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RESEARCH PAPER

Developing a Conceptual Framework for the Design of a Modular Service Platform: The Case of the Logistics Industry

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Abstract

Despite growing interest in digital transformation and modular services, many logistics firms—especially in Iran—lack a cohesive framework that integrates modular architecture with operational and technological needs amid rising complexity and customer demands. This study aims to develop a conceptual framework for a modular logistics service platform that enhances flexibility, innovation, and collaboration across supply chain actors. The research identifies core service modules and examines how modularity can support the design of efficient, adaptive service offerings. Using a qualitative case study approach, the study investigates one of Iran's leading courier companies. Data were collected through semi-structured interviews with ten senior managers, direct observations, and analysis of internal documents. Thematic content analysis revealed key service modules, processes, and a three-layer modular architecture consisting of service, process, and activity layers. These are structured around the First Mile, Mid Mile, and Last Mile segments, incorporating nodes, links, and carriers as core elements. The platform supports modular processes such as routing and packaging, enables outsourcing at multiple levels, and integrates Artificial Intelligence (AI), and Internet of Things (IoT) technologies to optimize performance. The framework addresses major gaps in existing literature, including role definition, modular governance, smart technology integration, and service scalability. This research offers a novel, multi-level modular logistics framework validated in a real-world context, providing a practical blueprint for logistics firms seeking to transition to flexible modular platforms that enhance efficiency and collaboration.

Keywords:
Modular Logistics Platform,
Service Design,
Service Modularity,
Logistics Architecture,
Supply Chain Flexibility.

1. Introduction

1.1. The Concept of Modular Platforms and Their Relevance in the Logistics Sector

Logistics companies such as A Courier Company offer a diverse range of services—from next-day intercity deliveries to same-day urban shipments, heavy-item transportation,

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warehousing, and packaging—each tailored to meet distinct customer needs. This diversity raises a fundamental question: How can such a broad set of services be integrated into a unified yet flexible structure? In other words, how can a logistics platform strike a balance between the need for standardization and the demand for adaptability?

In recent years, the increasing complexity of logistics operations and the growing role of digital technologies have underscored the importance of designing systems that are both flexible and scalable. A modular approach provides a promising pathway to achieve this goal by decomposing logistics services into autonomous yet interconnected components that can be configured and reconfigured as needed. Such an approach not only enhances flexibility and cost efficiency but also supports innovation and value creation across the logistics network.

Despite growing awareness of the benefits of modular design, many logistics companies still lack a cohesive framework for implementing modularity in practice. This challenge is particularly evident in the postal and transportation sectors of emerging economies, where firms must simultaneously handle high service diversity, increasing customer expectations, and infrastructure constraints. Addressing this gap requires a systematic framework that translates the concept of modularity into an operational platform for logistics services.

Accordingly, this study aims to develop a comprehensive framework for designing a modular logistics service platform that enables flexibility, scalability, and integration across various service layers. The framework aims to provide a clear architectural foundation that enables logistics firms to design, manage, and expand their services in a modular and adaptable manner.

Methodologically, this research employs a qualitative case study approach, focusing on A Courier Company as one of the leading logistics firms in Iran. Given the company's complex and multilayered operations, this approach enables an in-depth examination of processes, challenges, and opportunities related to modular service design. Data were collected through semi-structured interviews with senior managers and logistics experts, supplemented by direct observations and a review of internal documentation.

As a result, this study proposes a three-layer modular framework comprising the Service, Process, and Activity levels. The model identifies key modules and their interconnections across the First Mile, Mid Mile, and Last Mile segments, providing a foundation for designing and delivering new, efficient logistics services. Specifically, the research addresses the following questions:

1. What are the primary logistics service modules across the three levels of service, process, and activity?
2. What are the submodules associated with each of these levels?
3. What are the defining characteristics of the resulting modular framework and its implications for logistics service design?

2. Literature Review

Over the past four decades, a key concept has gradually emerged at the intersection of market demands, technological advances, and competitive pressures: modularity. Initially introduced in the context of industrial manufacturing, modularity steadily made its way into the service sector, and particularly into logistics. Over time, it has become a foundational pillar in the design of modern logistics platforms.

A historical analysis of the evolution of modularity in logistics—from the 1980s through 2024—demonstrates how the concept evolved from a theoretical abstraction into a practical, ecosystem-oriented framework. This transformation has been shaped by environmental challenges and technological progress, culminating in modular architectures capable of rapid adaptation, multi-actor collaboration, and intelligent responsiveness to shifting market needs.

The five stages outlined below trace this developmental trajectory—from the early recognition of the need for flexibility in logistics processes to the emergence of digital modular architectures that now serve as the core of next-generation logistics platforms.

2.1. Phase 1 (1980s to Early 2000s): The Emergence of Flexibility as a Strategic Imperative

In this initial phase, logistics research predominantly emphasized the importance of flexibility and the agility of logistics processes. Competitive dynamics and customer demands were comparatively simpler, yet the idea of responsiveness to market changes began to take shape early on. For instance, Golden and Baker [1], in their influential paper Future Directions in Logistics Research, drew the academic community’s attention to the future of logistics and its environmental challenges. They argued that logistics should no longer be viewed solely as the physical movement of goods, but rather as a capability that must adapt to uncertainty and shifting market conditions.

While the concept of modularity had not yet been formally articulated during this period, the foundational ideas necessary for future modular logistics architectures were nonetheless laid. These included the need for new strategies to manage the increasing complexity of logistics operations and reduce costs. Furthermore, although not yet prominent in the literature, the notion that logistics management must keep pace with technological advances began to emerge. This set the stage for later studies that would focus on tools such as Quality Function Deployment (QFD) and the development of modular approaches to logistics service design [4].

2.2. Phase 2 (Early to Mid-2000s): The Emergence of Modularity in Logistics

As the late 1990s gave way to the early 2000s, the concept of modularity—originally grounded in industrial manufacturing—began to extend into the service domain and, eventually, into logistics. One of the most influential early efforts in this transition was the work of Pekkarinen and Ulkuniemi (2008) [31], who systematically translated the principles of product modularity into the context of business service development. Their abductive, empirically grounded study introduced the notion of a modular service platform built upon four interrelated dimensions—service, process, organizational, and customer interface—demonstrating how service providers could achieve flexibility and cost efficiency by configuring and recombining modular components according to customer needs. This study marked a critical shift from treating modularity merely as a technical concept to viewing it as a strategic architecture for service innovation, forming a theoretical bridge between manufacturing modularity and logistics service design.

During the same period, scholars such as Hofer and Halman [2] introduced the idea of “layout platforms” in complex product systems, hinting at their applicability to logistics operations. Building on this conceptual foundation, Lin et al. [3] proposed a formal model for a modular logistics service platform, defining a three-layer structure—service, process, and activity—that allowed service components to be recombined like Lego bricks for rapid customization. Around the same time, Bask et al. [5] emphasized that to fully harness modularity’s potential, it must be embedded not only at the process level but also within the broader business model architecture of logistics firms.

Collectively, these contributions positioned the early 2000s as the formative stage of modular thinking in logistics and service industries. This phase deepened both academic and practical understanding of how modular architectures could enhance adaptability, enable service innovation, and balance the dual imperatives of standardization and customization in logistics platforms.

2.3. Phase 3 (Mid-2010s to Early 2020s): The Convergence of Modularity, Digital Ecosystems, and Multi-Actor Collaboration

Following the conceptualization of modularity and the development of three-layer platform structures in Phase 2, the mid-2010s witnessed the rise of digital transformation in logistics. This era introduced new approaches that integrated modular thinking with digital technologies and multi-actor collaboration. Several key trends defined this phase:

Expansion of IoT and Enabling Technologies: Scholars such as Xu et al. [14] introduced the concept of collaborative logistics networks, demonstrating that when implemented through modular platforms, such networks could facilitate dynamic, open interactions among companies, software providers, and even customers. The advent of technologies like the Internet of Things (IoT) played a pivotal role, enabling the collection of highly granular data. This gave rise to digital modules that could be embedded into platforms to enhance real-time tracking and service scheduling.

