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Analysis On Activity-Based Costing Approach For JD Logistics Warehousing Operation (Nanning Area)

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Abstract– *This study aims to apply the Activity-based Costing (ABC) method to analyze and optimize the warehousing operations of JingDong(JD) Logistics, focusing on its Nanning Intelligent Logistics Park. As China's e-commerce sector grows, logistics costs remain a significant challenge, with warehousing identified as a key cost driver. By implementing the ABC approach, this research seeks to accurately allocate costs, identify inefficiencies, and propose targeted improvements in operational processes. The results of the study show that the ABC method yields lower costs compared to traditional costing methods, and that the total cost of the warehousing center accounts for 44.71% of the total cost of the park, with the cost of storage and custody operations accounting for 62.6% of the warehousing cost, the operation with the highest cost share. Between 2022 and 2023, the costs of this logistics park generally increased, particularly reaching annual peaks in November and December, reflecting increased pressure on operating costs. The study examines the park's cost structure and operational practices, offering insights into cost reduction and efficiency enhancement. In order to manage costs effectively, this study proposes a number of recommendations for improvement. This research contributes to the advancement of cost management practices in self-build logistics companies and offers valuable implications for the broader e-commerce logistics industry..*
Index Terms—*Activity-Based Costing, logistics activity, logistics operation cost, warehose.*

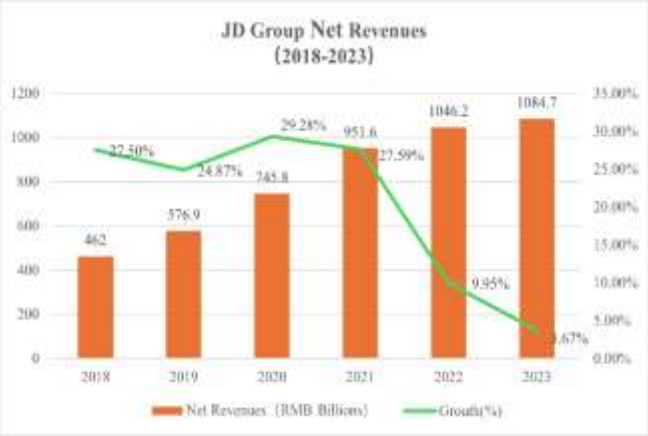
I. INTRODUCTION

With the rapid rise of e-commerce in the 21st century, China's logistics industry has experienced significant growth. According to the National Bureau of Statistics, total social logistics increased from 298 trillion RMB in 2019 to 352.4 trillion RMB in 2023, with an average annual growth rate of 5.44%[1-5]. However, despite its scale, China's logistics industry remains less competitive than developed countries, with logistics costs accounting for 14.4% of GDP in 2023, compared to the global average of 12% and less than 9% in countries like the US, UK, and Japan. Effective logistics cost control could save enterprises 15-30% of expenses. As China's e-commerce market matures and competition intensifies, profit margins shrink, making refined logistics and supply chain management essential. Warehousing costs represent the largest portion of logistics expenses, highlighting the potential for cost savings through operational optimization [6]. Activity-Based Costing (ABC), a mature cost management method widely applied in manufacturing, is increasingly adopted in logistics [7, 8]. ABC calculates activity costs based on resource drivers and product costs based on activity drivers, offering precise cost information and supporting operational efficiency improvements.

JD Group, founded in 2003 and listed on NASDAQ in 2014, is China's largest self-operated e-commerce platform. Its logistics arm, JD Logistics, established in 2007, has become a leading supply chain service provider. However, JD's revenue growth slowed from 47% in 2020 to 21% in 2023[9-13]. To address this, JD Logistics aims to reduce overall costs by 20% over three years by enhancing lean operations and offering logistics services to external clients [14].

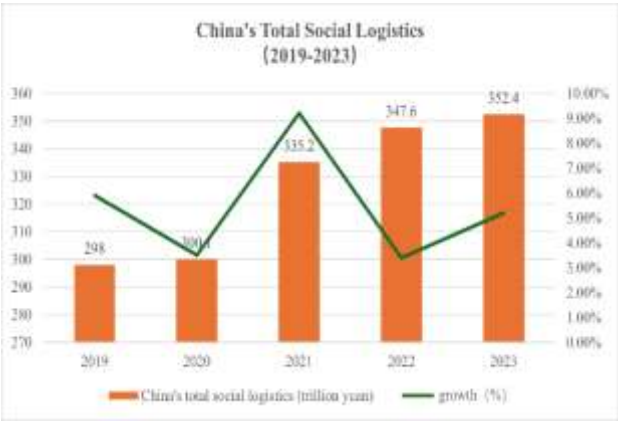
JD Nanning Intelligent Logistics Park, established in 2019, serves Guangxi and southwest China. Covering 220 acres with three warehouses totaling 68,000㎡, it primarily stores and distributes household goods, snacks, digital appliances, and more. Despite efficient operations, high warehousing, processing, and distribution expenses create cost pressures. Separate management of storage, sorting, and transportation further complicates unified cost analysis.This study applies ABC to analyze the park's operational costs, recalculating expenses across storage, sorting, and transportation. By identifying key cost components and their influencing factors, the study proposes practical cost reduction strategies. The findings support JD Logistics' competitiveness while offering valuable insights for the broader logistics industry and contributing to logistics cost management theory with empirical evidence.

