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Applications and Impacts of Internet of Things (IoT) in Logistic Industry in Vietnam

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Abstract:
Vietnam's logistics ecosystem has rapidly developed. Vietnam logistic industry is listed in top Asian countries in the field. In recent years, high technologies have been applied in Vietnam logistics such as Artificial intelligence (AI), Big data, Cloud computing and Internet of things (IoT). The applications of IoT support the fast development and less risk for logistics. The paper presents the applications and impacts of IoT for Vietnam logistic sector. Moreover, the numerical analysis of IoT applications helps us to emphasize the important role of IoT for Vietnam logistics. The recommendations in future is given for further development of IoT for Vietnam logistics.

Keywords: Internet of Things, Logistic development, Digital economy

1. Introduction

In recent years, the applications of high technologies have developed logistic sector in Vietnam. The Artificial intelligence (AI), Big data, Cloud computing and Internet of things (IoT) help us automate the tasks in logistic sector such as: package management, delivery management, loss management and smart transportation.

The Internet of Things (IoT) connects physical objects like shoes, streetlights, and forklifts. IoT uses technologies like Bluetooth, RFID (Radio Frequency Identification), Wi-Fi, LTE (Long-Term Evolution), and wired networks to connect objects and generate valuable data [2]. This integration of IT and operational technology enhances connectivity across industries and allows for better decision-making. Despite low adoption rates, IoT deployments have surged, growing 333% since 2012. Key drivers include common IP standards, IPv6 adoption, expanded wireless connectivity, better battery life, and ruggedized devices. Open innovation and falling tech costs further accelerate IoT adoption. By 2020, Cisco projects over 50 billion connected devices, with IoT making up 83% of connections. However, this is just the beginning as there are up to 1.5 trillion potential devices that could be connected with IoT [3].

The paper focuses on the applications of IoT in Vietnam logistic industry. Moreover, we analyze the benefits of applications of IoT in logistic sector in Vietnam. The paper demonstrates the applications of IoT with some case studies in logistics in Vietnam.

2. Literature Review

The section reviews the applications of IoT in logistic sector. The Internet of Everything (IoE) connects physical objects and people, processes, and data, integrating cloud, big data, social collaboration, mobility, and security to drive innovation and transformation [4], and IoT is a subset of it. IoE is expected to create $19 trillion in global value over the next decade, with IoT generating $8 trillion in Value at Stake. Smart parking, for example, can transform cities by connecting dark assets with sensors, generating real-time data on availability, location, and pricing. IoE's real value lies in data and insights that drive transformation, with analytics and business applications essential for making sense of this data. IoE's potential in supply chain and logistics is significant, with $1.9 trillion contributing to this sector.

The Internet of Things (IoT) has become a reality through the convergence of various technologies, such as wireless communication, microelectronics, and the Internet communications. This advancement is propelling the world into a new era. IoT is transforming nearly every aspect of daily life—from how we drive and shop to how we monitor and manage electricity usage at home. Smart sensors and embedded chips in everyday objects continuously communicate with one another, exchanging vast amounts of data measured in thousands of gigabytes [5].

The "physical" Internet can take the form of directly connected devices, such as sensors and robots, or act as a conduit enabling communication between devices. This connectivity is made possible by wireless data transfer technologies like Bluetooth, RFID, and Wi-Fi, along with mobile networks such as 3G, 4G, and LTE. Together, these technologies link countless devices into a unified network [6,7].

The implementation of IoT in logistics delivers fast and effective results. This technology enables real-time tracking of assets, packages, and personnel across the entire value chain. It also offers opportunities to automate business processes, reducing reliance on manual labor, enhancing quality and predictability, and lowering operational costs. Furthermore, the Internet of Things optimizes collaboration between people and network-connected devices, supports continuous monitoring, and helps guide processes in the right direction [8].

Globalization is making supply chains increasingly complex and expansive, placing growing pressure on logistics and storage systems. As a result, effective supply chain management is becoming more challenging, and the Internet of Things (IoT) is playing a crucial role in addressing these demands. In today’s fast-paced global economy, IoT helps meet the evolving needs of transport and logistics companies [9].

Inventory management and warehousing are key components of the logistics ecosystem. By deploying small, cost-effective sensors, companies can track inventory in real time, monitor the condition and location of goods, and develop intelligent warehouse systems. IoT sensors also provide valuable data for trend analysis, enabling more accurate forecasting of stock requirements. This helps prevent both shortages and overstocking [10].