Recognition of Ecosystem Dynamics and Multi-Actor Structures: Unlike earlier phases that focused predominantly on intra-organizational processes, this stage highlighted the necessity of modularity within a broader ecosystem. Studies such as Pan et al. [8], building on the concept of the Physical Internet, illustrated how inter-organizational collaboration and standardization of logistics modules (both hardware and software) could result in more integrated supply chains. In this model, each actor contributes modules or services that are interoperable with others across the ecosystem.

Business Model and Economic Viability: Researchers such as Lubarski [9] explored the adoption of modularity in logistics firms and identified a key challenge: despite growing interest, the absence of clear economic and governance models—such as cost/benefit-sharing mechanisms, module ownership, and data exchange standards—hindered practical implementation. This indicated a shift in modularity from a purely technical or process-oriented concept to one involving managerial, strategic, and incentive-based dimensions.

Resilience and Complexity Management: As supply chains became more complex, concerns related to resilience, risk management, and system simplification gained prominence alongside modularity. While most studies in the 2010s treated modularity conceptually, the rise in global supply chain disruptions created an urgent need for structures capable of withstanding shocks. During this time, early ideas linking modularity and resilience began to emerge—although the full articulation of this approach materialized in the following phase (late 2010s to 2024).

In summary, Phase 3 represents the "integration of modularity with digital ecosystems and multi-actor strategies." It was during this period that scholars recognized the importance of aligning modular platform design with emerging technologies and network-based coordination tools. This phase served as a bridge between the foundational modular concepts of Phase 2 and the emergence of collaborative, intelligent logistics architectures that would fully mature in Phase 4.

2.4. Phase 4 (2020–2023): Digital Convergence and the Rise of Multi-Actor Logistics Platforms

During this period, digital transformation and the imperative for broad stakeholder collaboration in logistics gained unprecedented attention. On one hand, DocShipper [12], in the article Game-Changing Supply Chain and Logistics Trends in 2025, emphasized that modularity could serve as a foundational enabler for rapid adaptation to market changes. They argued that logistics networks must evolve into structures composed of modules that can be quickly added or removed to meet complex customer demands. On the other hand, Janjevic et al. [13], through the design of multilayered distribution networks, demonstrated that without a modular approach, managing urban logistics layers becomes significantly less effective. They contended that each distribution layer can only support service customization if it is modularly structured.

Between 2021 and 2022, the focus increasingly shifted toward smart integration and multi-actor coordination. Xu et al. [14], in their study on Collaborative Logistics Networks, highlighted that interconnecting logistics modules through interactive networks could enhance service speed and quality. Wang [15], in his discussion on Logistics 4.0, underscored the limitations of digitalization alone and argued that only through its fusion with modular structures could platforms achieve real-time data analytics and on-demand responsiveness.

Liu et al. [17] extended this conversation to the logistics cluster level, suggesting that modular infrastructures enable clusters to deliver a mix of specialized services at lower cost and shorter lead times. Furthermore, Albrecht et al. [16], in Leveraging Digital Technologies in Logistics 4.0, demonstrated that technologies like IoT and AI can only yield their full potential when embedded in modular logistics platforms—where each module can independently perform functions such as tracking, scheduling, or route optimization while remaining interoperable within a larger digital ecosystem.

What fundamentally distinguishes this phase is the elevated significance of digital convergence and collaborative engagement. Firms increasingly recognized that successful implementation of modular structures requires collaboration among diverse stakeholders—including software developers, logistics startups, and e-retailers. Consequently, logistics platforms began moving toward openness, standardized physical and digital interfaces, and harmonization of data collected via sensors and intelligent systems [14].

2.5. Phase 5 (2024): Holistic Maturation of Modularity in the Digital and Multi-Actor Landscape

By 2024, modular platform thinking in logistics had evolved significantly and reached a state of relative maturity. Technologies such as Artificial Intelligence (AI), the physical internet, and resilience-focused management practices were increasingly being embedded within modular architectures. At this stage, the central debate had shifted from "Why modularity?" to "How can modularity be effectively and multidimensionally implemented?" Scholars emphasized that modularity alone is insufficient without business models aligned with stakeholder incentives and without clear governance frameworks among collaborating entities [29, 30]. This perspective revealed a critical challenge: Despite recognizing the advantages of modularity, firms struggled with implementation in the absence of robust mechanisms for cost-benefit sharing and governance.

Simultaneously, intelligent technologies such as AI began to penetrate logistics at an accelerated pace. Researchers demonstrated that modular platforms offer an ideal foundation for deploying advanced algorithms. Indeed, the integration of AI and IoT technologies enhanced decision-making speed and service personalization across multi-actor platforms [21, 22]. Furthermore, the physical internet emerged as a unifying infrastructure for synchronizing physical and digital modules, stressing the need for standardized units and shared interfaces [18, 20]. Accordingly, the main focus of contemporary research became the operational integration of modular units with intelligent systems and open architectures.

In addition to digitalization, themes of resilience and risk management became more prominent during this phase. Researchers argued that while modularity enables flexibility and innovation, without robust strategies for risk mitigation and resilience, logistics networks remain vulnerable to sudden disruptions [25, 24]. A delicate balance emerged between the customization and standardization of modules—one that enabled sustainable operations under unpredictable conditions. Environmental concerns and social pressures also drew attention to modularity as a means of flow optimization and waste reduction; yet, scholars emphasized that such outcomes depend on comprehensive approaches encompassing business strategy and stakeholder alignment.

Thus, 2024 marked a turning point where all core pillars of modularity—AI, digitalization, resilience, and governance—were brought together. Emerging approaches included the design of open platforms, the integration of physical logistics units with data-driven software, and the creation of incentive structures for ecosystem participants. Companies began to realize that, to maintain competitive advantage in the evolving logistics market, a modular platform must not only meet customer needs but also be underpinned by powerful digital infrastructure, standardized interfaces, resilient processes, and organizational support. This stage represents the culmination of modular logistics evolution, enabling the emergence of dynamic, collaborative, and multi-dimensional logistics networks—while still leaving fertile ground for further research.

3. Method

3.1. Research Gap

Recent studies from 2024 indicate that while the concept of modular platforms in logistics services has been broadly embraced, several dimensions—particularly governance, scalability, and physical-digital convergence—remain underexplored. The majority of existing works discuss modularity in a conceptual or technological sense, often without providing precise operational mechanisms that connect service, process, and activity levels within a unified modular framework. Recent studies in 2024 confirm that the hierarchical interaction between service, process, and activity layers has not yet been adequately addressed. For instance, [30] emphasizes that "few studies investigate the design of modular logistics services" and identifies "a gap and a lack of knowledge of modular design of logistics services in the literature." This finding indicates that while modular principles have been conceptually discussed, the translation of these ideas into structured service architectures remains incomplete. Similarly, [19] highlights that most current modular applications focus on physical components or technologies, whereas the interactions between processes and activities within logistics services are rarely examined in depth. This reinforces the absence of a layered operational framework linking modular functions across different service tiers. Furthermore, the systemic complexity of logistics ecosystems exacerbates this challenge. [24] points out that "transformational tensions between sustainability, risk, and operational performance complicate the design of modular logistics platforms," noting that current studies seldom specify how modular layers interact under such pressures. In summary, despite growing attention to modularity in logistics, the literature still lacks:

1. A clear multi-level operational framework that connects service, process, and activity modules;
2. The design of new logistics services based on a modular architecture has received limited attention in prior studies

3.2. Research Objective

The primary objective of this study is to develop a systematic framework for designing and implementing a modular platform that delivers logistics services, particularly within the postal and transportation industries. This framework enables logistics companies to design, manage, and customize their diverse service offerings as independent yet coordinated modules, while facilitating collaboration and integration among other key supply chain actors, including courier firms, e-commerce platforms, end customers, and software developers.

By introducing a three-layered architecture (comprising service, process, and activity levels), the study proposes solutions for achieving flexibility in designing new services and reducing operational complexity. Ultimately, it seeks to contribute to greater efficiency and innovation in the logistics sector.

Accordingly, the research addresses the following questions:

1. What are the primary logistics service modules across the three levels of service, process,

and activity?
2. What are the submodules associated with each of these levels?
3. What are the defining characteristics of the integrated framework derived from the above modules across all three levels?