Fig. 1 China's total social logistics volume and growth from 2019 to 2023



Source: China National Bureau of Statistics , author collation

Fig.2 JD Group's revenue and growth from 2018 to 2023



Source: JD Group, author collation

II. CALCULATIONS STEPS

A. Theory of Activity-based costing method

The Activity-Based Costing (ABC) method, proposed by Kaplan and other scholars, allocates costs based on different activities, linking cost consumption to each product's operational workload. Compared to traditional costing, ABC more rigorously allocates indirect costs by assigning expenses to each product, service, or cost object through activity drivers. It provides more accurate cost information, supporting better decision-making and enhancing enterprise competitiveness [15].

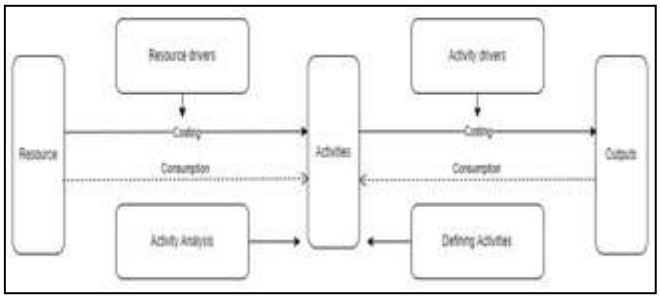
B. The basic principle of operation cost method

ABC operates on the principle that "activities consume resources, and products consume activities." It allocates costs in two stages: first, resource costs are assigned to activity cost pools based on resource drivers, and second, activity costs are assigned to products according to activity drivers. This method offers more precise indirect cost allocation compared to traditional methods. Therefore, the allocation path of indirect costs under the ABC method is "resource → activity → product"[16, 17].

C. Data collection

In order to achieve the research objectives, this study data was collected from multiple channels to ensure accurate cost calculation. Indirect data sources include JD Group's financial reports, research literature, and official statistics from the National Bureau of Statistics of China. Direct data was gathered through field visits, in-depth interviews, and operational system access at JD Nanning Logistics Park. The processed data forms the foundation for operational cost calculations.

Fig. 3 Activity-based Cost Basic Principle Diagram

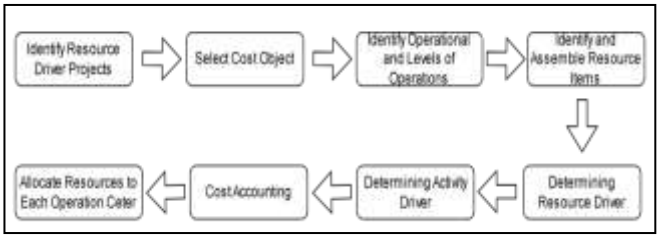


Source: Shanxi Normal University

D. Calculation steps

According to the basic operation principle of ABC method, "products consume operations and operations consume resources", the basic research steps of logistics business process cost analysis in this paper are shown (fig.4).

Fig. 4 Steps in calculating the activity-based costing method



Source: Dalian University of Technology

1) Determine the resource items

The overall link of logistics operation is regarded as a system of material exchange between the enterprise and the outside world, and all human, material and financial resources entering the system are included in the scope of resources to achieve full coverage of the accounting scope. According to the actual situation of JD Nanning Logistics Park, by analyzing and organizing the original cost data collected, the resource items required for calculation are divided into: personnel costs, construction costs, warehouse rent, equipment depreciation, transportation and distribution costs, order consumables, rent and property costs, water and electricity costs.

2) Selection of cost objects

According to the service nature of JD logistics enterprises, determine the cost object for each order in the fulfillment process of the cost, that is, in order to complete the order in the park under the management of the operation of the various links in a certain period of time for the calculation of the logistics cost of the cost object.