Overall, IoT implementation enhances inventory accuracy, ensures safe storage, streamlines product retrieval, and significantly reduces human error [10]. In Vietnam, Viettel company successfully launched the country’s first commercial Narrowband-IoT (NB-IoT) network in Hanoi and Ho Chi Minh City, establishing a robust foundation for IoT deployments in 2018-2019 [11]. Then, Vietnam Post company introduced

VMap, a real-time address database using IoT to digitize and geocode household addresses, improving last-mile delivery accuracy. Recently, in 2025 survey found that about 68% of logistics firms are investing in smart transport, warehouse management systems, and IoT – despite challenges like limited capital and tech staffs [12].

3. IoT applications in logistic industry in Vietnam

3.1. Applications of IoT

Across the whole value chain, including warehousing, transportation, and last-mile delivery, IoT enables creative solutions to challenging operational and business problems by improving logistics efficiency, safety, security, and customer experience.

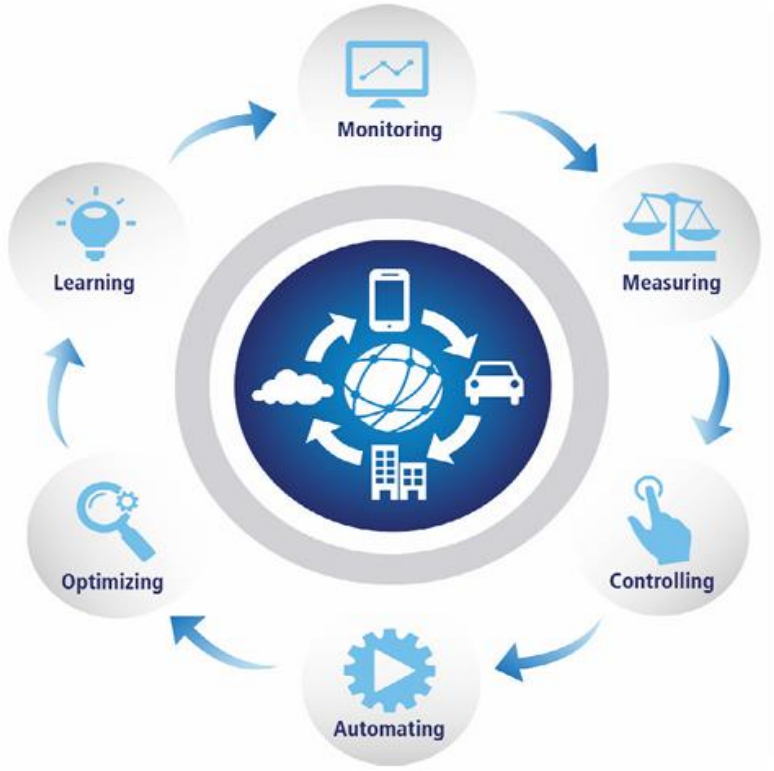

Fig.1. IoT-enabled Capabilities [13]

As shown in Figure 1, IoT in logistics offers significant benefits, including real-time monitoring of assets, parcels, and people, reducing manual intervention, improving quality, predictability, and cost efficiency. Therefore, optimizing coordination between people, systems, and assets, and thus, driving analytics for best practices. Advances in mobile computing, IT consumerization, 5G, and big data analytics are driving technological progress. At the same time, customer demand for IoT-based solutions is increasing. These factors together are accelerating IoT adoption in the logistics industry.

IoT is revolutionizing various industries, including logistics, by optimizing asset utilization, improving traffic and fleet management, and enhancing environmental sustainability. In-vehicle telematics and vehicle-infrastructure integration have revolutionized vehicle management, with companies investing in connected vehicles like LoJack and OnStar. Seoul City Transportation Information Center (TOPIS) has transformed from a 2004 bus management system into a comprehensive public transportation hub, enabling real-time bus arrival times and improved public transport adoption. The Port of Hamburg's smart PORT initiative modernizes IT infrastructure, integrating ship, rail, and road traffic management. IoT also enhances operational efficiency by enabling resource tracking for petroleum, natural gas, electricity, and water,

reducing waste and preventing disasters. Israel's largest municipal water utility, Hagihon, uses smart devices to enhance water management, maintenance, and revenue collection in Jerusalem. Other examples include Water for People and Oslo's smart street-lighting program.

