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Original Article

Effective Cargo Ports Factors for Logistics Distribution and Ergonomics Workplace by the Relative Importance Index (RII)

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Abstract - *The way a nation's economy becomes more international and global is greatly influenced by its logistics system. Logistics systems are becoming increasingly crucial as the world rapidly changes. In order to improve the Port of Tanjung Priok's operations, logistics distribution, and ergonomic issues, this study investigates these key factors. We used the Relative Importance Index (RII) method to collect data by administering questionnaires to experts in ergonomics, logistics, and cargo ports. With an RII of 0.96, the study concluded that the port's capacity to manage various kinds of cargo and its operational effectiveness were the most crucial elements. Strategic alliances with logistics and shipping firms had an excellent RII score of 0.87. Managing hazardous materials and safeguarding data have emerged as key concerns in logistics distribution. From an ergonomic perspective, the use of Personal Protective Equipment (PPE) and emergency training were the most important factors contributing to a RII score of 0.85. The research indicates that operational efficiency, technology, safety regulations, and strategic alliances are crucial for improving cargo port performance, but environmental sustainability, albeit significant, is a secondary priority.*

Keywords - *Cargo Port, Ergonomic Workplace, Logistics Distribution, Logistic Performance Index, Relative Importance Index (RII).*

1. Introduction

Logistics systems have become increasingly significant in assessing the impact of globalization and international engagement on a nation's economy. Many governments now see the need for a flexible, effective logistics infrastructure as a major challenge, given how quickly the world is changing. The Logistics Performance Index (LPI) is a comprehensive way to quantify how well a country facilitates trade and keeps things moving. It is used to assess how well a country handles logistics. The amount of money spent on logistics, the efficiency of ports, and the level of competence of the workforce are all significant determinants of the performance of logistics in ASEAN member states. The effectiveness of a nation's logistics is greatly influenced by these interconnected factors. This, in turn, affects the economy's level of regional and global competitiveness. [1]. According to studies, a nation's overall logistics performance is significantly impacted by critical factors such as port infrastructure, expedited customs procedures, and the pace at which commodities travel through the nation. To improve international trade and logistics, these components must be assembled [2]. The World Bank's 2023 report said that Indonesia's logistics competitiveness fell to 61st in the world and 6th among ASEAN countries [3].

The lack of quick and affordable shipping services is a major factor in Indonesia's waning logistical competitiveness, especially in the ASEAN area. The inadequate transportation infrastructure is one of the main causes of this issue, according to studies. As a result, the national logistics distribution system is not as efficient as it ought to be. The infrastructure of the nation, including its highways, rail networks, seaports, and airports, is unable to meet the demands of a corporate environment that is becoming faster and more interconnected. At the regional and international levels, Indonesia's logistics performance is still severely hindered by this lack of infrastructure. [4]. Numerous investigations have revealed that Indonesia's major ports frequently have issues. Tanjung Priok Port is a famous example of this. The fact that its infrastructure is aging and not as good as that of many international ports is one of the primary issues. A further issue is the scarcity of contemporary cargo-handling machinery. Lack of space and a shortage of skilled personnel for paperwork and administrative tasks are further factors contributing to inefficiencies. The entire logistical flow is disrupted by these issues combined, which typically result in prolonged loading and unloading times.

Additionally, the authorities that oversee ports, such as the Indonesia Port Corporation (IPC) and the Customs and Quarantine Authority, frequently lack coordination and synchronization [5, 6]. Tanjung Priok Ports surrounding industrial areas function similarly to a wheel's spokes, assisting in its motion. The port has a great opportunity to develop into a major global hub thanks to this strategic approach. As a result, Indonesia's economy will become more competitive overall. However, numerous studies have revealed that the port's infrastructure is still experiencing issues. The fact that its shipping channel is only 10 to 14 meters deep and occasionally filled with sediment is one of the main issues. Sedimentation issues are exacerbated by the container terminal basins' uneven and frequently shallow depths. The ports' piers range in length from 591 to 1500 meters, which is insufficient for larger mother ships. The insufficient space in warehouses is one infrastructure issue. People now depend more on trucks to load and unload goods and temporarily store them. Due to the lack of suitable storage spaces, many business owners use the port area itself for temporary storage [7].

Tanjung Priok Port requires a port that can manage the flow of goods and provide methods for moving materials in order to improve and speed up operations. Due to ongoing logistical issues, Tanjung Priok Port requires a backup port to facilitate the movement of goods. Creating systems that transport materials more efficiently and quickly is one way to achieve this. Additionally, this project must consider how to meet the distribution needs of various regions. It must ensure that ergonomic concepts are implemented in all linked workplaces and that logistics function effectively. Document processing services require qualified personnel and effective material handling techniques to function effectively at the provincial, inter-island, and international (export/import) levels.

