An Integrated SWARA, QFD, and ISM Approach for Agricultural Injuries in India

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ABSTRACT

A survey was carried out to study and collect data about the agricultural farmer injuries of Odisha in India. Five villages with major population with farming as occupation were selected. A total of 145 farmers were selected for the study. It was found that, the number of accidents by hand tools such as spades, plain edge sickles, serrated sickles, and shovels were 13 (16.45%), 6 (7.59%), 11 (13.92%), and 7 (8.86%), respectively. Also, it was observed that maximum number of male and female farmers who were victims of agricultural injury were in the age group of 31 to 45. A smaller number of injured farmers were found in the age group of 18 to 30. Factor analysis followed by the SWARA method was used to rank the important variables which were found as the causes for agricultural accidents or injuries by the responses obtained through questionnaires. Finally, QFD & Interpretive Structural Modeling (ISM) and MICMAC analysis was performed, to frame design requirements in the form of safety requirements.

KEYWORDS

Agricultural Farmers, Hand Tools, Injuries, ISM, Odisha, QFD, SWARA

1. INTRODUCTION

Cultivating part is a vital however dismissed division everywhere throughout the world. A man leans more and more towards automated and agreeable life. So human development is increasingly pulled in towards the mechanical division. Cultivating business is an old traditional business, yet at the same time it is a non-profitable business segment. Occupational safety is a major issue of discussion for farming specialists. The techniques for working in field in extreme atmosphere (warm, rain, etc.), the contact with the chemicals (pesticides, fertilizers, etc.), the exposure to soil, dust & animals, the contamination due to bacteria, injury due to hand tools and musculoskeletal disorders are the most important injuries faced by all agricultural workers. Farmers require adequate precautionary measure and wellbeing measures at the season of field and machine work, with the end goal that no physical harm strikes them. The fatality rate in farming is far higher than some other financial area. Despite of the fact that a little extent of the workforce is utilized in cultivating, a large proportion of all fatal workplace accidents occur in agriculture.

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Most of the farming injuries are the outcome due to the improper selection and use of hand tools. The traditional hand tools like spade/hoe, sickle, hammer, shovel, knife among others play a major role in performing the farming activities, and these tools have been used since the ancient time though some modifications are found nowadays. Since most of the farmers of Odisha in India belong from poor financial ground, they usually lean toward using the traditional hand tools in cultivating instead of using the developed power operated machineries. The hand tools are generally utilized in farming activities like land preparation, weeding, harvesting of crops for specifying a few. However, the farms accident rate is not decreasing, similar accidents happen each year (Hope et al., 1999). Murphy (1992) has characterized farming as the occupation which relies upon the farming awareness skill of individual and the capability to do complicated and repetitive tasks. To enhance the ability and performance of individuals, as well as the safety level in the working place, all the above skills as defined by Murphy (1992) are essential and also it was reported that nonappearance of any of the expertise can bring about farming injury (Voaklander et al., 2006). Although agricultural injury does not have any standard definition (Kumar et al., 2000), some authors have proposed one. For instance, Cooper et al. (2006) have defined the agricultural injury as the injury that occurs while performing farm work or going to or from work. Nag and Nag (2004) have differentiated farming accident as farm implement related agricultural accidents and nonfarm implement related agricultural accidents. Accidents with the use of hand tools or farming machineries are included in farm implement related agricultural accidents, whereas accidents without the use of hand tools or farming machineries are included in nonfarm implement related agricultural accidents i.e. snake biting, hazardous fuels & gases, airborne irritant, noises, vibrations, zoo noses, dusts, chemicals, fungal, end toxins, carrying heavy loads, exposure to heat, falls from height and electrical hazards. Moreover, looking at the occupational health & safety issues of the nominal farmers in India, it is highly desirable to frame policies against accidents, frame training programmes and to take sufficient safety measures such that injuries of farming sector can be avoided.

Different authors and researchers have successfully applied the integrated approach of both multi criteria decision methods (MCDM), and quality function deployment (QFD) technique, in various complex issues. For instance, Yazdani et al. (2016) have used an integrated model of supplier selection problem using SWARA, QFD and the MCDM tool called WASPAS. Where SWARA method was designed to give more weight to customer requirements and then, the quality function deployment (QFD) followed by the house of quality matrix was used to transform customer requirements into the supplier evaluation index. Additionally, to rate the performance of suppliers and present supplier ranking scores, WASPAS was used. Similarly, Yazdani et al. (2017) have used an integrated approach for green supplier selection in which for constructing a relationship structure, the inter-relationships between the customer requirements was obtained by decision-making trial and evaluation laboratory (DEMATEL) method. Further, QFD model was used for identifying the degree of relationship between customer requirements and each pair of supplier selection criteria. This was then followed by complex proportional assessment (COPRAS) for prioritizing and ranking of the alternative suppliers.

This paper aims at developing an integrated approach in the agricultural sectors for evaluating various risk factors and reasons for agricultural injuries, and ranking them based on their weights by using SWARA method. Then based on the obtained significant reasons for agricultural injuries, the QFD technique was utilized to recommend the design requirements in the form of safety precautions to be followed to avoid such injuries. Finally, ISM methodology was used to identify the relationship among those design requirements.

1.1. Literature Review on Agricultural Injuries

Very few literatures exist on agricultural injuries and accidents in India. A few authors and researchers have reported that the agricultural accident rate is higher than the industrial sectors. Tiwari et al. (2002) in their study in Madhya Pradesh state in India have found the agricultural accident rate as 1.25 per thousand workers per year. It was also reported that because of farming machineries, 77.6%
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