In the past few years, IoT has been widely applied in multiple industrial sectors.

Tackle safety concerns: Union Pacific uses IoT sensors to monitor train wheels and predict equipment failures, reducing derailment risks. With real-time analytics, they process over 20 million temperature readings daily, identifying potential hazards and enhancing rail safety. Meanwhile, Dundee Precious Metals (DPM) uses IoT to improve efficiency and safety at its Bulgarian goldmine. By integrating and monitoring its entire operation, DPM has enhanced miner safety and quadrupled production, reducing costs and ensuring safety.

Helping with physical health: With nearly 50 million health and fitness trackers in use in 2015. Healthcare organizations are leveraging IoT for advanced wellness monitoring, such as smart contact lenses for diabetes patients. IoT is also improving chronic disease management by monitoring patients' vitals, medication adherence, and in-hospital care. It reduces errors, enables emergency response, supports long-term care, and shapes policy.

Home security: smart solutions like SmartThings and August Smart Lock, enabling remote door control, motion alerts, intrusion detection, pet tracking, and new delivery options.

Retail: By improving inventory management, loss prevention, mobile payments, shelf availability, checkout optimization, in-store guidance robots, and mobile payment solutions. These innovations extend to omnichannel retail, enhancing the overall retail experience.

Customer experience: IoT technology uses beacons and sensors to improve customer experiences in retail and service settings. These devices connect wirelessly to mobile apps, enabling targeted marketing and personalized services. Companies like Apple's iBeacon and Estimote use affordable beacons, while hyper-relevance offers personalized experiences. IoT-driven customer recognition is transforming retail experiences, with companies like Dandy Lab and Mondelez analyzing consumer behavior for personalized ads.

Manufacturing and utilities: In real estate, it integrates sensors to monitor energy usage and optimize operations. Insurers use IoT to enhance risk assessment and pricing by tracking real-time driving behavior, creating personalized premiums. Some insurers use GPS tracking, but privacy concerns limit its adoption.

3.2. Examples of applications of IoT in logistic sector in Vietnam

According to a report published by the Ministry of Science and Technology of Vietnam, in March 2024, 68% of medium and large logistics enterprises in Vietnam have applied IoT in warehouse and transportation management. A large number of logistic companies in Vietnam have successfully applied IoT solutions to improve their productivities and reduce costs.

A specific example of IoT technology application is at Vinamilk Company, they have deployed IoT technology application in cold chain management, helping to reduce 15% of product damage rate during transportation.

In Vietnam, several companies like Viettel Post and Giao Hàng Nhanh (GHN) use IoT-enabled GPS tracking to monitor delivery vehicle locations in real-time, optimize routes, and reduce fuel consumption.

Delivery companies (e.g., Shopee Express) use IoT to monitor driver behavior, traffic conditions, and customer locations for faster and more predictable deliveries.

Vietnam exports seafood, fruits, and pharmaceuticals. IoT helps monitor and control temperature-sensitive goods during transit, especially from southern provinces (e.g., Cà Mau, Đồng Tháp) to ports like Cát Lái or Hải Phòng.

Table 1 resumes key IoT applications in logistic sector in Vietnam. The IoT solutions allow the logistic companies obtain a lot of successes in last few years.

Table 1. key IoT applications in logistic sector in Vietnam

Area	IoT solutions	Benefit
Cold Chain	We use sensors in trucks/warehouses; telematics	We can real-time monitor the temperature, door status, route data; reduce spoilage and compliance risk
Smart transportation	Automated Guided Vehicle (AGVs)	Transportation companies use AGVs and centralized IoT system across major distribution centers quickly
Communications	GPS, NB-IoT telematics, LoRaWAN, LTE/5G trackers	The communications enable real-time tracking, dynamic routing, driver behaviour insights—boosting efficiency and reducing delays

4. Impacts of IoT applications for logistics in Vietnam

The section analyzes the significant impacts of IoT. The logistics industry is a key player poised to benefit from the IoT revolution. IoT is revolutionizing logistics by connecting assets, enabling real-time tracking, data analysis, and automation. Advances in sensor technology, wireless networks, and data processing drive IoT adoption, enhancing operational efficiency and providing dynamic services. Connected warehouse assets use sensors to monitor equipment stress, temperature, and throughput, preventing major failures and improving operational efficiency. IoT enhances worker health and safety by connecting workforce and vehicles, reducing risks and improving warehouse safety. IoT-enabled forklifts detect obstacles and communicate with each other, preventing collisions. Sensors and cameras detect improper storage risks, alerting warehouse teams for corrective action. In the future, warehouse workers will connect to IoT systems via smartphones, scanners, and wearables, improving efficiency and safety. Smart warehouse energy management systems also optimize energy use.