2. Overview of Previous Work

Because it links land and sea transportation, port cargo is a crucial link in the global logistics chain. Effective cargo management requires ports to take into account a variety of factors, including infrastructure rule compliance and cargo types. Correct loading, unloading, and storage management can save time and money in the supply chain. Automation and tracking systems are examples of modern technology that improve productivity and safety. For a port to prosper and develop into a reliable location for shipping, all parties involved must cooperate. Generally speaking, cargo management also considers larger strategies to ensure that the international maritime sector remains sustainable and competitive [8]. No. 26 of 2012 Presidential Regulation, which lays out the strategic framework for the expansion of Indonesia's National Logistics System [9], has made clear the direction and extent that the country's logistics industry should take. To achieve its objective of becoming a sovereign maritime republic, Indonesia is believed to require a functional, integrated National Logistics System to link land and sea areas. Beyond simply facilitating connections, the logistics system does more. By ensuring that development occurs concurrently in various geographical regions and economic sectors, it also aids in the fair and balanced growth of the economy. Additionally, it strengthens the nation's economy and reduces its reliance on foreign nations. The National Logistics System is an essential tool for preserving the Unitary State of the Republic of Indonesia, as well as an economic tool.

One major issue that has harmed the nation's trade balance is the high cost of transportation services. In order to make local goods more competitive, the plan emphasizes that local transportation companies must reduce their prices [10]. Basic logistics services, additional services, and value-added services are the three categories into which logistics center services can be separated, as illustrated in Figure 1.

Infrastructure includes both technical and hardware components (such as buildings and equipment). Warehousing and integrated multimodal services constitute the most significant infrastructure in a logistics center [11]. The J. In his paper, Eley emphasized how ergonomics can improve productivity, health, and safety by matching job requirements with human capabilities [12]. The author examines ergonomic strategies to reduce job-related risks, such as cumulative trauma disorders and back stress, emphasizing the importance of workplace design that fits workers to improve productivity and safety.

A theoretical overview of ergonomic workplaces and Human Factors Engineering (HFE) focusing on their role in designing human-compatible systems was presented in detail by W. Karwowski in his article [13]. The articles introduce an axiomatic approach to ergonomic workplace design and discuss how HFE can optimize system performance and human well-being. Besides that, various studies have identified cargo port factors by adding and considering distribution logistics factors and cognitive ergonomic workplace factors.

The most relevant articles that discussed the cargo port factors were summarized in Table 1. Cargo ports are where most of Indonesia's imports and exports come in and out of the country. These ports should make it easy and quick for goods to move between places in the U.S. and around the world because they play such a vital role.