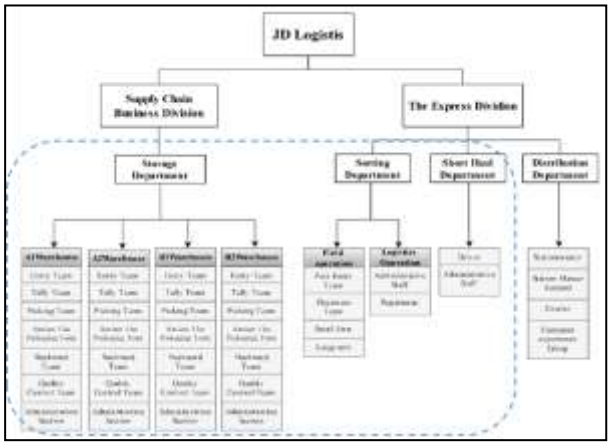
3) Determine the operation center and operational activities

In the context of the business processes and characteristics inherent to JD Nanning Logistics Park, an investigation into its operational level reveals its primary composition, which encompasses warehouse management, sorting and processing, transportation and distribution centers. A thorough analysis and organization of the management structure of JD Nanning Logistics Park (Fig. 5) reveals that the park's management department is set up in accordance with the operational links, encompassing 3/4 of the ring of the entire operational core chain. This includes the warehousing department, the short-distance transportation department, and the sorting department [18, 19].

Through field visits and the production process within the enterprise, the author has organized the operation process of the JD Nanning Logistics Park (Fig.6), the entire logistics operation starting from the receipt of goods into the warehouse until the end of the distribution of goods to the hands of consumers, the costs incurred in the process that is, the operating costs. Overall, there are four major links, i.e. warehouse, picking, transportation and distribution, and this paper focuses on analyzing and calculating the operating costs of the three links of warehouse, picking and transportation in the park(Table 1). At

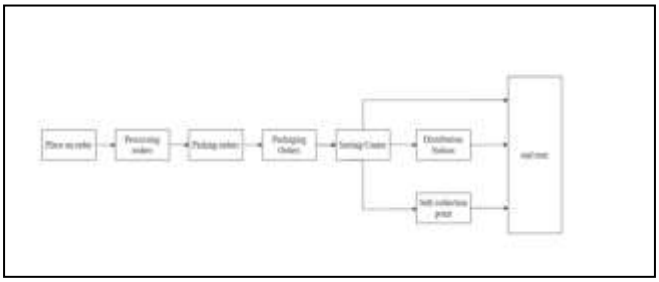
the same time, consumers shopping through the e-commerce platform, orders transferred to the warehouse for picking, packing, export operations, sorting and distribution is called the order

Fig. 5 JD Nanning logistics park management structure



Source: Author's collation, information from JD

Fig. 6 JD nanning logistics park order fulfillment flowchart



Source: Author collation

fulfillment process, this process is the main source of the park to consume the cost and get income, therefore, JD e-commerce platform of various promotional activities, bringing fluctuations in sales orders, these fluctuations will be through the change of the number of orders on the park's operating costs to have a direct impact.

4) Determination and attribution of resource items

Every item in JD Logistics constantly consumes resources in the operation process. According to the identified operation centre and operation activities, the consumption of resources can be allocated to each operation centre. The resource items consumed by JD Nanning Logistics Park include rent and property costs, utilities, decoration costs, office expenses, equipment depreciation and maintenance, self-employment - transportation equipment depreciation, labour wages, order consumables, recruitment, training and compensation and other costs. After allocation to the operating centres they are as shown in Table 2. According to the principle of ABC operation cost method, in the operation process of the whole park, the cost of consumed resources can be divided into direct cost and indirect cost according to the relationship with the operation object, and the indirect cost is mainly reallocated according to the order in the logistics operation process(Table 3).

Table 1 Table of Operation Centers and Activities

Operation Center	Main Operations
Warehouse management center	Incoming goods, storage and custody, inventory count, outgoing goods
Sorting and processing center	Sorting operation, packaging operation
Transportation and Distribution Center	Transportation vehicle scheduling, transportation and distribution

Table 2 Resource Consumption Table for Operations Centers

Operation Center	Resource Items
Warehouse management center	Rent and property costs, utilities, equipment depreciation, packaging consumables, employee wages .....
Sorting and processing center	Rent and property costs, utilities, depreciation of logistics equipment, personnel costs, packaging consumables, loading and unloading costs .....
Transportation and Distribution Center	Transportation and distribution costs, vehicle depreciation, insurance .....

