Journal of Computing and Electronic Information Management
ISSN: 2413-1660 | Vol. 12, No. 1, 2024

Impact of 5G technology on digital transformation of Jingdong Smart Logistics

Zekai Kong

Henan Polytechnic University, Jiaozuo, China
510045742@qq.com

Abstract: With the rapid development of information technology, smart logistics plays a key role in digital transformation. Taking Jingdong as the research object, this paper focuses on the application of 5G technology in the field of smart logistics, and discusses in depth its impact on the digital transformation of Jingdong's smart logistics. On the basis of analysing the current situation of digital transformation of Jingdong's smart logistics, it focuses on the specific application of 5G technology in the logistics network, with a special focus on the promotion of 5G cloud leased lines to mobile warehousing. The detailed analysis of the financial comparison table reveals the positive impact of 5G technology on Jingdong's logistics business, as reflected in the significant increase in revenue and gross profit. Meanwhile, in-depth research on the practical application of 2.5G technology in Jingdong Intelligent Logistics provides valuable experience for the introduction of 5G technology.

Keywords: 5G technology; Jingdong Smart Logistics; Digital transformation; Logistics network.

1. Introduction

Driven by the wave of digitalisation, the logistics industry is undergoing unprecedented transformation and upgrading. Among them, the rise of 5G technology provides powerful impetus and possibilities for the digital transformation of smart logistics. 5G is not only a new type of communication technology, but also a link between the physical and digital worlds, injecting a new intelligent, efficient and sustainable vitality into the logistics process [1]. As China's leading e-commerce platform, Jingdong's logistics network extends across the globe, and digital transformation has great potential to improve efficiency, optimise resource allocation and provide better services. 5G technology, with its high-speed, low-latency and large connectivity, will connect all aspects of Jingdong's logistics, thereby breaking down the information silos and realising the instantaneous transmission and efficient handling of data [2]. Intelligent decision-making, real-time monitoring, logistics network optimisation and other key aspects will usher in a qualitative leap. Under the framework of digital twin, 5G technology is not only a link between the physical and digital worlds, but also a key engine for creating intelligent logistics and realising efficient operations [3]. By deeply studying the role of 5G technology in the digital transformation of logistics, this paper aims to provide theoretical support and practical guidance for the future development of Jingdong's smart logistics. Through an in-depth analysis of the prospects for the integration of 5G technology and Jingdong Intelligent Logistics, the existing digital transformation achievements and the future development trend, it will reveal how 5G technology has become a key driving force for the digital transformation of Jingdong Intelligent Logistics, further promoting the development of the logistics industry in the direction of smarter, more efficient and sustainable.

2. Application of 5G Technology in Jingdong Smart Logistics

Table 1. Financial highlights of Jingdong Logistics (six months ended 30 June / RMB'000)

/	2023	2022	Year-on-year change (%)
incomes	77,761,309	58,623,176	3260.00 per cent
Maori	5,029,922	3,634,597	3840.00 per cent
Loss before tax	-382,212	-1,322,773	-7110.00 per cent
Loss for the period	-528,874	-1,433,499	-6310.00 per cent
Non-IFRS profit/(loss) for the period	114,171	-584,944	inapplicable

Source: Jingdong Annual Report

The data in Table 1 reveals a financial summary of Jingdong Logistics for the six months ended 30 June, including data on revenue, gross profit, loss before tax, loss for the period, and non-IFRS profit (loss) for the period. By analysing the year-on-year changes in these figures, it is possible to reveal the financial performance of Jingdong Logistics in the context of its digital transformation and attempt to link it to the adoption of 5G technology. Jingdong Logistics has seen a significant increase in revenue in 2023 compared to 2022 (3260.00%). This is an effect of digital transformation and logistics intelligence. 5G technology plays a key role in improving connectivity and data transfer speeds, making the logistics network more efficient, which in turn contributes to the increase in revenue. The significant

increase in gross profit (3,840.00%) reflects the positive impact of digital transformation on the profitability of Jingdong Logistics.The application of 5G technology in improving data support and intelligent decision-making helped optimise operations and reduce costs, thereby increasing gross profit [4].

