

**DEVELOPMENT OF AN
ERGONOMIC RISK ASSESSMENT
TOOL FOR FOUNDRY ENVIRONMENT**

ABSTRACT
of the thesis

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ABSTRACT

Manufacturing sector is the life line for continuous growth of any country. Though this sector provides ample employment opportunities, nevertheless some of these activities are physically intensive and carried out manually. At the same time global competition in manufacturing sector demands higher productivity levels. Hence occupational ill-health and work-related disorders are predominant in manufacturing industries due to the inevitable presence of manual work even after several waves of industrial automation and technological advancements. Under these circumstances, ergonomic based studies are becoming more and more relevant. Foundry is one such manufacturing sector, where the manual work is still dominant and many activities are probable sources of job strain. Since many western countries are outsourcing their foundry activities to India, it is becoming home for several foundry clusters. In this context the present study attempts to understand and assess the predominance, severity and effects of occupational health hazards that are present in Indian foundry environment. Though several tools exist for assessing occupational risks, they are domain specific, can handle single task at a time and working environment is not considered. This limitation further motivates the present work.

This work has four major modules comprising the confirmation of the need of the study, identifying the problematic activities in foundries, validation of the study results and proposing improvements to critical problematic activities.

During the first stage, preliminary survey has been designed to elicit the necessity of ergonomic study in foundry environment. For this purpose an open end questionnaire has been developed and responses have been collected from foundry workers individually involved in activities belong to melting/pouring, molding, fettling, pattern making and core making shops. The study has revealed that majority of foundry activities spread across various shops are prone to health hazards. This necessitates further studies directed towards reducing occupational health hazards amongst workers.

Based on the results of the preliminary study, the ergonomic based questionnaire has been designed and survey has been conducted among foundry workers spread across small to large scale foundries. The questionnaire based physical risk assessment tool has been designed such that it gives appropriate weightages to physical work and environment in which it is carried out. A new measure of physical effort, “physical effort index” is proposed to assess the risk factor. Results indicate the effectiveness of the proposed index in estimating the risk factor levels.

The proposed tool has been subjected to validity tests in order to ensure its applicability in the foundry environment. Later the survey results have been tested for reliability using statistical methods. The outcome of the proposed tool is further substantiated by comparing the results with the domain specific standard tools proposed in the literature where ever applicable.

The proposed tool brought out the prevalence of risk in the fettling, melting/pouring, molding, core making shops. The identified problematic activities have been broadly categorized under environmental and postural

problems. The environmental problems are predominant in melting and pouring sections whereas postural problems exist in all the shops. Computational Fluid Dynamics (CFD) approach has been used to analyze and improve the melting/pouring environment whereas improvements in posture have been recommended with the help of tools that work on the principles of biomechanics.

The summary of the study and analysis is presented below:

- The foundry work place is found to be hazardous, necessitating ergonomic changes.
- A worker occupies more than one posture in foundry to complete multiple tasks assigned.
- A simple and holistic tool which does not interfere with the work is proposed to assess these activities considering Job Factors and Work Environment.
- Physical Risk Factor Index is proposed for assessing the risk at foundry workplace.
- Foundry work place has been assessed using the proposed index.
- The assessment results imply most of the activities in foundry fall under the category of 'Very Strenuous'.
- The strenuous activities are analyzed to propose possible improvements.