Table 3 Cost structure table of JD Nanning Logistics Park

Operation Center	Direct Cost	Indirect Cost
Warehouse management center	Packaging consumables	Equipment depreciation, labor costs, utilities, etc., construction costs, personnel wages
Sorting and processing center	Packaging consumables	facility costs, rent, property costs, equipment depreciation, utilities, labor costs, staff wages, etc.
Transportation and Distribution Center	Labor wages, etc.	Loading and unloading costs, training costs, depreciation of transportation equipment, insurance costs, etc.

5) Determination of resource drivers

Resource drivers are the basis for allocating consumed resources to each logistics center. Reasonable resource drivers are the key to the accurate allocation of resource items to operation centers or cost objects. By organizing and calculating the data of the park for 2022-2023, the resource item drivers and amounts are determined as shown in the Table 4. The calculation shows that the average annual cost of the warehouse center, sorting center and transportation center are 567,748,822.56, 34,006,358.64 and 395,895,919.13 respectively.

6) Determination of operating factors

The activity driver is a criterion for allocating the cost of each logistics operation center to the cost object, and the cost of the operation center cost pool is allocated to the logistics cost object according to the workload of each activity. Based on the data collection and organization of JD for the years 2022-2023, a table of operational drivers and data collection (Table 5) and the determination of the resource driver rate for each operation center (Table 6) were developed:

7) Allocating resources to individual operations

Based on the data in Table 4-6, the costs for each activity in each operation center can be calculated separately based on the ABC costing method.

Based on the calculation, the following table (Table 7) is derived:

Table 4 Table of resource drivers

Operation Center	Resource	Amount (RMB)
Warehouse management center	Building Costs	10545178.81
	Warehouse Rental	12494398.88
	Depreciation of warehouse equipment	5252630.43
	Warehouse manager's salary	22526317.82
	Warehouse resource consumption	5956296.63
Sorting and processing center	Building Utilization Costs	7883979.305
	Depreciation of sorting equipment	196716.315
	Sorting staff wages	25050887.82
	Order Consumables	736835.41
	Daily Operating Expenses	137939.795
Transportation and Distribution Center	Transportation Employee Wages	14432260.52
	Transportation Costs	25157258.61

Table 5 Table of Operational Motivations

Operation Center	Main Operations	Driver	Numerical value
Warehouse management center	Goods warehousing	Volume of goods in stock (cubic meters)	3248764
	Storage and Custody	Average value of goods in stock (dollars)	1.159
	Inventory count	Number of inventory counts (times)	24
	Goods out of stock	Volume of goods out of stock (cubic meters)	3248764
Sorting and processing center	Sorting operations	Number of goods sorted (pieces)	174640993
	Packaging	Number of orders packed (units)	147363723
Transportation and Distribution Center	Transportation Vehicles	Transportation mileage (kilometers))	17654157.34
	Transportation and Distribution	Weight of transported goods (tons)	668499586.3

Table 6 Percentage of resource drivers for each operations center

Operation Center	Main Operations	Resource driver rate
Warehouse management center	Goods warehousing	20%
	Storage and Custody	50%
	Inventory count	10%
	Goods out of stock	20%
Sorting and processing center	Sorting operations	50%
	Packaging	50%
Transportation and Distribution Center	Transportation Vehicles	30%
	Transportation and Distribution	70%

Table 7 Table of operating costs

Operation Center	Main Operations	motivations	numerical value	Operation Center Cost (¥)	Resource Driver Rate (%)	Operating Costs
Warehouse management center	Goods warehousing	Volume of goods in stock (cubic meters)	3248764	56774822.56	20%	3.495
	Storage and Custody	Average value of goods in stock (dollars)	21954108		50%	1.293
	Inventory count	Number of inventory counts (times)	24		10%	236561.761
	Goods out of stock	Volume of goods out of stock (cubic meters)	3040784		20%	2.881
Sorting and processing center	Sorting operations	Number of goods sorted (pieces)	73651862	54006358.64	50%	0.231
	Packaging	Number of orders packed (units)	87320497		50%	0.195
Transportation and Distribution Center	Transportation Vehicles	Transportation mileage (kilometers))	8862889.5	39589519.13	30%	1.340
	Transportation and Distribution	Weight of transported goods (kg)	930448979.5		70%	0.030

8) Operation center costing

Based on the above data, calculate the monthly and annual costs for each of the three operation centers and each activity.

III. Results And Analysis

A. Operating Cost per Order

The average operating cost per order in JD Nanning Logistics Park is calculated at 2.81 RMB per order. This cost is derived by distributing the total annual operational costs across the total order volume, providing a basis for JD Logistics to set service pricing.