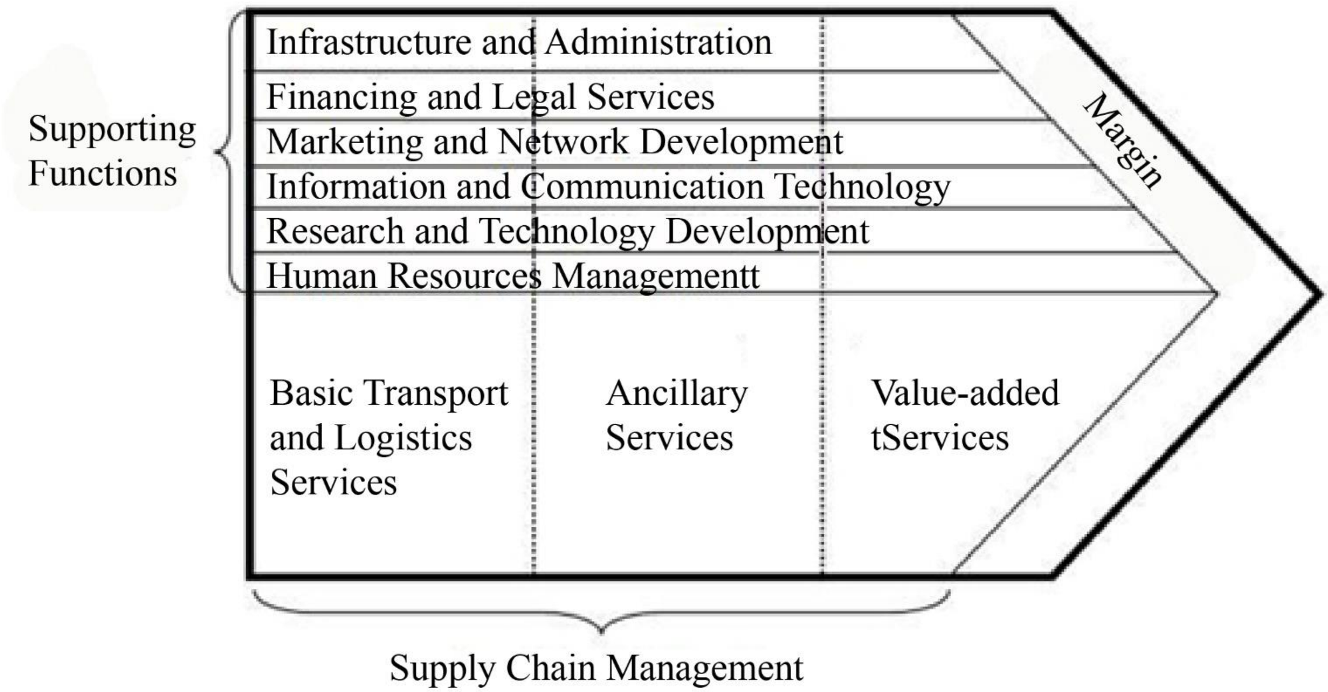

Fig. 1 Logistics center service system

Table 1. Cargo port factors category and the most relevant articles

No	Category	References
1	Cargo Port	[14-19]
2	Logistics Distribution	[20-24]
3	Ergonomic	[25-29]

However, the implementation of these logistical responsibilities still faces several operational challenges that need to be addressed systematically. There are usually two basic frameworks that people worldwide use to manage and evaluate the operations of cargo ports. The first is the Logistics Performance Index (LPI), which is published every five years and compares logistics efficiency. The second one is the National Logistics System (Sislognas) blueprint, developed in 2012 and specific to Indonesia. It is a fundamental framework for planning and enhancing logistics operations across the country.

Tanjung Priok Port, Indonesia's busiest port, located in Jakarta's special capital region, has been found to still need significant improvements based on fundamental theories and earlier research on cargo port operations and logistics distribution in global and Indonesian contexts. The human element is still largely unexplored despite the fact that the current study has looked at many technical and infrastructural aspects. Therefore, it is crucial to have a solid grasp of port-related theoretical frameworks in order to identify the best supporting ports to assist Tanjung Priok in meeting its operational needs. To maximize logistical efficiency, a methodical and organized approach is necessary for locating and evaluating appropriate auxiliary ports. In order to provide a more efficient selection process intended to improve cargo port efficiency, this study used a multidisciplinary methodology that integrated literature on logistics, distribution centers, workplace ergonomics, and cargo port management (Figure 2).

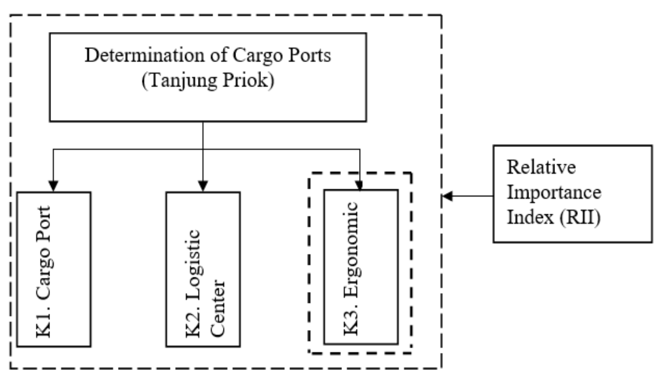

Fig. 2 Determinants of supporting cargo ports in tanjung priok port

From the figure, the decision model being investigated for the determination of supporting cargo ports in Tanjung Priok Port is divided into four main groups, namely;

(K1) Cargo Port Factors
(K1.1, K1.2… through K1.65) Sub-Factors
(K2) Logistics Center Factors

(K2.1, K2.2… through K2.52) Sub-Factors
(K3) Cognitive Ergonomics
(K3.1, K3.2… through K3.23) Sub-Factors

3. Methodology

A variety of data collection techniques, including structured interviews and questionnaire surveys, were primarily used to gather and produce study data. The questionnaires were made to find out what the most important elements are that affect the choice of supporting ports for Tanjung Priok and to see what the most important factors are that affect its cargo port performance. These surveys concentrated on ports situated around the Special Capital Region of Jakarta. The gathered data served various functions: it enabled the identification and examination of pertinent variables grounded in known theoretical frameworks within port operations, logistics distribution, and ergonomic approaches. The insights also helped create a complete evaluation methodology for choosing the right supporting ports. The next part goes into more detail about the research methods used in this study.