3.3. Research Methodology: Case Study in A Courier Company

This study adopts a qualitative case study approach to investigate the phenomenon of modular logistics platform design in a real-world organizational setting. Case study research is particularly well-suited for exploring complex systems and interrelated processes, utilizing multiple sources of data. A Courier Company, one of the largest logistics firms in Iran with over 64 years of experience and a network of more than 1,000 branches, was selected as the case organization. The goal of this case study is to analyze the company's modular logistics platform and examine how modular architecture contributes to its operational performance and innovation capacity.

Given the complexity of its structure, the case study method was deemed appropriate for exploring the internal processes, structures, and challenges faced by A Courier Company. It allows for a holistic analysis and enhances the validity and comprehensiveness of the findings through data triangulation.

3.4. Case Study Implementation Steps:

3.4.1. Case Design

In the design phase, A Courier Company was chosen due to its unique position in Iran's logistics sector. The research questions were shaped around analyzing the firm's modular platform and identifying the effects of modularity on its performance.

Table 1. Case Compony profile

Aspect	Description
Company Size	Over 1,000 active branches and approximately 5,000 employees across Iran; annual parcel volume exceeding 40 million shipments.
Service Portfolio	Intercity next-day delivery, same-day urban delivery, heavy and bulky item transport, warehousing, packaging, and international forwarding services.
Technological Infrastructure	ERP-based logistics management system, digital parcel tracking, customer-facing mobile and web interfaces, and ongoing implementation of AI- and IoT-enabled routing and monitoring systems.
Key Market Challenges	Growing demand for speed and customization, high operational costs caused by fragmented infrastructure, and limited interoperability among regional logistics actors.

3.4.2. Data Collection

Data were gathered through three primary sources. First, semi-structured interviews were conducted with senior managers, branch representatives, and logistics experts within the company to understand core processes, challenges, and requirements related to modular platform design. A purposive sampling strategy was initially applied to select participants with direct expertise in logistics operations and modular platform concepts. Subsequently, snowball sampling was employed to expand the sample, whereby each interviewee was asked to recommend additional qualified participants. This process continued until theoretical saturation was achieved—after ten interviews, no new insights emerged. This ensured a diverse range of perspectives, responsibilities, and professional experiences.

In addition to interviews (see Table 2 for the profile of participants), direct observation of operational processes in branches and package processing centers was conducted to gain a detailed understanding of logistics service execution. Moreover, internal company documents—including performance reports, operational manuals, and public logistics records—served as supplementary sources to validate and enrich the data.

This multi-source data collection strategy enhanced the credibility and reliability of the findings, ultimately allowing the research to address its core questions effectively:

- How can a modular logistics service platform be designed?
- What are the key modules of logistics services?

Table 2. Profile of interview participants

No.	Age	Gender	Education Level	Field of Study	Organizational Position	Years of Experience
1	45	Male	Master's Degree	Logistics Management	Senior Operations Manager	20
2	38	Female	Bachelor's Degree	Industrial Engineering	Logistics Planning Manager	14
3	50	Male	Ph.D.	Supply Chain Management	Vice President of Logistics & Support	25
4	42	Male	Master's Degree	Business Administration (MBA)	Systems and Methods Manager	18
5	36	Female	Bachelor's Degree	Industrial Management	Regional Manager, A Courier Company	12
6	48	Male	Master's Degree	Transportation & Traffic	Intercity Transport Manager	22
7	41	Male	Master's Degree	Technology Management	Information Systems Manager	17
8	39	Female	Master's Degree	Industrial Engineering	Product Development Manager	15
9	46	Male	Ph.D.	Industrial Engineering	Innovation Manager	19
10	44	Male	Master's Degree	Strategic Management	Strategy Manager	21

3.4.3. Data Analysis Method

To analyze the qualitative data collected in this study, a step-by-step qualitative content analysis approach was employed. The process involved three main stages: open coding, categorization, and thematic extraction.

In the first stage (open coding), all recorded interviews were fully transcribed into textual form. The researchers meticulously reviewed the transcripts multiple times, identifying phrases and statements that reflected ideas related to modular structure, design requirements, operational challenges, and expert perspectives. These meaningful units were then segmented into smaller conceptual codes. Efforts were made to extract key expressions precisely and objectively, using the original language of the interviewees without researcher bias.

In the second stage (categorization), the extracted codes were grouped based on semantic similarities and conceptual relationships to form coherent categories. This step followed an inductive approach and underwent multiple rounds of revision. To ensure analytical rigor and reliability, the categorization was conducted independently by two researchers. The resulting categories were then compared and discussed in joint sessions to reach consensus and finalize the categorization scheme.

In the third stage (thematic extraction), the finalized categories were further examined to identify broader patterns and overarching themes that reflected the core conceptual framework of the modular platform.

3.4.4. Framework Validation

To validate the proposed framework, it was presented to a focus group consisting of six operational and strategic managers from A Courier Company, along with three independent logistics experts. The focus group participated in multiple sessions to evaluate, critique, and refine the framework.

In response to their feedback, the initial model was revised through several iterations to ensure that it was not only practically feasible but also aligned with the actual needs of the logistics industry and the contextual realities of Iranian logistics firms.

4. Results

4.1. Identifying Logistics Service Modules

To identify the modules involved in delivering logistics services, the main operational segments of the logistics journey were first mapped out. These segments were frequently referenced by managers during interviews and are also embedded in the operational data and dashboards of *A Courier Company*, where they serve as key components of planning and management. In the open coding stage, numerous quotes from interviewees were coded under the three major segments of modular logistics: First Mile, Mid Mile, and Last Mile. Each of these segments emerged as a distinct theme, repeatedly emphasized across the transcribed interviews. For instance, in relation to the First Mile, several participants highlighted the importance of timely coordination and resource deployment. One senior manager remarked, “The biggest challenge in the first stage is ensuring fast coordination between our agents and retail partners. If packages aren’t collected on time, the entire process falls behind.” Similar statements throughout the dataset point to the time-sensitivity and operational fragility of this phase. As for the Mid Mile, multiple respondents discussed infrastructure reliance and inter-hub synchronization. A logistics coordinator explained, “Our main hub is the heart of operations—any delay between hubs impacts the whole system.” This insight was echoed in various interviews, emphasizing the role of automated systems and efficient sorting mechanisms in maintaining flow continuity. Lastly, the Last Mile was frequently identified as the most unpredictable and customer-facing stage. A delivery executive shared, “Final delivery is always the trickiest. Customers expect both speed and precision.” This quote reflects a broader pattern in the data, where many interviewees described the Last Mile as cost-intensive, highly dynamic, and a critical determinant of customer satisfaction. Together, these coded examples illustrate the layered complexity and modular breakdown of the logistics service structure as experienced in practice.

The core concepts include:

- First Mile**:** This phase involves collecting packages from origin points such as customers, retail stores, or production centers and transferring them to central warehouses. It requires strong coordination and effective resource management to ensure the overall efficiency of the supply chain.
- Mid Mile**:** Serving as the bridge between central warehouses and local distribution centers, this segment plays a critical role in reducing logistics costs and enhancing environmental sustainability. The use of technologies such as automated sorting and flow management systems can significantly improve efficiency in this stage.
- Last Mile: This final segment involves delivering the package from distribution centers to the end customers and is often considered the most challenging part of the logistics process. Innovative solutions such as smart lockers, drone delivery, or electric vehicles can help reduce costs and improve customer satisfaction.

In this study, a schematic representation is used to define and gradually elaborate the modular structure of a logistics service. the high-level modules—First Mile, Mid Mile, and Last Mile—are established as the foundational components of the service delivery architecture. These macro-modules serve as the building blocks of customer-oriented logistics services. In the subsequent sections of the paper, each of these macro-modules will be further decomposed into finer-grained submodules to develop a complete modular service framework To identify submodules under the three core logistics modules, it is essential to define several key operational concepts commonly found in logistics service design. Drawing upon operational data from *A Courier Company*, this study introduces and defines four foundational components of logistics architecture**: N**odes**,** links (edges)**,** carriers**,** and routes**.**

4.1.1. Node (Station)

The concept of "Node" was repeatedly emphasized in interview data as a fundamental structural element in the logistics network. One senior operations manager described its role as follows: "Our agents act as local nodes—they're not just delivery points; they handle pickup, initial sorting, and data entry. Without those nodes functioning efficiently, the whole system slows down."