B. Total Park Operating Costs

The total annual operating costs for JD Nanning Logistics Park are RMB100,801,612.1 in 2022 and RMB101,421,155.9 in 2023. The warehouse management center consistently accounts for the largest proportion of costs, 44.17% in 2022 and 45.24% in 2023, with an average annual proportion of 44.71%, making it the department with the highest proportion of costs for two consecutive years.

Table 8 Total annual costs by operations center

Year	Operation Center	Amount (RMB)
2022	Warehouse management center	44528443.4
	Sorting and processing center	30833125.8
	Transportation and Distribution Center	25440042.9
	Total	**100,801,612.1**
2023	Warehouse management center	45886752.59
	Sorting and processing center	37262887.82
	Transportation and Distribution Center	18271515.52
	Total	**101421155.9**

A side-by-side comparison of the total costs of the two years 2022 and 2023 shows (Fig. 7) that the total operating costs of the park in 2022 and 2023 are basically close to each other, with no significant increase, while the order volume continues to grow, which indicates that all departments of the park are doing a better activity-based of cost control.

In terms of the cost of each operation center, the total cost of the warehouse center in the two years is ¥44528443.4 and ¥45886752.6, the total cost of the sorting center is ¥30833125.83 and ¥37262887.82, and the total cost of the transportation center is ¥25440042.9 and ¥18271515.52.

The cost share of the three operation centers shows a relatively stable distribution, by comparing the cost of each operation center, among which, the cost share of the warehousing center is 44.17% in 2022, and 45.24% in 2023, with a slight increase, which indicates that the cost of the warehousing center accounts for a relatively large proportion of the total cost and is relatively stable. Although the proportion of a small increase, but still need to pay attention to the efficiency of warehousing operations, whether there is a decline in the utilization rate of storage space, equipment maintenance costs increase and other issues, to further explore the potential to reduce warehousing costs, such as optimizing inventory management, improve the layout of warehousing and so on.

The cost share of sorting centers rose more significantly from 31% in 2022 to 37% in 2023. This may be due to the increase in sorting workload as a result of the growth in business volume, which will lead to an increase in labor costs, equipment investment costs, and so on. The cost share of transportation and distribution centers declines from 25% in 2022 to 18% in 2023, a more significant decrease. This may be due to the effective cost control measures adopted by the park in the transportation and distribution chain, such as optimization of transportation routes, improvement of vehicle loading rate, and rational arrangement of distribution plans, thus reducing transportation and distribution costs. This is a positive achievement in cost control and experience can continue to be gained to maintain and further optimize cost control in the transportation and distribution chain.

C. Costs by Operation Center

Overall, the total cost of the storage center has been the highest among the three operation centers for 2 consecutive years, with an average annual cost of 44.71% for the entire campus. Looking further deep the cost composition of the storage center, it can be clearly seen: the storage and custody link accounts for the highest cost of the entire storage center, amounting to more than 60%, followed by the cost of outgoing operations.

Fig. 7 Operation Cost Structure of JD Nanning Logistics Park in 2022 and 2023

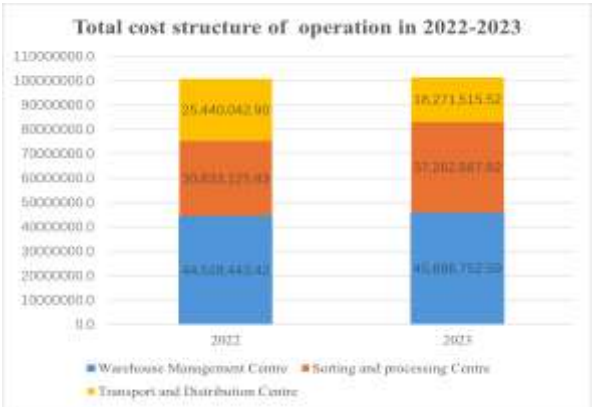
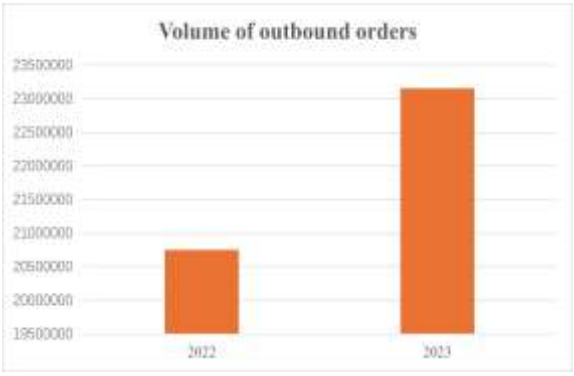