Jingdong Logistics showed a clear trend of reduction in both loss before tax and loss for the period. The application of 5G technology in the digital transformation may have driven operational efficiency and reduced the loss profile. Non-IFRS earnings (loss) for the period was highly variable, but this could be influenced by a number of factors, not just the digital transformation. the application of 5G technology in improving the security and reliability of communications may have helped to reduce the potential risks, which could have had an impact on the profitability profile. When analysing these financials, it is important to note that digital transformation is a multi-factorial process, of which 5G technology is only one key factor [5]. At the same time, financial data are affected by a variety of factors, including market competition and industry environment. Therefore, a comprehensive analysis of financial performance can better understand the impact of digital transformation and 5G technology application on Jingdong Logistics [6].

Table 2. Financial Comparison Table (2023 vs. 2022 for the six months ended 30 June)

2023	2022
incomes	77,761,309
business costs	-72,731,387
Maori	5,029,922
Sales and marketing expenses	-2,353,216
R&D expenditure	-1,824,511
General and administrative expenses	-1,675,410
Other net (1)	441,003
Loss before taxation	-382,212
Income tax expense	-146,662
Loss for the period	-528,874
Owners of the Company	-637,211
non-controlling interest	108,337
-528,874	-1,433,499
Owners of the Company	-95,570
non-controlling interest	209,741
114,171	-584,944

Source: Jingdong Annual Report

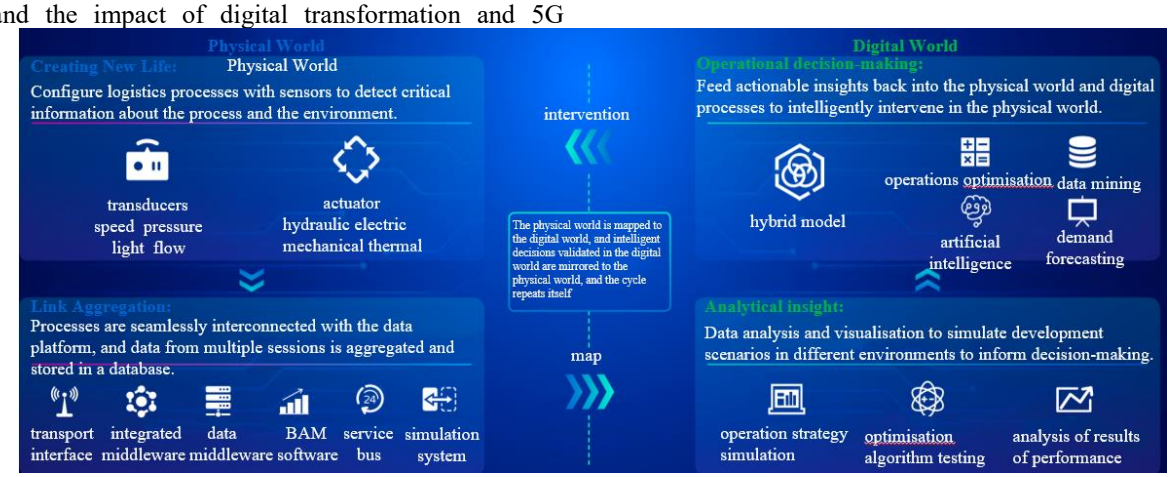

Fig. 1 5G-driven creation of a full chain of digital twin worlds

Through 5G technology, extending from the macro logistics network to the micro logistics production, it realises the comprehensive connection of massive data from upstream enterprises to end-users, and from torso to capillaries, which includes the aggregation and processing of originally unstructured data, and ultimately maps out a digital twin world with structured features [7]. In this digital twin, intelligent decisions can be rapidly interacted and validated in the data world, and ultimately, these intelligent decisions can be implemented in the physical world, enabling continuous improvement and innovation in logistics design. 5G technology has reshaped this twinned intelligent world by linking the data to bring about cost reduction, efficiency gains and synergistic optimisation. This integrated digital and physical framework opens up entirely new possibilities for the logistics industry [8], as shown in Figure 2 below.

