

## Article

# Improve Integrated Material Handling (IMH) Efficiency of Local High-Rise Building Projects by IMH Framework Optimization and Empirical Analysis

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## Abstract

Fast urbanization and economic development lead to a prosperous high-rise building industry with high material handling efficiency (MHE). However, the integrated material handling (IMH) framework optimization and empirical studies on Chinese high-rise buildings are not in-depth. Here, the IMH practice in Chinese Chongqing high-rise building projects (CHBPs) was researched, and the effect factors of MHE were discussed to propose improvement strategies. A questionnaire survey (191 participants), qualitative topic analysis, quantitative descriptive statistics, reliability/correlation analysis, an independent sample t-test, analysis of variance (ANOVA), and regression analysis were performed. As a result, the understanding of the IMH concept, effectiveness of training projects, and positive effect of regulations were found to favor an improved MHE. Moreover, a weak positive correlation between work experience and MHE was found. Through the proposed model development framework, the combination of theoretical analysis and empirical research can provide comprehensive tools and knowledge resources for IMH practices in CHBP to improve MHE. Through quantitative indicators such as the material handling efficiency index (MHEI), the training project impact score (TPIS) and the regulation perception index (RPI), this framework offers an objective basis for continuous monitoring and improvement.

**Keywords:** integrated material handling; efficiency; building project; research framework; empirical analysis



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## 1. Introduction

Quick urbanization and economic development have boosted the development of the high-rise building industry in Chongqing, in China [1]. The unique geographical location and climatic conditions in Chongqing can result in a significantly improved complexity in the architectural design and construction, leading to hard material handling (MH), high cost, slow progress, and high security risk [2,3]. The material handling efficiency (MHE) can directly affect the schedule, cost and quality of a building project [4]. An effective MH strategy can greatly reduce the work hours, lower the safety risk, and improve the overall efficiency of the construction site [5]. At present, in the high-rise office building construction in Chongqing, the MH has become one of the key factors which can affect the schedule and quality of the project. Due to large dosages and multiple kinds of building materials, combined with a small construction space, the effective organization and management