Fig. 8 Order volume of JD Nanning Logistics Park in 2022 and 2023



Labour costs and site-related costs account for a larger share of the cost components of warehouse centers. In 2022, wages of warehouse managers account for a higher share of total costs, reaching 50.6%, and the combined share of warehouse rent and construction costs is about 51.7%. This shows that the operation of the warehouse center is highly dependent on human resources and site facilities, and that controlling labour costs and site costs is crucial to reducing the total cost of the warehouse centre. To reduce labour costs, JD Logistics can implement an intelligent warehouse management system to automate and inform warehouse management and reduce reliance on labour. The use of automated racking and handling robots can improve the storage and handling efficiency of goods and reduce the

Fig. 9 Structure of operation cost share by operation center in 2022-2023

number of manual operations, thereby reducing labour costs. In terms of site costs, the warehouse layout can be optimised to improve the utilisation rate of warehouse space, avoid wasted space and reduce warehouse rental costs.

In the cost composition of the sorting center, personnel cost and equipment depreciation also occupy an important position. in 2022, the proportion of sorting personnel salary to total cost is about 81.2%, and the depreciation of the sorting equipment, although the amount is relatively small, is also a part of the cost. In addition, the cost of order consumables should not be ignored, and the cost of order consumables accounts for about 2.4% of the total cost. This indicates that the sorting center in cost control, in addition to focusing on personnel and equipment costs, but also need to optimize the use of order consumables to improve the efficiency of resource utilization. In order to reduce personnel costs, more efficient sorting equipment and processes can be used to improve sorting efficiency and reduce personnel requirements. For order consumables, it is possible to negotiate with suppliers for more favorable purchase prices, or optimize packaging design to reduce the use of consumables.

Transportation costs and personnel wages are the main parts of the cost components of the transportation center. The key to cost control of the transportation center is to optimize the transportation routes,

improve the vehicle loading rate, and reduce the transportation costs, and at the same time, reasonably arrange the work of the personnel to improve the work efficiency and reduce the labor costs. Big data and artificial intelligence technology can be used to optimize the planning of transport routes, choose the optimal transport routes according to the distribution of goods, traffic conditions and other factors, reduce transport mileage and reduce transport costs. In terms of personnel management, the working time and tasks of drivers can be reasonably arranged to improve the efficiency of drivers and avoid personnel idleness and waste.

Fig. 10 Warehouse center operational activity Cost Structure

D. Monthly Cost Analysis for Each Operation Center

The analysis of the monthly cost data of each operation center in 2022-2023 (from Fig. 11) shows that there are fluctuations in the monthly cost of each operation center. In 2022, the month with the highest cost of the warehousing center is December, which reaches ¥4475129.1; the month with the highest cost of the sorting center is December, which reaches ¥318,0008.094; and the month with the highest cost of the transportation center is December, which reaches ¥269,497,967.965. In 2023, the highest cost month for warehouse centers is November at ¥4,553,441.6; the highest cost month for sorting centers is November at ¥4,084,782.744; and the highest cost month for transportation centers is November at ¥1,844,563.939. Overall, costs were generally higher in November and December of each year for all operations centers.

Fig. 11 Comparison of monthly ABC costing of three operation centers of JD Logistics, 2022-2023

E. Analysis of Peak Cost Factors

Through the analysis of the monthly cost data of each operation center in 2022-2023, it is found that the costs of the warehousing center, the sorting center and the transportation center fluctuate significantly in different months. Overall, the cost of each operation center is generally higher in June, November and December each year, which is mainly affected by the dual impact of the peak season of e-commerce promotions and seasonal factors.

1) 1. Impact of e-commerce promotions

November and December of each year is the peak season for promotions in the e-commerce industry, such as the "Double Eleven" and "Double Twelve" shopping festivals, during which the order volume of JD increases significantly, which directly leads to a sharp increase in the business volume of the operation centers, which in turn drives significant fluctuations in costs.

a) Warehouse Center

Increase in the volume of goods in and out of warehouses: During the promotional season, the surge in the volume of orders led to a significant increase in the volume of goods in and out of warehouses. For example, in November 2022, the volume of goods in storage reached 154,527.7 cubic meters and the volume of goods out of storage reached 235,870.9271 cubic meters, far exceeding the average of other months. Increased demand for warehousing space: the rise in the volume of goods stored may require the temporary rental of additional warehouses, increasing the cost of warehousing rentals.