3.1. Sample Size

The sample for this study comprises professionals with a minimum of 10 years of experience in their respective industries. As shown in Table 2, the people who answered were put into five groups.

Table 2. Respondence categories

No	Category
R1	Logistic Distribution Industries
R2	Foundation For Maritime High School
R3	Maritime Quality Assurance Agency
R4	Supply Chain Indonesia
R5	Indonesian Ergonomics Association

3.2. Ranking and computation of the Relative Importance Index (RII)

The Indonesian National Logistics System plan, basic theories, past research, and the Logistics Performance Index all work together to make the human perspective a single skill, with its own factors that affect it. They then showed these criteria to a committee of port experts to make sure they were valid and mirrored the real situation at the port. The validation process involved five prominent Indonesian port specialists, each with over ten years of experience in the field.

To fairly evaluate and rank these components, the study used the Relative Importance Index (RII). Construction management project planning and the social sciences are just a few of the industries that use RII, a methodical approach to ranking elements according to their perceived importance. This makes it especially useful in situations where making decisions and establishing priorities are necessary. In order to measure the significance of particular components, the Relative Importance Index (RII) method translates respondents' ratings into numerical values. These assessments are typically gathered using a Likert scale with a range of 1 to 5. Anything with a higher score is more significant or influential. The methodical ranking of elements based on their relative weight or influence is made possible by the calculated RII values.

$$RII = \frac{\sum W}{A \times N} \qquad (1)$$

Where,
W = the weight assigned to each factor by respondents (i.e., rating given by respondents on the Likert scale).
A = the highest possible weight (i.e., the maximum rating on the Likert scale, e.g., 5 if using a 1-5 scale).
N = the total number of respondents.

The following are the steps for the *RII* Method;

1. Collect Data: Distribute a survey or questionnaire to the respondents, where they rate the factors based on their perceived importance (e.g., from 1 to 5, with 5 being "very important").
2. Assign Weights: Based on the respondents' answers, assign weights to each factor. For example, if five respondents rate a factor as 4, 5, 3, 4, and 2, these values will be the weights (W).
3. Calculate *RII*: Determine each factor's index and relative importance based on respondent ratings using the RII formula.
4. Rank Factors: Sort the factors according to their RII scores. The most significant factor is the one with the highest RII, whereas the least significant factor is the one with the lowest RII.

4. Results and Discussion

The responses to questionnaires given to experts in Indonesia's supply chain distribution, logistics, and cargo port operations are displayed in Appendix Tables A1 and A2. The responses from ergonomics specialists who are members of the Indonesian Ergonomics Society are also displayed in Table A3 of the appendix. These tables are meant to show how well the questionnaire items align with the objectives of the study and how useful they are. They also assist in determining how well the study's procedures work, particularly if the analytical techniques selected can produce reliable results.

The results of the cargo port questionnaire using the Relative Importance Index (RII) method indicate that port performance is significantly impacted by a number of significant factors. The ability of a port to handle a variety of cargo types (RII: 0.988889 – Rank 1) is the most important factor. This demonstrates how important it is for ports to adapt to changing times. The handling services quality (RII: 0.981481 – Rank 2), the operations general efficiency (RII: 0.981481 – Rank 3), and the efficient management of vehicle traffic (RII: 0.981481 – Rank 4) come next. These top-ranked metrics show how important it is for a port to be able to rely on and adjust to its services. Other important factors include the availability of sufficient lifting capacities (RII: 0.977778 – Rank 7), the ease of payment methods (RII: 0.977778 – Rank 6), and the clear loading and unloading costs (RII: 0.977778 – Rank 5). The condition of the roads leading to the port (RII: 0.977778 – Rank 8) and the availability of ongoing labor support (RII: 0.977778 – Rank 9) were two other infrastructure-related factors that were extremely important. These two elements are critical to the efficient and timely operation of ports.

Additionally beneficial are technologies that facilitate more efficient operations (RII: 0.951852-rank 29), storage services (RII: 0.974074-rank 10), queuing systems (RII: 0.974074-rank 11), and port security systems (RII: 0. 966667-rank 15). Things like lowering carbon footprints (RII: 0.933333 rank 40) and using less energy (RII: 0.940741 rank 37) are receiving more and more attention as more businesses go green. The port's connections to major logistics networks, particularly highways and rail networks (RII: 0.92963 rank 44), receive a lower score than its international routes (RII: 0.825926 position 63). Because of this, we must create a more equitable and connected world.

