# Chapter 9
# Understanding the Role of GIS in Packaged Marine Product Supply Chain

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## ABSTRACT

*The supply chains of packaged marine products are very perishable, geographically distributed and are under strict regulatory and cold-chain parameters. Geographic Information Systems (GIS) have good potentials to help overcome such challenges but few empirical studies have identified and ranked the major factors that drive the adoption of GIS in packaged marine products supply chains. The focus of this research is to fill this gap by determining and prioritizing the essential factors of GIS adoption based on the consensus of the experts. To begin with, the possible drivers of GIS adoption were established by a thorough literature review of works on the marine supply chain, cold-chain logistics, traceability, and spatial decision support. The Fuzzy Delphi Method was used in the second stage to assess and rank these drivers by the expert opinions.The findings suggest cold-chain integrity and*

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*temperature-risk control to be of the most high-priority driver of GIS adoption, then route optimization and transit time reduction and traceability, transparency, and recall preparedness*

## 1. INTRODUCTION

The supply chain of packaged marine products refers to the flow of seafood such as fish, shrimp, crab, and processed marine foods from harvesting to the final consumer in packaged form. These supply chains are highly time-sensitive, quality-driven, and cold-chain dependent (Subramaniam et al., 2023; Kidane 2025). Moreover, supply chains of packaged marine products are quite perishable, decentralized geographically, and face intense regulatory and cold-chain demands. The capability to handle geographically dispersed risks, logistics activities, and compliance is increasingly important in making effective decisions by such systems.

Packaged marine product supply chains are some of the most operationally challenging food networks since they are perishable, require cold-chain maintenance, export documentation, and rising sustainability, and traceability demands. Marine products are usually packaged as frozen seafood, chilled processed fish, value-added ready-to-eat or ready-to-cook products and cans. These items pass through a chain of landing centers, aggregation, processing, cold warehouses, distribution, and domestic or export markets (Koirala et al., 2025).

One of the challenges posed by packaged marine products supply chain is that risk and performance have a spatial nature. The processing clusters, cold stores, landing centers, markets, and catch zones are scattered geographically. Time of transportation, the environment surrounding it, port accessibility, exposure to disasters, and enforcement have spatial variations. These spatial considerations have strong effects on retention of freshness, spoilage, logistics cost, service levels and compliance results (Stentiford et al., 2022). The capability of handling location-dependent decisions has influenced supply chain performance in the marine products industry over the past years. Poor route planning, congestion around ports, ineffective location of cold storage or exposure to high-risk areas can be the direct cause of quality deterioration, spoilage losses, increased logistics expenses, and failure to meet food safety and export regulations. Consequently, supply chains decision-makers need tools that can not only handle data relating to operations, but also directly use spatial intelligence in the planning, execution, and control operations.

Geographic Information Systems (GIS) offer an effective platform on how to overcome these challenges by providing the opportunity to collect, combine, analyze and visualize data related to location(Ullah et al., 2023; Billal et al., 2025). GIS enables players in the supply chain to know the location of activities, geographic