Several interviewees highlighted different types of nodes and their functions. For instance, a logistics strategy expert noted:
"The main hub in Tehran is our key transit node. Everything converges there—packages from multiple regions are sorted, repackaged, and sent out again. It's the heart of our flow system."

Another manager reflected on the importance of destination nodes:
"The final node, close to the customer, is where the experience really happens. If that fails—if delivery is late or the package is damaged—it affects the whole brand."

These quotes, among many others, illustrate how the interviewees identified and operationalized different kinds of nodes—origin, transit, destination, and temporary—each with distinct logistics functions.

There are four major types of nodes, each performing specific functions in logistics operations (Figure 1).

- Origin Nodes: These are the entry points of goods into the supply chain, such as factories, production centers, or farms. Their primary role is to prepare goods for the initial leg of transport, often involving packaging and loading. In *A Courier Company*, the company's local agents acted as origin nodes, handling customer interactions, package preparation, and dispatch to central hubs.
- Transit Nodes (Hubs): Serving as consolidation and distribution centers, hubs facilitate the sorting, merging, and redirection of goods across various routes and regions. They are typically composed of large warehouses or regional distribution centers. Optimizing these hubs using technologies such as Warehouse Management Systems (WMS) and automated robots significantly improves throughput and reduces operational delays. For example, in *A Courier Company*, the central Tehran hub—referred to as "T-Hub"—was responsible for managing and sorting all packages collected from first-mile operations.
- Destination Nodes: These nodes are the final touchpoints where goods are delivered to end customers or consumers. They include retail stores, local delivery centers, or directly the customers' residences. At this stage, customer experience is critical, and the use of technologies such as smart lockers and drone delivery can enhance satisfaction and reduce delivery times. In *A Courier Company*, local agents also managed operations at these destination nodes, performing last-mile deliveries.
- Temporary Nodes: These are short-term facilities used for temporary storage or transit of goods, such as cross-docking terminals or loading bays. They help manage congestion in busy link segments and optimize traffic flow within the network.

In summary, nodes represent the essential structural units of the supply chain. When enhanced through technologies such as real-time tracking, intelligent management systems, and optimization algorithms, they improve network performance and reduce costs. Each node, depending on its position in the chain, contributes a distinct function to the logistics system and enhances the integration and sustainability of service delivery.

The concept of the node will be incorporated as a core component in the proposed modular logistics service framework presented in this study.

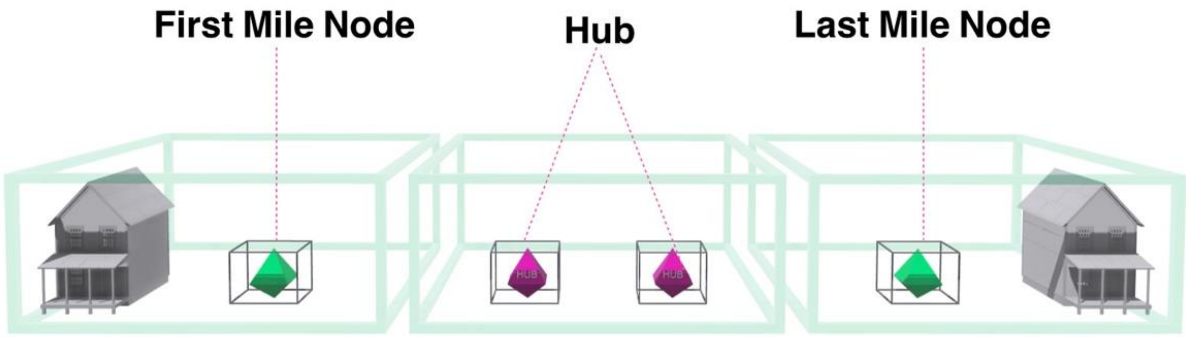

Figure 1. Integration of the node

4.1.2. Edge (Link)

The significance of “Link” (or Edge) in the logistics network was frequently discussed by interview participants, who viewed it as a dynamic and performance-critical component of modular logistics. One regional logistics director explained: “The route from the pickup point to the main hub is not just a line—it’s a critical link. If traffic or vehicle availability disrupts that path, the whole schedule falls apart.”

Another manager highlighted how link optimization can improve efficiency: “We redesigned the Mid Mile link between hubs last year—switching to night-time routes and adding a secondary vehicle—cut our delay rate by nearly 30%.”

A third participant emphasized the impact of link monitoring technologies: “With real-time tracking, we can see exactly where a package is delayed—it's always the link between local agents and the sorting center that creates bottlenecks.”

These quotes, among others, reflect a shared understanding among managers that links are not passive connections but active logistical processes whose reliability, speed, and transparency determine the overall effectiveness of the system.

The first set of links in the First Mile occurs between the customer and the local agency (Pickup Point), typically involving small vehicles or motorcycles. These links are used to collect parcels and transport them to the first storage or processing point. They require precise scheduling to ensure timely pickups and minimize delays.The subsequent link runs from the agency to the local hub (Figure 2). In this case, transportation from the pickup point to regional processing centers (Local Hubs) is handled by larger vehicles or light trucks. Optimizing this link can significantly reduce transportation costs.

Mid Mile links connect major hubs, particularly across long distances. These links often utilize large trucks, trains, or airplanes and are responsible for the bulk transfer of goods to national or regional centers. Their efficiency depends on route planning, optimized loading strategies, and multimodal integration.

Last Mile links refer to the final segment between local distribution centers and the customer’s destination. This phase may involve delivery vans, bicycles, or drones and is often considered the most costly and operationally complex part of the logistics process. It has a direct impact on customer experience.

A modular logistics platform can integrate and optimize these various links through advanced technologies, such as:

- Real-time tracking systems to manage goods flow across all link types
- Smart routing algorithms for optimizing long-haul transport and link capacity
- IoT-based predictive systems to detect and prevent potential disruptions or delays

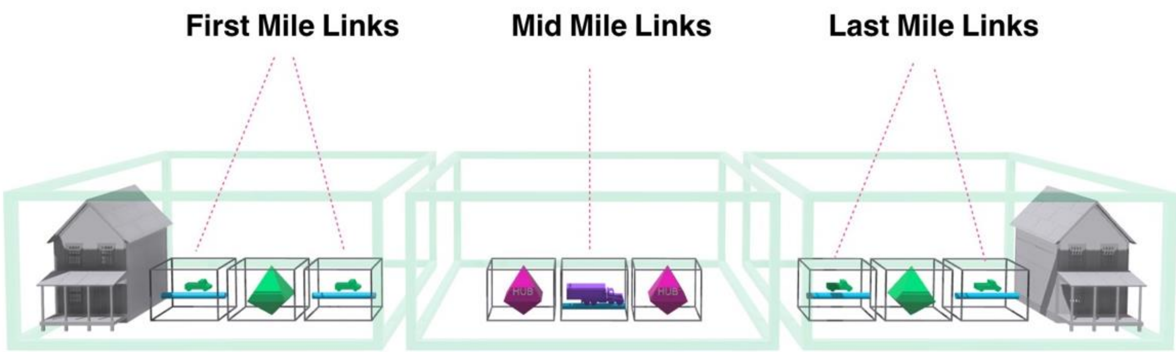

Figure 2. Integration of the link concept into the modular logistics service platform of a courier company

4.1.3. Route

Interview participants consistently emphasized the critical role of "Route" as the backbone of logistical operations, often describing it as the thread that weaves all components together. One senior operations manager remarked: "The route isn't just about where the package goes—it's about how everything connects. If one link or node is off, the entire route fails to deliver on time."

Another logistics analyst shared a concrete example of route optimization: "We used to rely on a fixed sequence of hubs, but after analyzing delivery times, we created a bypass route through a smaller node that saved us 12% in transit time."