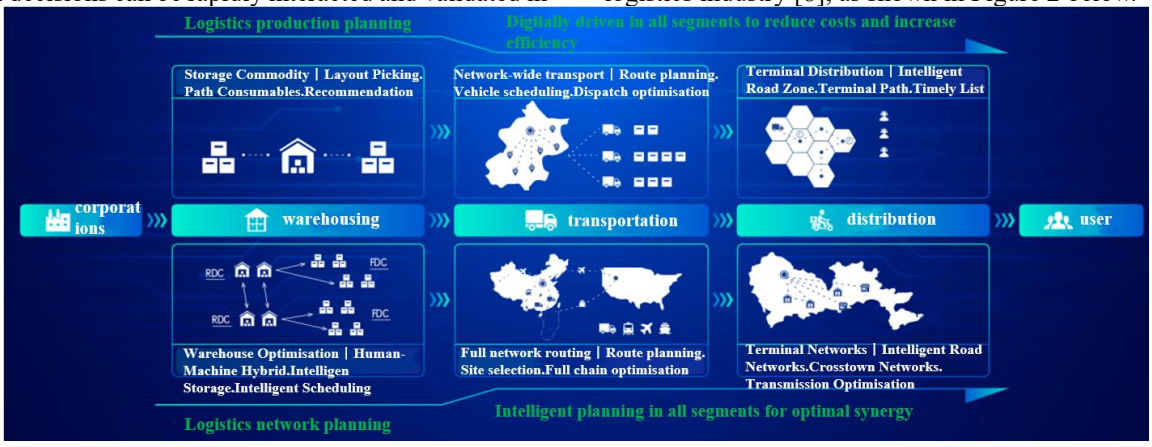

Fig. 2 5G facilitates digitally driven, intelligent planning for all aspects of logistics

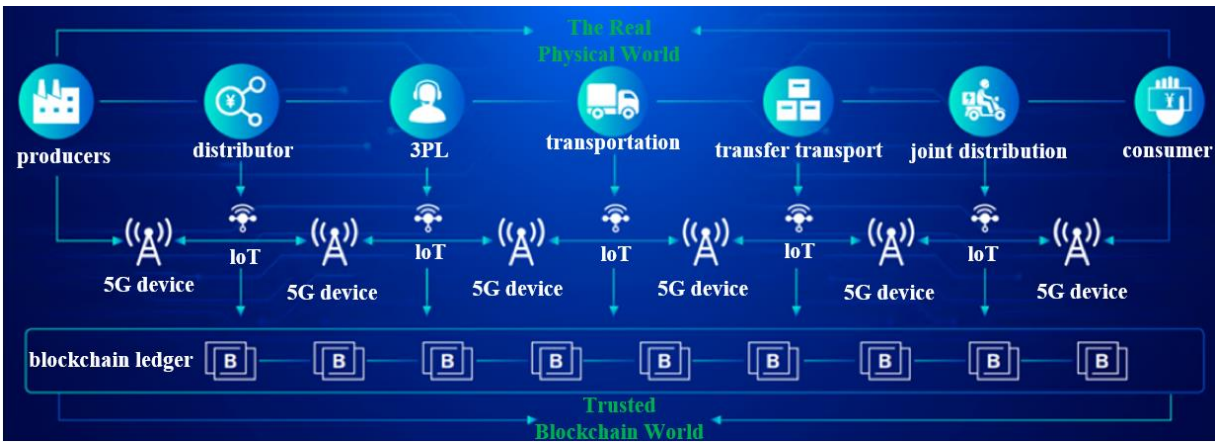

Fig.3 5G and blockchain together to visualise logistics tracking

The commercial application of 5G technology will trigger a push to scale the Internet of Things (IoT), which is seen as a key connector for mapping the blockchain to the physical world. Through IoT technology and the collection of sensor devices, data covering a wide range of aspects such as temperature, humidity, coordinates, etc., which are encrypted and distributed on the blockchain through blockchain technology. At the same time, smart contracts provide automatic alerts on risk factors, enhancing real-time awareness of potential risks [9] . The data generated by this IoT is not only for internal use by enterprises, but can also be a powerful tool for regulatory agencies such as customs, port offices, inspection and quarantine bureaus. Through multiple applications such as real-time monitoring, e-signature, port operation scheduling, accident cause tracing, and transport liability determination, this data provides all-round support for the safety and efficiency of the entire logistics ecosystem, as shown in Figure 3 below. This combination of IoT and blockchain technology provides a smarter, safer and more efficient solution for the logistics industry [10].