Increased investment in manpower and material resources: in order to cope with the large volume of goods in and out of storage, the warehouse center needed to invest more manpower in handling and management, while the frequency of equipment use also increased significantly, resulting in higher manpower costs and equipment depreciation costs.

b) Sorting centers

Increased picking and packing workload: the growth in order volumes has led to a significant rise in the number of goods picked and the number of packing orders. For example, the number of goods picked in November 2022 reached 6593740 pieces and the number of packing orders reached 8017593 units.

Increase in temporary labor costs: In order to complete picking and packing tasks in a timely manner, the sorting centers need to recruit a large number of temporary workers, while equipment running time is extended, resulting in a significant rise in personnel costs and equipment depreciation costs.

Increase in consumables and training costs: The increase in order volume has led to a rise in the use of order consumables, while the addition of temporary laborers has increased training costs, and their work efficiency is relatively low, further affecting costs.

Increase in equipment maintenance and upkeep costs: equipment is prone to breakdowns over a long period of time, requiring an increase in maintenance and upkeep costs.

c) Transportation centers

Increase in the volume of transported goods and transported kilometers: the volume of transported goods and transported kilometers increased significantly during the promotional season. For example, in November 2022 transportation mileage reached 875,051.216 kilometers and the total volume of transported goods reached 400,231,164.56 kilograms.

Increased investment in transportation resources: In order to meet transportation demand, transportation centers may need to increase the number of transportation vehicles, hire more drivers, or even use expedited transportation services, resulting in higher transportation and labor costs.

Increase in vehicle wear and maintenance costs: frequent use of vehicles accelerates their wear and tear, increasing repair and maintenance costs.

Increased transportation mode adjustment costs: To ensure on-time delivery, transportation centers may choose faster but more costly modes of transportation, such as air transportation or expedited ground transportation, further pushing up transportation costs.

2) Impact of seasonal factors

In winter, especially in November and December, some areas may be affected by bad weather, such as rainfall and freezing, which not only increases the difficulty and risk of cargo transportation, but also has a significant impact on the cost of storage and transportation links.

a) Transportation Center

Cost of additional protective measures: In order to cope with inclement weather, transportation centers may need to take additional protective measures, such as installing anti-skid chains on vehicles and increasing the protection of cargo packaging, etc., which increases transportation costs.

Transportation Delays and Expedited Costs: Adverse weather may lead to transportation delays, and in order to deliver goods on time, it may be necessary to choose more expensive expedited transportation methods, further pushing up transportation costs.

Increased vehicle repair and maintenance costs: Vehicles are more prone to breakdowns due to intensive use in inclement weather, requiring more frequent repairs and maintenance and increasing maintenance costs.

b) Storage centers

Increased operating costs of heating facilities: the need to increase the operating hours of warehouse heating facilities in winter to maintain the appropriate temperature and humidity in the warehouse and to safeguard the quality of goods, which will lead to an increase in costs such as utility bills.

IV. Conclusion And Recommendations

A. Improving the utilization rate of storage space and reducing operating costs through process reengineering

From the perspective of total cost structure, the total cost of the warehousing center accounts for the highest proportion among the three operation centers in the whole park, with an average annual cost of 44.71% for two consecutive years, of which the storage and custody operations account for 60%. The cost of the sorting center is also growing rapidly, and the increase in the volume of shipping orders has created a higher demand for sorting site management. Considering that the park has only been in use for three years, it is not possible in the short term to obtain a larger park area by building a new site, and it is recommended to reduce operating costs through process reengineering[20].

Optimization Recommendations: Warehousing: Intelligent warehouse management system is introduced to realize automated storage and retrieval of goods by using automated shelves and handling robots. Automated shelves can automatically adjust the storage position according to the size and weight of the goods, improve the utilization of warehouse space and reduce the cost of storage rent[21]. Handling robots can handle goods quickly and accurately according to preset programs, reducing manual handling costs. Optimize the layout of the warehouse, according to the frequency of goods in and out of storage reasonable arrangement of storage location, high-frequency in and out of storage of goods placed in the area of easy to handle, improve the efficiency of goods turnover, reduce warehousing costs[22].

Sorting: Adopt advanced automatic sorting equipment and intelligent sorting algorithms. Automatic sorting equipment can quickly and accurately sort goods, improve sorting efficiency and reduce personnel investment[23, 24]. Intelligent sorting algorithms can optimize the sorting path and sequence according to the destination, weight, size and other information of the goods, improve the accuracy of sorting, and reduce the error rate and duplication of labor. Reasonable arrangement of sorting personnel's work tasks and work time, avoiding personnel idleness and overwork, improving work efficiency and reducing labor costs. Transportation link: use big data analysis to optimize transportation routes. Collect and analyze multi-source data such as traffic road conditions, weather conditions, cargo distribution, etc., and choose the optimal distribution plan by combining the vehicle loading rate and transport time requirement[24]. Use real-time traffic data to avoid congested roads and reduce transportation time and fuel consumption. According to the distribution of goods, rationally plan distribution routes, improve the full load rate of vehicles and reduce transportation costs. Strengthen the maintenance and management of transportation vehicles, regular maintenance and repair, to ensure that the vehicles are in good operating condition and reduce transportation delays and cost increases due to vehicle failures.