A technology lead also highlighted the modular design perspective: "We treat routes as configurable systems—depending on volume or time of day, we reassign links or switch carriers without touching the core nodes."

Together, these insights illustrate how routes are viewed not as static paths, but as dynamic, modular configurations that can be adjusted for performance and scalability. They reflect how routing is central to the platform's adaptability and logistical precision.

Route design involves selecting the optimal combination of nodes, links, and carriers to ensure efficiency and speed in service delivery. This conceptual structure forms the foundation for designing modular platforms in logistics services. In a modular system, each of these components (node, link, carrier) serves as a building block for defining modules that can be flexibly modified, replaced, or recombined to enable the development and optimization of new service offerings.

4.1.4. Process

Interview data revealed that processes are the operational heartbeat of logistics execution, orchestrating activities across nodes, links, and carriers. As one senior logistics coordinator expressed:
"No matter how advanced our systems are, if the loading and unloading processes are slow or inconsistent, we lose time and customer trust."

Another manager explained how certain processes, such as packaging or labeling, can be modularized:
"We isolated the packaging process so it could be handled either in the hub or even outsourced to a local vendor, depending on load and urgency."

A transportation supervisor offered an example from carrier-level operations: "The routing software now dynamically assigns deliveries to drivers based on real-time data. That wasn't just a tech upgrade—it completely redefined the dispatching process."

These quotes underscore how processes are not static routines, but dynamic modules (Figure 3,4) embedded throughout the logistics chain. They can be standardized, customized, or outsourced—each adjustment influencing service performance, cost, and flexibility.

For example, the Loading and Unloading process is a critical logistics activity that occurs during the initial and final stages of transport within logistics nodes. This process plays a vital role in minimizing product damage and reducing handling time. When supported by mechanized equipment such as forklifts or autonomous robots, this process can significantly reduce operational time and enhance productivity.

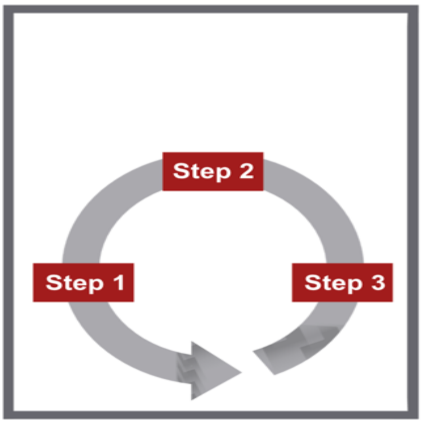

Figure 3. Schematic representation of the process concept

Another example is the Packaging process, which is performed to protect, identify, and facilitate the transportation of goods. The adoption of sustainable and recyclable packaging materials is increasingly emphasized to reduce environmental impact.

Additional key logistics processes include Warehousing and Transportation. In the transportation process, optimizing delivery routes through the use of AI algorithms can significantly reduce delivery time and enhance operational efficiency.

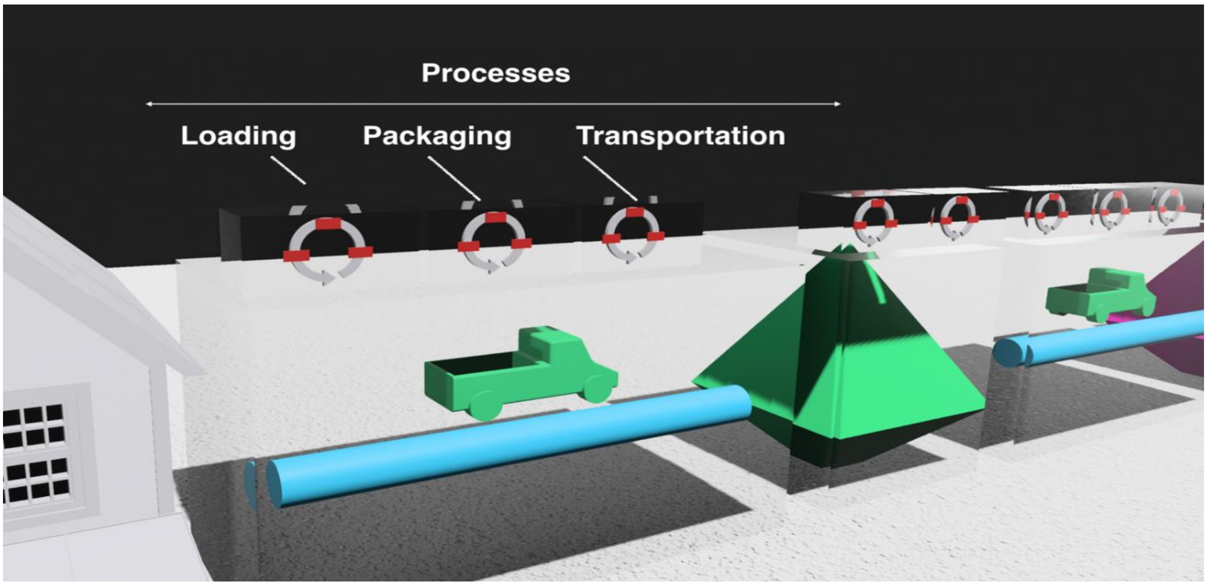

Figure 4. Schematic illustration of the relationship between the process concept and components of the logistics route

4.1.5. Modular Design in the Logistics Systems of a Courier Company: A Multi-Level Architecture

The modular design approach adopted in the logistics systems of *A Courier Company* follows a structured and hierarchical model that disaggregates processes and operations across multiple levels (Figure 5). This architecture allows for the flexible design, adaptation, and construction of new services. Within this framework, logistics services are divided into three primary layers: **First Mile**, **Mid Mile**, and **Last Mile**. Each of these modules contains smaller components—**nodes**, **links**, and **carriers**—which are further broken down into submodules known as **processes**. Processes represent the most granular level in this hierarchy and form the operational backbone of logistics services.

At the first level, **First Mile** refers to the collection of goods from customers or suppliers and their transport to initial hubs. **Mid Mile** handles inter-hub transfers between regional or national facilities, while **Last Mile** focuses on the final delivery of goods to end customers from local distribution centers. The overall efficiency of the logistics network is highly dependent on the coordination among these three core stages.

At the second level, each of these major modules is composed of three critical elements:

- **Nodes**: Operational points where activities such as storage or sorting occur.
- **Links**: The routes that connect one node to another.
- **Carriers**: The vehicles responsible for moving goods between nodes.

For example, a central warehouse may serve as a node within the Mid Mile, while the route connecting two hubs represents a link. Similarly, trucks in the Mid Mile or electric vans in the Last Mile are examples of carriers.

The third level consists of **processes**, which are the most detailed operational units in the system. These include activities such as loading and unloading at nodes, route scheduling along links, and capacity management for carriers. As the most flexible and customizable components of the architecture, processes can be added, modified, or replaced to support new service designs. For instance, revising the real-time tracking process in First Mile links or introducing new capacity optimization routines for carriers can yield significant performance improvements in service delivery.

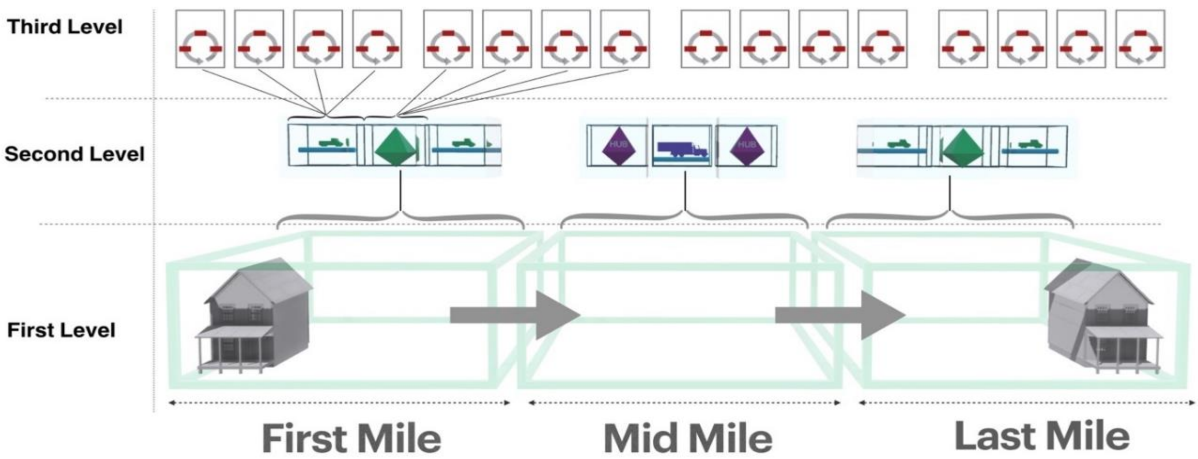

Figure 5. Multi-level modular structure in the platform design of a courier company

4.1.6. Establishing a Modular Platform and Outsourcing Logistics Modules

Modular design in logistics systems not only enables high flexibility in managing and adapting processes, but also creates the conditions for companies to outsource specific logistics modules to third-party partners. This approach allows *A Courier Company* to focus on strategic activities while leveraging the capabilities and expertise of external partners. The result is a platform composed of multiple actors who collaboratively deliver logistics services. Outsourcing can occur at various levels of the supply chain and across different modules.