3. Jingdong Logistics Digital Transformation Status and Challenges

On the road of digital transformation, Jingdong Logistics faces a series of challenges and opportunities. Among them, the cloud dedicated line of 5G technology provides a practical solution for mobile warehousing to move from concept to reality.The excellent performance of the 5G network, with an experience rate of more than 100Mbps and a peak rate of more than 10Gbps, injects a powerful impetus for mobile warehousing. This not only allows mobile warehousing to get rid of the bottleneck in data transmission rate in the past, but also makes the digital transformation more realistic and efficient [11]. The introduction of this high-speed network has made substantial progress in the digital transformation of Jingdong Logistics. 5G technology cloud line not only meets the needs of digital transformation for big data transmission and real-time interconnection, but also makes a solid step forward for Jingdong Logistics in the field of mobile warehousing [12], as shown in Figure 4. This transformation is not only a theoretical conception, but also achieved obvious results in practical application, which depicts a more optimistic blueprint for the future development of Jingdong Logistics.

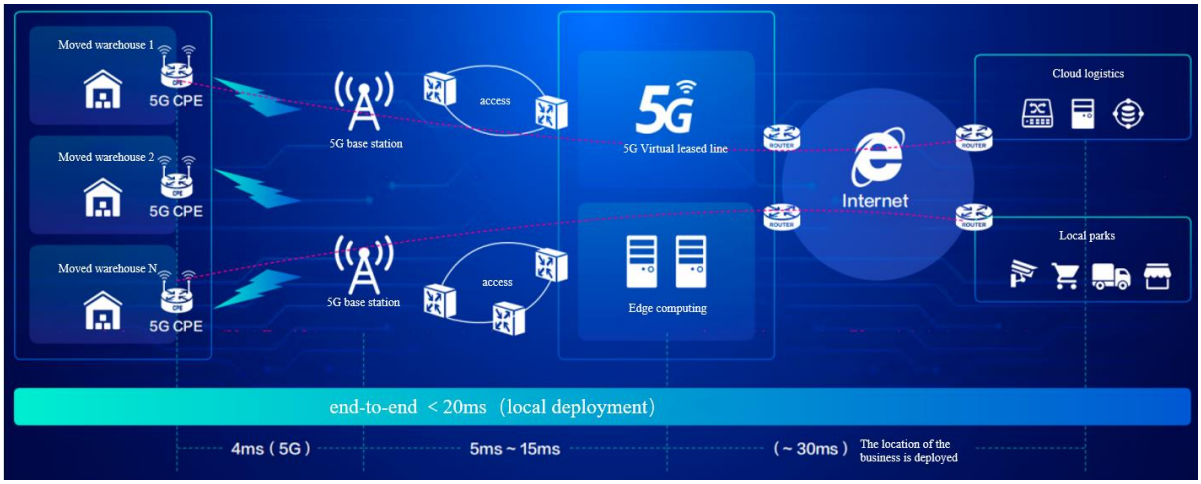

Fig. 4 5G Cloud Private Line and Mobile Warehousing

Logistics, as a key industry that integrates the physical and digital worlds, the combination of 5G technology and the Internet of Things (IoT) has become a bridge to realise the close connection between these two worlds.The combined effect of 5G+IoT enables the vast amount of information emerging from the physical world to enter the digital world in digital form, followed by the integration of artificial intelligence, machine intelligence, augmented reality/virtual

reality (AR/VR), blockchain and other key technologies to achieve digitalisation and intelligence in logistics. This process not only improves logistics efficiency, but also reduces logistics costs, providing users with a better experience and a higher level of security [13] , as shown in Figure 5 below. 5G technology plays a key role in this context, driving the digital transformation of smart logistics and creating a new development prospect for the entire logistics industry.