B. Strengthening sales forecasts and keeping operating costs stable

From the monthly costs, there is a clear pattern of peaks and valleys, e-commerce platforms in June, November-December promotions significantly drive the warehouse operating costs higher, while the other months of the cost of the overall in a more stable state. Optimization recommendations:

Supply chain synergy: Strengthen synergy and cooperation with suppliers and partners. Negotiate with

suppliers to optimize the delivery time and batch size, and make a reasonable supply plan according to the inventory level and sales forecast of the park. Reduce the storage cycle of goods in the warehouse and lower the storage cost through accurate supply plan[25].

Joint distribution: In terms of transportation and distribution, carry out joint distribution or share logistics resources with other logistics enterprises. In some areas, and other logistics enterprises to set up a distribution fleet, sharing transportation vehicles and distribution routes, to improve the full load rate of vehicles, share the cost of transportation.

Information sharing: Establish an information sharing platform to realize real-time communication and coordination of all links in the supply chain[26]. Suppliers can know the inventory level and replenishment demand of the park in real time, and adjust the production and supply plan in time[27]. The park can obtain the production progress and delivery information of suppliers, and make warehousing and transportation arrangements in advance. Maintain close communication with downstream customers to understand changes in customer demand, adjust distribution programs in a timely manner, and improve customer satisfaction. Through information sharing, it reduces operational delays and cost increases caused by poor information and improves the operational efficiency of the entire supply chain.

C. Enhance cost awareness and improve cost management effect from multiple angles

According to the comparison results after calculation, the use of Activity-based costing method is lower than the traditional method, indicating that the use of ABC method is more reasonable in the core aspects of warehousing operations. However, most of the personnel within the enterprise have not realized the impact of operational actions on costs, and some operational data are not included in the daily management statistics of the enterprise. Optimization recommendations:

Full participation: customized cost management training for employees at different levels. Senior managers organize cost strategy seminars to discuss in depth the integration path between cost management and corporate strategy. Middle managers participate in cost analysis and decision-making training courses to learn to use Activity-based costing data to make business decisions. Grassroots employees understand the direct impact of daily operations on costs through regular cost awareness seminars.

Incentive Mechanism: A cost control incentive system is established to incorporate cost management indicators into employee performance appraisals. Rewards are given to teams and individuals with outstanding performance in cost control, such as bonuses, honorary certificates or promotion opportunities. Set up a cost-saving sharing mechanism to extract a certain percentage of the cost savings realized due to the efforts of the employees to reward the relevant personnel, to stimulate the initiative of employees to participate in the cost control initiative[28].

D. Specialized support to build a talent team

In the course of the study, it was found that although the enterprise already has personnel specializing in operational quality management and enhancement, each department is configured with varying talents and capabilities, and it is necessary to sustain a team of professional talents to support the work of cost management and data analysis. Optimization suggestions:

External Recruitment: Recruit professionals with rich experience in logistics cost management and application of operation cost method from outside to fill key positions such as cost management and data analysis. Search for excellent talents in the industry through headhunting companies, professional recruitment websites and other channels[28].

Internal training: Cooperate with universities and scientific research institutions to establish talent training bases, and directionally train compound talents to meet the needs of the park. We internally select employees with potential, provide targeted training and promotion opportunities, and encourage them to develop in the direction of cost management specialization[29]. For employees with outstanding performance in front-line work, strong learning ability and innovative thinking, they are selected to attend cost management training courses. After the training, they are arranged to participate in actual cost management projects to practice and improve their abilities in practice. Ongoing training: We formulate ongoing training programs for employees in cost management-related positions, and invite industry

experts to conduct training on the latest application of the operation cost method and cutting-edge theories of logistics cost management. Regularly organize high-end training lectures, inviting famous scholars and corporate executives at home and abroad to share the latest cost management concepts and practical experience. Organize internal experience sharing sessions for employees to exchange experiences and lessons learned in cost management practice. Encourage employees to take professional qualification exams, such as Certified Management Accountant (CMA), Certified Logistician, etc., and provide material incentives and career development support to employees who have obtained relevant certificates.

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