4.2. Outsourcing at the First Mile, Mid Mile, and Last Mile Levels

4.2.1. Outsourcing at the First Level

At the highest level, companies may delegate entire logistics stages to external service providers. For instance, *A Courier Company* has outsourced its **First Mile** and **Last Mile** operations to regional representatives. These agents are responsible for collecting, transporting, and delivering goods to end customers, while the company concentrates on order management, customer service, and process oversight.

This collaborative model reduces operational complexity, enhances efficiency, and improves the customer experience. By outsourcing specific logistics stages, the company can benefit from the localized expertise of its agents while simultaneously reducing operational costs. Such partnerships contribute to faster execution, greater scalability, and a more streamlined service network.

4.2.2. Outsourcing at the Second Level: Nodes, Links, and Carriers

At the second level, companies may outsource individual core logistics modules such as **nodes**, **links**, or **carriers** to third-party providers. In the case of *A Courier Company*, the transportation operations along hub-to-hub links within the **Mid Mile** module have been outsourced to the third party company. This logistics partner is fully responsible for conducting the inter-hub transportation operations and all associated processes.

Under this collaboration model, T-Express operates based on a defined **Operational Level Agreement (OLA)**, which specifies service timeframes and quality standards. Such partnerships not only enhance operational efficiency but also enable *A Courier Company* to focus on strategic activities such as digital infrastructure development and process optimization.

This outsourcing strategy allows *A Courier Company* to reduce costs and leverage the expertise of specialized third parties, while still retaining oversight over service quality and delivery timelines. It also enables the company to concentrate more effectively on internal processes such as order management, customer service, and experience enhancement. Furthermore, transportation assets—such as trucks or maritime fleets—can also be outsourced under specialized contracts to external providers, further increasing operational agility and scalability.

4.2.3. Outsourcing at the Third Level: Processes

At the most granular level, companies can outsource specific logistics **processes** such as routing, inventory management, or order processing. These processes are typically executed by technology providers who utilize AI and real-time data to drive optimization. For example, services related to route management or fleet tracking can be independently handled by specialized software providers.

Logistics firms often delegate complex processes like route optimization to third-party service providers. Many companies, for instance, use platforms such as **HERE Technologies** or **Google Maps API** to enhance route planning and fleet operations. These AI-driven, real-time systems help reduce delivery times and operational costs.

In the case of *A Courier Company*, processes such as **routing**, **packaging**, and **carton preparation** have been outsourced to specialized service firms. For example, in the packaging process, the company collaborates with expert providers that use advanced technologies to automate tasks such as designing and producing custom cartons based on the shipment's specifications.

Furthermore, routing operations have also been outsourced to external partners who leverage AI and real-time data to optimize transportation paths, thereby improving efficiency and ensuring on-time deliveries.

4.3. Designing Various Services on a Modular Logistics Platform

The modular logistics platform (figure 6) enables the formation of a collaborative network composed of companies, service providers, and technologies that collectively facilitate the flow of goods, information, and services across the supply chain. This system, grounded in collaboration and outsourcing, fosters specialization and enhances overall efficiency.

Within this architecture, each company or service provider assumes a specific role, contributing to greater flexibility and operational effectiveness in the supply chain. The platform represents a flexible and participatory operational model built on outsourcing and collaboration. By distributing responsibilities and promoting specialization, it empowers companies to deliver higher-quality services, reduce operational costs, and introduce innovation into the logistics ecosystem.

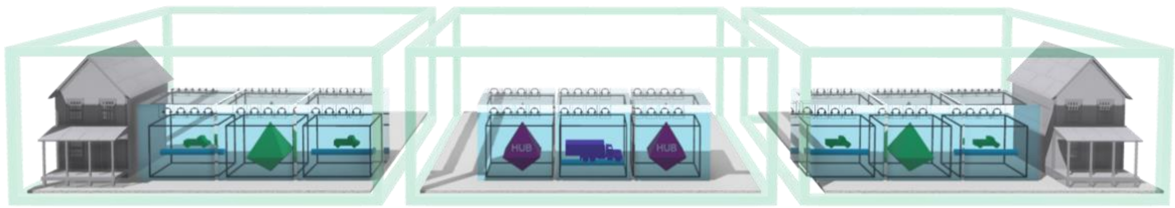

Figure 6. Definition of modules in the logistics platform of a courier company

Establishing a modular logistics platform through outsourcing—whether at the first, second, or third level—offers numerous advantages. For instance, companies can concentrate on their core strategic activities while delegating non-core processes to specialized partners. Outsourcing to expert providers enables the utilization of advanced technologies and economies of scale to reduce costs and enhance operational efficiency.

Moreover, modular platforms offer rapid adaptability to changing market conditions and customer needs. Collaboration with technology providers allows firms to leverage tools such as AI and the Internet of Things to optimize their operations. Finally, utilizing local capacities and partnering with international actors enables companies to enter new markets and extend their services across different regions.

Within the framework of a modular logistics service platform, the services of *A Courier Company* can be evaluated based on how their respective modules are managed. Two key services suitable for comparative analysis within this structure are the **next-day intercity delivery** and the **same-day urban delivery**. While both services consist of similar components, the allocation and governance of modules differ. In the following section, these two services are analyzed and compared based on their modular configurations.

4.3.1. Definition of the "Next-Day Intercity Delivery" Service Based on A Courier Company's Modular Logistics Platform: First-Level Outsourcing

Within the modular logistics platform proposed in this study, the design of new logistics services becomes feasible through the decomposition and recombination of fixed and variable modules (figure 7). This approach allows core logistics processes—such as intercity transportation—to be standardized and centrally controlled, while enabling flexibility in the execution of first- and last-mile activities.

Specifically, for the next-day intercity delivery service, the **Mid-Mile** module is treated as a fixed component. This module includes all intercity transportation activities that are directly managed by A Courier Company and executed according to predefined standards and processes. The stability and centralization of this module ensure high visibility, reduce errors, and enhance operational efficiency.

In contrast, the **First-Mile** and **Last-Mile** modules are defined as variable components that can be outsourced to independent agents located across the country. These agents, acting as third-party participants, undergo standardized training to perform parcel pickup (First Mile) and final delivery to customers (Last Mile). This configuration enables rapid adaptation to market dynamics and varying customer needs, as agents can be added, replaced, or restructured without disrupting the overall platform.

This dual strategy balances strict standardization for critical intercity operations with flexible, decentralized service delivery at the local level. The fixed Mid-Mile module ensures compliance with the company's service quality standards, while outsourcing First- and Last-Mile operations to local agents reduces infrastructure costs and enhances responsiveness. Regular audits and performance evaluations further support continuous improvement and value creation.

In conclusion, this modular framework not only facilitates the design of diverse and customizable logistics services, but also integrates system stability with localized agility—making it an effective model for intercity logistics platforms seeking innovation, cost efficiency, and operational excellence.

