



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : **Ph.D.**

Thesis Title:

**Innovative Design Interventions to Address Safety-related Issues in FMCG
Industrial Shopfloor: Ergonomics Perspective**

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Thesis Submitted to the Department/ Center : **DESIGN**

Date of completion of Thesis Viva-Voce Exam : **04 OCTOBER 2024**

Key words for description of Thesis Work : **Ergonomics, Human Factors, OSH, Industrial Design, FMCG, Innovation, Design Thinking**

SHORT ABSTRACT

Ergonomics and Occupational Safety & Health (OSH) are critical in the current industrial environment to ensure the smooth operation of production processes. Consideration of these aspects enhances shopfloor working conditions and workers' well-being. A lot of ergonomics and OSH-related research has been carried out in diverse industrial sectors to improve shopfloor working conditions, workers' health, and productivity. However, there is a lack of OSH-related studies in the context of the Fast Moving Consumer Goods (FMCG) industry, which is the key contributor to every country's GDP and employment. FMCG industries in Industrially Developing Countries (IDCs) typically operate in manual and semi-automated production/ operational settings and are vulnerable to various ergonomic stressors and safety hazards. Ergonomics-related ignorance persists in such industries, and adverse shopfloor scenarios prevail. In the current scenario, the FMCG-related research focuses on management-related issues to achieve production/ operation excellence and typically overlooks the ergonomics perspective. Various non-standardized job activities exist in manual and semi-automated FMCG units, which causes safety hazards and OSH concerns. In this regard, the present study intends to address safety challenges on the manual and semi-automated FMCG shopfloors through ergonomic design and the development of context-specific innovative tools/ devices as mitigation options. FMCG manufacturing units operate on varied production scales, including small-scale, large-scale, and mega-scale, and their work parameters differ. A single solution to meet their needs/ requirements may not be appropriate. In this purview, for devising innovative solutions to address safety-related issues for varying levels of production scale, it is hypothesized that the design and development of innovative tools/ devices in the context of OSH on the shopfloor of the FMCGs is constrained by the scale of production, cost, and available resources.

In the present research, an ergo-audit at the twenty FMCG manufacturing units working in manual and semi-automated setups located in Assam-northeastern Indian state was conducted. It aimed to understand the peculiar working parameters of FMCG manufacturing and to identify various OSH-related issues prevailing at

manual/ semi-automated Indian FMCG manufacturing units. Several ergonomic stressors and OSH issues were found and reported to stakeholders (factory management, safety supervisors, and workers) to prioritize the most critical area of concern. Deploying the card-sorting technique rework of defective pouches/ sachets was identified as the most critical issue that needs immediate attention. Rework is a non-standardized work activity prevalent on every FMCG shopfloor, irrespective of the production scale. Due to its inherent demand for working with a sharp blade/ cutter held in bare, slippery hands and the need for manual hand squeezing, it is injury-prone and highly laborious. It requires prompt attention to promote safety in such injury-prone job activities. As the need/ requirement of stakeholders for intended mitigating solutions varies depending on their work demands and the number of pouches to be reworked daily, there is a need to develop context-specific innovative tools that address the need/ requirement of each scale of production levels. In the current research, through practical shopfloor-oriented work, three variants of innovative tools/ apparatus capable of addressing the context-specific needs of the varied scale of manufacturing units were developed, deploying a systematic design strategy based on the thorough implementation of ergonomics and design principles. The physical prototypes were developed and tested for potential success on respective shopfloors. The apparatuses/ tools, which were developed and factory-trialed, were evaluated for productivity improvement and ensuring user compatibility from various human factors perspectives. These effectively mitigated safety concerns and various ergonomic stressors associated with FMCG rework.

The current study is novel in that it contributes new, critical, and context-specific knowledge to the FMCG research arena. The current study is unique in that it identifies and mitigates non-standardized job activities in the formal manufacturing sector, whereas previous studies mainly focused on identifying ergonomic stressors. Furthermore, its innovative component is the demonstration of resolving the same segment's OSH difficulties at three different levels of manufacturing scale. The study's generalizability stems from its detailed explanation of the generic technique for detecting ergonomic stressors and safety-related concerns in any industrial sector and treating them at different levels of production scale, as illustrated in the framework established. In a nutshell, this systematic design philosophy may encourage young researchers to perform such research projects on manufacturing shopfloors, which are typically regarded as severe formal contexts. Overall, the current research raises ergonomic awareness among many stakeholders in the FMCG arena, and such practical investigations on the industrial shopfloor support the 'Zero Accident Vision' philosophy and demonstrate a proactive attitude toward its advocates. The current study is based only on FMCG manufacturing units located in Assam and has not explored such units in other Indian states. It has taken into account the task of providing mitigating solutions to rework activity, that is, 'after the fact' event occurrence, i.e., the situation that arises after the pouches become defective and need to be reworked, and does not address the prevention of event occurrence in the first place. The innovative tools developed (present design solutions) are context-specific to the FMCG rework operation of low-viscosity products. In the current research context, these issues define the limitations and future scope of effort.