IoT in freight transportation will improve efficiency, safety, and automation by enhancing track and trace, combating cargo theft, and providing real-time visibility. Agheera has developed an open platform to

consolidate data from various telematics and sensors, enabling global asset tracking through a single, user-friendly portal. IoT improves fleet and asset management by monitoring usage, optimizing capacity, and reducing inefficiencies. Sensors track vehicle utilization, improving fuel economy and reducing deadhead miles. IoT also enables predictive asset lifecycle management, detecting failures and scheduling maintenance automatically. It also enhances health and safety by preventing collisions and monitoring driver fatigue. IoT-driven tools like Resilience360 analyze global disruptions and trigger automated mitigation strategies.

IoT is revolutionizing last-mile delivery by improving efficiency and customer experience. It enables real-time connectivity between providers and recipients, driving new business models and operational improvements. Smart mailboxes, parcel lockers, and connected fridges are some of the technologies that optimize last-mile delivery. IoT-driven smart home products automate replenishment, reduce lead times, and predict purchases. IoT-tagged parcels enhance visibility and efficiency. IoT also enables new business models, such as optimizing return trips and connecting delivery personnel with nearby senders. RFID and NFC smart labels enable real-time monitoring of individual products, tracking factors like temperature and humidity. These technologies ensure product integrity, verify product safety, and enhance last-mile delivery by identifying fragile or temperature-sensitive items.

The report emphasizes the importance of IoT integration in logistics, highlighting the need for businesses to focus on connectivity across various use cases. It suggests that IoT requires building and managing an intelligent network of connected assets that integrates across various verticals and horizontals within the supply chain. The logistics sector must be connected before implementing new solutions, requiring significant investment. Key success factors include standardized unique identifiers, seamless interoperability, trust and data ownership management, a clear focus on IoT reference architecture, and a shift in business mindset.

For logistics to develop sustainably, high-quality human resources are indispensable. According to VLA statistics, Vietnam needs about 18,000 new logistics personnel each year, but the current training system can only meet about 10-15%. Therefore, there needs to be a policy of linking universities - enterprises - the state in training specialized and practical skills. Total modern warehouse area by the end of 2023 will reach ~3.7 million m², an increase of 12% compared to 2022; of which, 68% is modern warehouse. Transportation mode structure: Road transport is still the most popular with 74.16% of freight volume transported in the first 9 months of 2024. Inland waterways account for 20.36%, sea transport accounts for 5%, while rail and air transport account for only 0.2% and 0.01% respectively. Warehouse market: Estimated size of about 4 million m2 of floor space by the end of 2023. The annual growth rate of the warehouse market in the period of 2020-2023 is 23%. There are expected to be 25 new warehouse projects by 2027 with a total additional leasable area of 1.87 million m2. Transportation Management System (TMS): 68% of medium and large manufacturing enterprises have adopted TMS, helping to optimize routes and reduce transportation costs by an average of 12%.

Table 2. Estimation revenue of IoT applications in logistic sector in Vietnam

IoT applications	Revenue (estimation)	Description
Total revenue of IoT in Vietnam	3.13 billion (USD)	Total IoT market is forecast to reach 3.13 billion USD by 2025.

IoT applications in logistic sector in Vietnam	777 million (USD)	IoT applications are used in manufacturing and supply chain.
Connected IoT applications in logistic in Vietnam	15 million (USD)	IoT applications are used for logistic sector.

Table 2 shows estimation revenue of IoT applications in logistic sector in Vietnam. Moreover, the revenue is predicted to increase 12.79% between 2025 and 2029. The IoT applications can further developed for logistics.

4. Conclusion

The paper presents the applications of IoT in logistic sector in Vietnam. The applications help logistic companies in Vietnam develop the logistic tasks efficiently. We can reduce human resources and save money using the IoT applications. In the future, the Big data, AI and IoT continues applying in logistic sector in Vietnam. To apply and operate the smart applications, Vietnam should improve the technology training for employees in logistic. Moreover, the cyber securities need to be applied to ensure the data security.

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