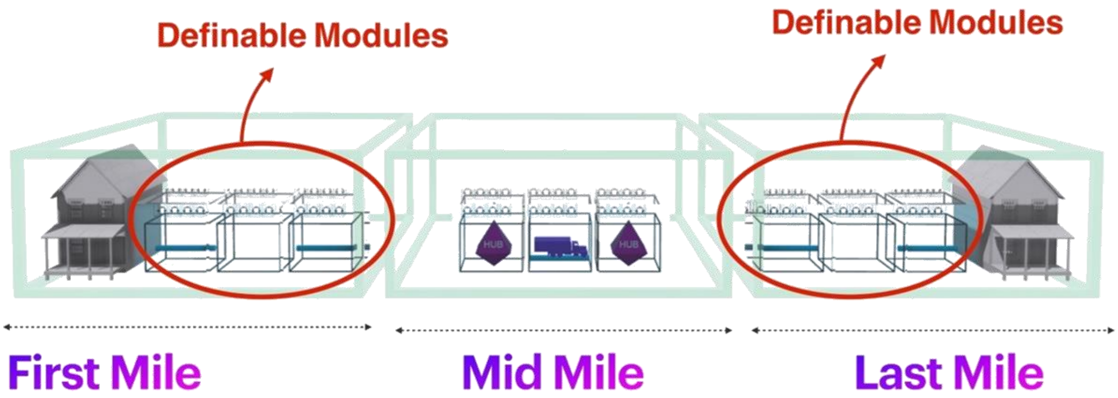

Figure 7. Definition of the next-day intercity service on a courier company's modular logistics platform

4.3.2. Definition of the "Same-Day Urban Delivery" Service on A Courier Company's Modular Logistics Platform: Second-Level Outsourcing

In the same-day urban delivery service, A Courier Company seeks to maintain centralized control over the First Mile and Last Mile modules, while preserving the Mid Mile as the structural core for inter-hub transportation (figure 8). Unlike the one-day intercity service, where the First and Last Mile modules are outsourced to independent representatives, this model foregoes representative networks and instead relies on designated fixed points throughout the city—local hubs—for parcel collection and distribution operations.

A key distinction in this service lies in its transport management approach. Independent couriers, rather than company agents, are employed as third-party actors to shuttle parcels between predefined urban hubs. An intelligent logistics application supports this operation by collecting and analyzing real-time data to determine optimal routes, considering traffic patterns and hub distances. It also allocates new orders based on courier availability, capacity, and proximity. If a parcel exceeds size or weight thresholds, the app either assigns an additional courier or redirects the parcel to an alternate hub. A live tracking system enables both sender and recipient to monitor shipment status in real time.

By establishing fixed urban hubs as logistical focal points, the company ensures centralized quality control while leveraging the flexibility of independent couriers. These hubs are directly managed by the company and equipped with facilities for temporary storage, sorting, and packaging. Real-time inventory monitoring and digital technologies allow continuous oversight of operational performance.

This configuration enhances delivery speed and accuracy. As couriers can be rapidly scaled up or down, the company can respond to demand fluctuations, expanding its fleet during peak hours and reducing costs during low-traffic periods. At the same time, process centralization at key hubs guarantees service standardization. Overall, this same-day urban model—through centralized hub management and flexible last-mile delivery via independent couriers—reduces local outsourcing complexities, improves service performance, and delivers a streamlined and satisfying customer experience.

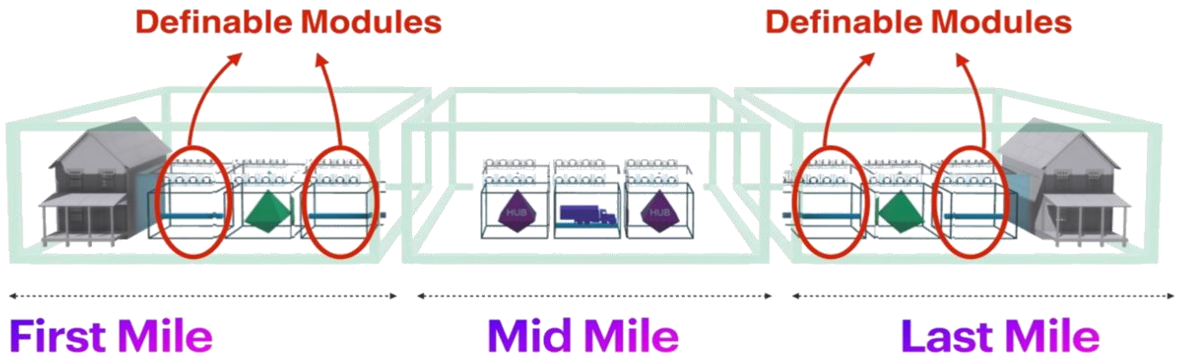

Figure 8. Definition of the same-day urban delivery service on a courier company's modular platform

4.3.3. Definition of the "AI-Based Routing Service" on the Modular Logistics Platform of a Courier Company: Third-Level Outsourcing

The analysis of these two services illustrates that the modular logistics platform can define different operational models tailored to various service types. In the one-day intercity service, the focus is on maintaining standards and quality control by outsourcing operational processes to independent agents, whereas the same-day urban service emphasizes centralized management of delivery points and the flexible use of freelance couriers for urban transport.

This comparison demonstrates that by adjusting the allocation and management of logistics modules, diverse operational models can be achieved that are aligned with market demands and operational requirements. Thus, designing a modular logistics platform enables companies not only to optimize existing services but also to create new offerings by combining modules and processes in different ways.

4.4. Design Rules and Integration Protocols of the Modular Logistics Platform

According to Baldwin and Clark (2000), *design rules* constitute the set of architectural principles and interface specifications that define how modules within a complex system can be independently designed, modified, or outsourced while remaining interoperable within the overall architecture. They determine the "visible information" that each module must share—such as structural boundaries, data standards, and operational constraints—so that individual components can evolve autonomously without disrupting system integrity. In this sense, design rules function as contracts between modules, ensuring decoupling, interoperability, and auditability across the entire modular platform.

In the case of *A Courier Company*, the modular logistics platform adheres to a similar logic. For each of the three main service modules—First Mile, Mid Mile, and Last Mile—explicit *design rules* have been established that define performance criteria, process boundaries, and integration requirements. These rules specify how each segment should interact with the others through standardized inputs and outputs, guaranteeing consistent quality and operational alignment across the network.

At the organizational level, every agent, hub, and carrier operates under clearly defined operational guidelines that function as *module-specific rules*. These include measurable parameters such as timing thresholds, service quality indicators, and documentation requirements. When a module—such as a First Mile collection process or a Mid Mile transportation link—is outsourced to third-party providers, these rules are formally embedded into the contractual agreements (Service-Level Agreements, SLAs). The third party is thus obliged to comply with the defined standards, and adherence is periodically audited by the company’s internal quality assurance system. This contractualization of design rules ensures governance continuity even when modules are externally managed.

At the process level, each operational component (e.g., loading, sorting, routing, tracking) is associated with a detailed set of design requirements and audit checklists. These define input–output data formats, process timing, and interface compatibility with digital systems such as ERP and AI-based routing tools. Such standardization enables any process to be replaced, upgraded, or integrated with minimal reconfiguration effort—a practical realization of plug-and-play modularity within the logistics platform.

Finally, integration protocols define the data and information standards that enable interoperability between modules owned by different actors. Shared data schemas, digital identifiers, and unified tracking formats ensure that operational data generated by independent hubs or carriers can be seamlessly aggregated and analyzed at the platform level. These protocols not only support real-time visibility and coordination but also uphold the modular system’s scalability and resilience.

5. Discussion and Reflection

The findings of this study provide insights that respond to the research gaps identified in the literature review. The most critical issues raised in the literature as research gaps include: unclear roles and ownership of modules, lack of sustainable business models for modular platforms, integration of smart technologies with modular structures, and scalability at national and international levels. The following explains how the proposed framework for designing a modular logistics service platform addresses these gaps:

5.1. Module Ownership and Role Clarity

According to Lubarski et al. (2024), one of the major challenges in modular platforms is the ambiguity surrounding roles and module ownership in a multi-actor ecosystem. The present framework, through its clear distinction between "service", "process", and "activity" modules, enables precise definition and documentation of each module’s "responsibility" and "ownership." In the Tipax case, the “First Mile,” “Mid Mile,” and “Last Mile” modules are each assignable to operational units or can be outsourced to external partners. This structure clarifies who is responsible for maintaining or improving each module and, as observed in Tipax, enhances motivation for continuous improvement. Thus, a challenge considered critical by Lubarski et al. (2024) is addressed to some extent in practice.