Fig. 5 Connecting the physical and digital worlds

4. 5G technology to drive the future of Jingdong's smart logistics

Logistics, as a core area of resource optimisation, can be abstracted into three layers: network planning layer, intelligent control layer and equipment execution layer. The network planning layer focuses on solving the problems of warehousing network planning, logistics chain site selection, network routing planning and inventory layout optimisation; the intelligent control layer is committed to solving the challenges of intelligent scheduling, path optimisation and multi-robot intelligent scheduling; and the equipment execution layer is responsible for accepting the instructions of the intelligent control layer and executing the logistics operations. The intelligent control layer is compared to the brain, while the equipment execution layer is similar to the limbs[14] . With the increasing maturity of 5G technology, key technologies such as Internet of Things (IoT), cloud computing, big data, artificial intelligence (AI), operations research, augmented reality/virtual reality (AR/VR), blockchain, robotics and so on will be deeply integrated in the whole process of logistics, as shown in Fig. 6 below. This integration will achieve scientific and reasonable network planning, efficient and intelligent scheduling, and automatic and unmanned logistics operations, and ultimately achieve the goal of reducing costs and increasing efficiency. 5G technology serves as a key engine to promote the future development of smart logistics in this process, bringing a broader prospect and a more efficient mode of operation for the intelligent logistics of Jingdong.

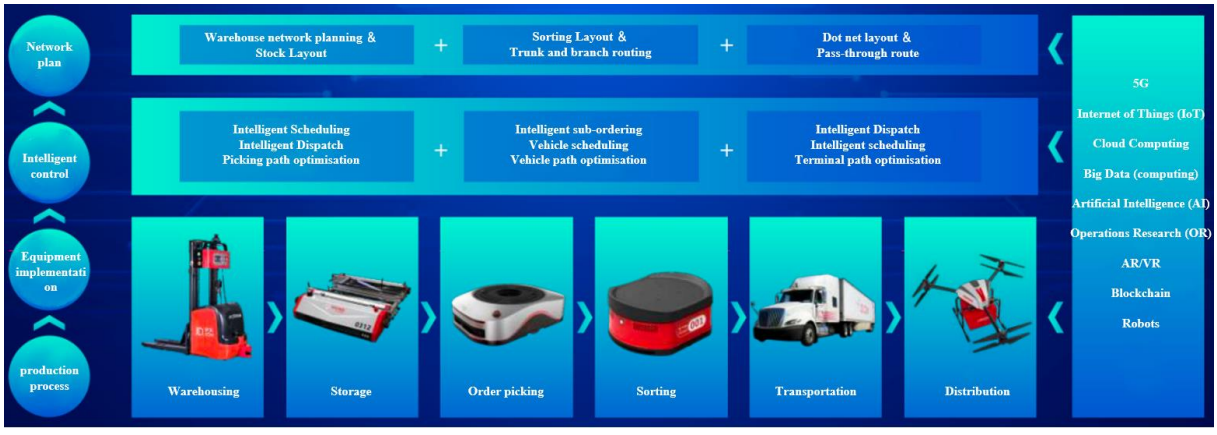

Fig. 6 Jingdong Intelligent Logistics Technology Panorama

5. Reach a verdict

Through the deep integration of 5G with IoT, cloud computing, big data, artificial intelligence, AR/VR, blockchain and other technologies, Jingdong Logistics has been able to build a full chain of digital twin worlds, transforming the massive information in the physical world into structured digital data, and realising the rapid validation and interaction of intelligent decision-making in the data world, and ultimately landing in the physical world. This transformation not only improves logistics efficiency and reduces logistics costs, but also achieves significant improvements in user experience and security. The commercialisation of 5G technology further promotes IoT applications at scale, making it a key connector to link the blockchain to the mapping of the physical world. With IoT technology and sensor devices, data uploaded over 5G networks can be encrypted and distributed, and automated alerts on risk factors can be realised through smart contracts. This enables regulatory agencies such as customs, port offices,

