Chapter 15
A Comprehensive Optimization Framework for Concrete Supply Chains in Large-Scale Construction Projects

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ABSTRACT

When taken as a whole, these issues cause construction businesses to lose a lot of money, delay projects, and become less competitive. Opportunities for cost savings and performance enhancement go untapped due to the absence of systematic optimisation techniques. Furthermore, ineffective supply chains increase traffic, material waste, and carbon emissions, all of which have an adverse effect on the

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environment. Large-scale building projects' concrete supply chains are beset by serious inefficiencies that raise prices, cause delays, and compromise quality. The construction industry's current supply chain management procedures are mostly based on antiquated methods that are not systematically optimised and do not make proper use of the technologies that are now available. The present condition of concrete supply chains in large-scale projects is characterised by a number of serious issues.

1. INTRODUCTION

One of the biggest industries in the world, the construction sector makes a substantial contribution to both infrastructural expansion and economic development. Concrete is the most popular building material in this sector, with over 4 billion tonnes used worldwide each year. Massive amounts of concrete are needed for large-scale construction projects, such as industrial complexes, high-rise buildings, and infrastructural improvements; hence supply chain management is essential to their success. Several parties are involved in the concrete supply chain, such as suppliers of raw materials, manufacturers of concrete, transportation companies, and building contractors. To guarantee uninterrupted material flow, maintain quality standards, and fulfil project deadlines, this intricate network must function in unison. But the industry has a lot of trouble efficiently managing these supply chains, especially when it comes to large-scale projects where the stakes are greater and there is less room for mistake. Conventional methods of concrete supply chain management often depend on reactive tactics and experience-based decision-making.

When working on large-scale projects with several suppliers, fluctuating demand patterns, and strict delivery deadlines, this strategy falls short. A more methodical and scientific approach to supply chain optimisation is required due to the growing complexity of building projects, rising material prices, and environmental concerns. In the concrete business, supply chain optimisation entails striking a balance between many conflicting goals, such as resource utilisation, timely delivery, quality assurance, and cost reduction. The problem is made worse by the perishable nature of ready-mix concrete, which has to be supplied and installed within a certain window of time in order to preserve its qualities. Supply chain choices become more urgent due to this time restriction, which also makes optimisation even more crucial.

The advent of Industry 4.0 technologies, such as advanced analytics, artificial intelligence, and the Internet of Things (IoT), opens up new possibilities for supply chain optimisation. These technologies have the potential to revolutionise the management of concrete supply chains by enabling automated decision-making, real-time monitoring, and predictive analytics. However, compared to other industries,