5.2. Sustainable Business Models

Kern (2024) emphasized that modular platform design must be aligned with a business model that facilitates benefit-sharing among stakeholders and motivates participation. The proposed framework addresses the economic dimension through "outsourced modules" at various levels, allowing the company to transparently calculate costs and revenues for each module. For example, if Mid Mile transport is outsourced as a separate module, its costs and revenues can be individually assessed. Consequently, cost-benefit sharing models between Tipax and outsourcing partners can be clearly defined—an approach aligned with the recommendations of Cichosz et al. (2024), particularly regarding transparency in digital business environments.

5.3. Smart Technologies and Modular Structure

Recent studies (Malhotra & Kharub, 2024; Liu et al., 2024; Brochado et al., 2024) show that integrating AI and IoT with modular architecture forms the foundation of "smart logistics" in the new decade. The present framework operationalizes this by defining distinct processes such as smart loading, automated routing, and real-time monitoring as separate modules, allowing them to be seamlessly integrated into the platform. This enables a company to test new technologies in isolation without altering the entire system and, if successful, to quickly replace outdated modules. This approach, implemented at Tipax, reduced risk and facilitated modernization.

5.4. Scalability at National and International Levels

A criticism raised in Brochado et al. (2024) was that scalability mechanisms were poorly defined. The current framework, with its three-layer structure (service, process, activity) and standardized modular definitions of nodes and links, facilitates expansion across broader geographic areas. Each link or node can integrate with other networks via predefined interfaces. Furthermore, Montreuil et al. (2024) noted that if unit load standardization (e.g., physical formats) is also maintained alongside this modular architecture, rapid international collaboration becomes feasible.

5.5. Integration of Physical and Digital, Resilience, and Risk Management

Results indicate that in the proposed platform, each module—whether physical (e.g., warehouse, vehicle) or digital (e.g., scheduling software, AI)—is part of the physical internet ecosystem. This aligns with the recommendations of Gerschberger et al. (2024) and Göçer et al. (2024), suggesting that in the face of environmental threats and market uncertainty, such modularity enhances resilience. In case of disruption, modules can either be relocated or reconfigured via digital processes to adapt to critical conditions.

6. Conclusion

6.1. Limitation and Scope of Generalizaion

While the single-case design enables deep contextual understanding and rich qualitative insights, it also presents **limitations regarding generalizability**. The findings are drawn from a single company operating within **Iran's specific institutional, infrastructural, and market environment**, which may differ from other national or regional logistics ecosystems. As such, the results should be interpreted as **analytically generalizable**—offering theoretical insights applicable to similar contexts—rather than statistically generalizable to all logistics firms. Future research could extend this work through **multi-case comparative studies** across different countries or firm types to validate and refine the proposed modular platform framework.

6.2. Suggestions for Future Research

This study revealed that although modularity in logistics services can serve as a powerful tool for flexibility, innovation, and cost management, several uncertainties remain that offer fertile ground for future investigations.

First, the development of governance and contractual frameworks remains a fundamental gap; without clearly defined models for cost–benefit sharing and module ownership, stakeholder motivation for participation is weakened.

Second, evaluating scalability in multinational environments is essential. Standardizing and aligning modules across countries or large international firms presents additional challenges due to cultural and legal differences.

Third, smart technologies and the integration of advanced algorithms such as AI and blockchain present significant opportunities for modular platforms. However, how to practically embed these technologies into modular structures remains an open question.

Fourth, conducting quantitative cost–benefit and return-on-investment analyses can clarify the economic justification of modularity for decision-makers.

Fifth, assessing the environmental sustainability impact of modularity is crucial, as companies increasingly seek ways to reduce waste and their carbon footprint.

Sixth, the cultural and human resource dimensions of adopting modular structures should not be overlooked; employee skill levels and managerial support for iterative modular changes play a key role in the practical success of this approach.

Finally—and perhaps most practically—future research should focus on controlled experimental designs to evaluate the effectiveness of the modular approach. By applying A/B testing or quasi-experimental methods across different logistics firms, researchers can precisely measure how modularization impacts key performance indicators such as delivery time, costs, customer satisfaction, and more.

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Appendix A: Questionnaire: Exploring the Design and Modularity of Logistics Services

Case Study: A Courier Company – Modular Logistics Service Platform

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Section 1: General Information

1. Please describe your **department/unit** and its **main responsibilities, missions, and specialized activities** within the organization.
2. What is your **current role or position**, and how does it relate to the design or execution of logistics services?
3. How many years of experience do you have in logistics or supply chain operations?
4. Which level of logistics operations are you most directly involved in?
   - ☐ First Mile
   - ☐ Mid Mile
   - ☐ Last Mile
   - ☐ Cross-functional

—

Section 2: Understanding and Defining Logistics Services

5. In your own words, **how do you define a logistics service**?
6. What does the term **“parcel journey”** mean in your organization, and how do you visualize its stages?

7. How would you **model the structure** of a logistics service (e.g., as a process flow, network, or modular system)?
8. In your opinion, what are the **main building blocks (modules)** of a logistics service?
9. How do these modules interact to create a complete logistics service offering?

—

Section 3: Organizational Structure and Roles within the Service

10. How would you describe the **role of local sales representatives** who are located in different cities within the overall logistics service?
11. What is the **role of hubs** within the logistics network, and how do they interact with other elements (agents, carriers, IT systems)?
12. How is **coordination** managed among agents, hubs, and carriers to ensure service continuity?
13. From your perspective, what functions should be **centralized** (core) and which ones can be **decentralized or outsourced**?

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Section 4: Outsourcing and Modularity

14. Which parts or processes of the logistics service are currently **outsourced**?
15. Which components **could be outsourced** in the future to improve efficiency or flexibility?
16. Which components represent **core competencies** that should **not be outsourced**, and why?
17. How are **performance standards** and **service quality requirements** communicated and monitored in outsourced modules?
18. Are there formal **contracts or SLAs** that specify operational obligations for third-party partners? Please explain.
19. How does the company **audit or evaluate** the compliance of external partners with its operational standards?

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Section 5: Designing New Logistics Services

20. What are the **main steps involved in designing a new logistics service** within your organization?
21. Which **departments or stakeholders** are typically involved in the service design process?
22. What **technological tools** (e.g., ERP, AI routing systems, IoT, data dashboards) are used in service design and monitoring?
23. What **new logistics services** are currently under development or planned for future launch?
24. How does **modular thinking** influence or facilitate the design of new services?

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Section 6: Modularity and Integration

25. If a logistics service is considered modular, **what defines the boundaries of each module**?
26. What mechanisms act as the **integration layer** or “glue” between different modules (e.g., shared data, unified scheduling, centralized governance)?
27. How is **information shared** across modules (First/Mid/Last Mile, hubs, agents, carriers)?
28. Are there **standardized data formats or interfaces** used to ensure interoperability between systems or actors?
29. How does the company ensure **compatibility** when modules are developed or operated by different parties?

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Section 7: Design Rules and Integration Protocols

30. What **design rules** (internal standards or operational principles) guide how modules are defined, connected, and audited?
31. How are these rules documented, updated, and communicated across organizational units?
32. How are **integration protocols** (data exchange, process synchronization, decision flows) defined between internal systems and external partners?
33. Are there **technical or governance constraints** that limit full modularity or plug-and-play functionality?
34. In your view, what improvements would strengthen **data standardization, module interoperability, and platform scalability**?

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Section 8: Strategic Reflection

35. What benefits has your organization observed from adopting modular or standardized logistics components?
36. What challenges or risks have arisen in managing multiple modular actors and outsourced units?
37. How do you foresee the evolution of modular logistics platforms in your industry over the next 3–5 years?
38. What recommendations would you give for achieving a fully modular, intelligent, and collaborative logistics ecosystem?