire survey and other case studies the various factors effecting the fitness and health of construction workers were thus identified.

V. ANALYSIS AND RESULTS

The data analysis will be done after the data collection is finished. All the data collected from the questionnaires will be analyzed and then summarized to obtain the appropriate and suitable result of the lean construction impact

The aim of this research was to identify the most important factors that led to the fitness of a construction worker which may directly or indirectly influence their working ability. The factors were identified through literature survey and a questionnaire was prepared to collect the response from different worker categories directly. Once response collection was completed it was followed with computation of WAI score. Further the productivity factors grouped under 10 categories were tested for significance using correlation analysis so that the data becomes much precise and clear to be used input variables while developing ANN Model. Thus all construction trade workers were different in their opinion on the questions of what all factors could effect their performance or productivity. This was clearly identified with the help of correlation analysis, considering the significance value < 0.05 . Thus the category of workers, like painters, barbenders, masons and carpenters had 5, 6, 8, and 7 productivity factors as significant. In the development of fuzzy model the significance approach was not

taken in to consideration , hence all the fitness factors were used as input. Thus with the help of fitness score estimated the ANN models were developed using the fitness score as one of the factor determining his / her productivity.

The developed ANN models considered limited number of factors. These factors are based on correlation significance. The factors can be increased for future works. The sample size may be further increased to give a more accurate result by improving the accuracy of the model. As the number of data increases more accurate will be the result. One of the greatest hurdle of the study was difficulty to obtain the required data for developing the model. The response from few workers could not be considered as perfect responses as they can had a slight difficulty in understanding the orally asked questions. There is a wide scope for future work under this work such as to work with an optimization process as these types of workers in general, maximize their earnings by subjecting themselves to greater risk of occupational health hazards mainly due to economic reasons.

VI. REFERENCES

- [1] Acharya SR, (2014) Utilization Pattern of Personal Protective Equipment among Workers, *Journal of Public Health*, (2):1-5
- [2] Alireza Afshari et.al (2010) Simple Additive Weighting Approach To Personnel Selection Problem, *International Journal of Innovation, Management and Technology* (5):511–515.
- [3] Amale Saftayet .al (2012) Construction Safety and Occupational Health Education in Egypt, the EU, and US Firms *Open Journal of Civil Engineering* 174-182
- [4] Anant V. Khandekar, Shankar Chakraborty (2016), *Personnel Selection Using Fuzzy Axiomatic Design Principles* , ISSN 1648-0627 / EISSN 1822-4202.
- [5] Anurag Sangole and Amit Ranit (2013) Identifying Factors Affecting Construction Labour Productivity in Amravati, *International Journal of Science and Research (IJSR)* 2319-7064.
- [6] Balkrishna B Adsule et.al (2011) Problems Among Migrant Construction Workers: A Unique Public-Private Partnership Project , *IOSR-JNHS*.29-32
- [7] B.C.H. de Zwart et.al (2002) Test–retest reliability of the Work Ability Index questionnaire *Occup. Med.* Vol. 52 No. 4, pp.177–181
- [8] B.Vijay Antony Raj and P.S.Kothai (2014) Study On The Factors Affecting The Performance Of Labours In Indian Construction Industry, (ICETS'14) volume 3, special issue 1
- [9] Consol Serra et.al (2007) Criteria And Methods Used For The Assessment Of Fitness For Work: A Systematic Review , *Occup Environ Med.*; (5):304–312
- [10] Dan Chong et.al (2014); Volatile Organic Compounds Generated in Asphalt Pavement Construction and Their Health Effects on Workers , *J. Constr. Eng. Manage. ASCE* , ISSN 0733-9364.