inspection and quarantine bureaus to conduct real-time monitoring, electronic signatures, port operation scheduling, accident cause tracing, transport liability determination, and other applications. The synergy between 5G and blockchain provides a means of visualisation for logistics tracking, and creates a more transparent, efficient, and secure logistics environment. In the process of digital transformation of Jingdong Intelligent Logistics, 5G technology also provides practical application scenarios for mobile warehousing and other fields. 5G network's ultra-high-speed bandwidth supports real-time collaborative control of mobile warehouses, allowing equipment such as warehousing robots to play a greater role in large-scale collaborative scheduling and production. This not only elevates warehouse operations and layout optimisation to a new level, but also provides viable technical support for future unmanned logistics operations.

References

[1] Khatib E J, Barco R. Optimization of 5G networks for smart logistics[J]. Energies, 2021, 14(6): 1758.

[2] Yan Y. Research on the innovation path of logistics formats based on 5G technology[J]. Open Journal of Business and Management, 2019, 7(4): 1936-1942.

[3] Li Z, Wang Y, Ji Y. Analysis of Key Technologies and Application Status of Smart Logistics[C]//International Conference on Autonomous Unmanned Systems. Singapore: Springer Singapore, 2021: 2804-2812.

[4] Demir S, Paksoy T, Kochan C G. Logistics 4.0: SCM in Industry 4.0 Era: (Changing Patterns of Logistics in Industry 4.0 and role of digital transformation in SCM) [M]//Logistics 4.0. CRC Press, 2020: 15-26.

[5] Zhang Z, Jin J, Li S, et al. Digital transformation of incumbent firms from the perspective of portfolios of innovation[J]. Technology in Society, 2023, 72: 102149.

[6] MacCarthy B L, Ivanov D. The Digital Supply Chain-emergence, concepts, definitions, and technologies[M]//The digital supply chain. Elsevier, 2022: 3-24.

[7] YU Meihong,YAN Mengling,HE Meizhang. Exploration of Green Logistics Capacity Expansion Mode Driven by 5G Application--Taking Cainiao and Jingdong as an Example[J]. Business and Economic Research,2020(19):103-106.

DOI:10.3969/j.issn.1002-5863.2020.19.025.

[8] Li Xiwen,Zhang Hangning. Reality Perspective and Direction Exploration of Intelligent Logistics in the Context of 5G - A Multi-Case Study Based on Jingdong Logistics, Shentong Express and Shunfeng Holdings[J]. Logistics Engineering and Management,2022,44(7):42-46.

DOI:10.3969/j.issn.1674-4993.2022.07.012.

[9] LIU Ting. Logistics drone solution based on 5G and cloud computing technology[J]. Logistics Times Weekly, 2022(10):30-33.

DOI:10.12323/j.issn.1673-0542.2022.10.005.

[10] Gou Xiao. Research on Intelligent Logistics Operation and Management under the New Development Pattern - Taking Jingdong Logistics as an Example[J]. Logistics Engineering and Management, 2022,44(5):151-153.

DOI:10.3969/j.issn.1674-4993.2022.05.041.

[11] Chen Ji. Reflections on the Construction of Intelligent Logistics System of Logistics Enterprises in the Era of Big Data - Taking Jingdong Logistics as an Example[J]. Small and Medium-sized Enterprises Management and Technology, 2022(19): 94-96.

[12] SUN Tingshu. Exploration on the Development Strategy of Intelligent Logistics in the Era of Big Data--Taking "Jingdong Logistics Qinglong System" as an Example[J]. Journal of Economic Research, 2021(11):51-53,60.

[13] Wang Shoshuo. Research on intelligent inventory management mode and its implementation strategy in the context of digitalisation [J]. Logistics Engineering and Management, 2023, 45(10):18-21,14.

DOI: 10.3969/j.issn.1674-4993.2023.10.005.

[14] Wang Tian. Research on the Development Strategy of Intelligent Logistics Based on SWOT Model --Taking Jingdong Logistics as an Example[J]. Mall Modernisation, 2021(6):43-45.