When it comes to satisfying user demands, ports that excel in services, operational efficiency, basic infrastructure security, and technology have a significant advantage. However, ports must also focus on environmentally friendly projects that facilitate international trade if they hope to maintain their competitiveness. In contemporary port management, these are becoming more and more crucial. The Relative Importance Index summary for cargo ports is displayed in Figure 3 below. The score for each group is displayed.

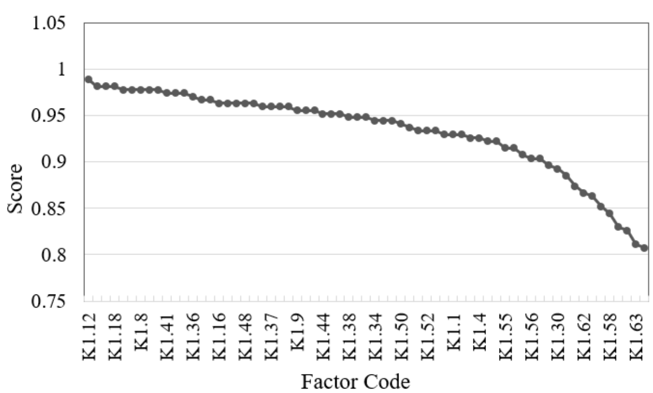

Fig. 3 Relative Importance Index (RII) diagram cargo port

The factors that influence the distribution of goods are ranked by the Relative Importance Index (RII). It demonstrates how important it is to have the appropriate equipment and technology in order to operate efficiently. Combining logistics service providers with information systems is the most important aspect (RII: 0.87037-rank 1). This component ensures that coordination improves and data flows smoothly. The cost of maintaining equipment (RII: 0.86667-2) and the accessibility and caliber of crane equipment (RII: 0.86296-rank 3) are also critical factors. This demonstrates how dependable and well-maintained equipment is necessary to reduce downtime and improve handling efficiency. Technology for tracking and monitoring (RII: 0.86296 position 4) increases transparency and customer satisfaction. Forklift equipment (RII: 0.85926 rank 5) is essential to maintaining the warehouse's efficient operation.

Automation technology and inventory management systems (RII: 0.85926 rank 6) are two helpful factors. RII: 0.85556-rank 7 shows how important automation and digitalization are becoming to improving logistics. Additionally, things like energy prices (RII: 0.85556-rank 8), connections with transportation service providers (RII: 0.85556-rank 9), and timely order delivery (RII: 0.85556-rank 10) demonstrate how crucial it is to maintain low costs and form solid alliances for operations that are consistently on time. The importance of having flexible logistics and customer-focused solutions is demonstrated by the proximity to ports (RII: 0.84444-rank 15) and the ability to customize services (RII: 0.84444-rank 18).

Although they are getting more attention, sustainability factors like energy efficiency (RII: 0.83704-rank 25) and lowering carbon emissions (RII: 0.8- rank 48) are still low on the list of operational goals. The proximity of airports (RII: 0.78889 rank 51), the high costs of land surrounding distribution centers (RII: 0.78148 rank 52), and the high costs of moving goods within a company (RII: 0.79259-rank 50) are all areas that require improvement. In general, you need to strike a balance between cost-effectiveness, new technology satisfying customer needs, and sustainable practices in order to be competitive in logistics distribution. The logistic distributions' Relative Importance Index is summarized in Figure 4 below. Each group's score is displayed.

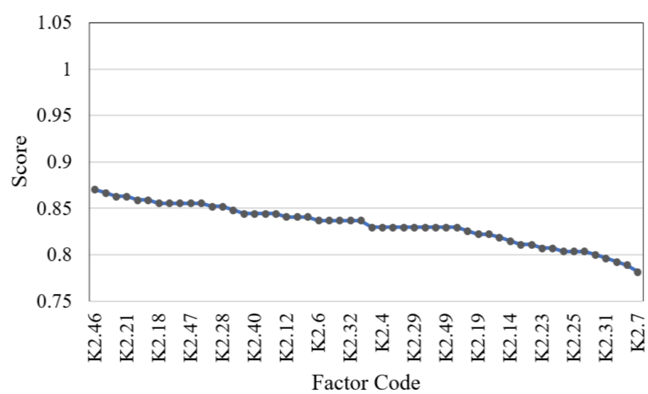

Fig. 4 Relative Importance Index (RII) for logistic distribution

Physical, mental, and environmental factors have a big impact on ergonomic workplace design, which is essential for enhancing worker productivity and well-being. The most crucial traits demonstrating the significance of a healthy workplace and positive relationships with coworkers are good ventilation to ensure air flows well (RII: 0.85926-rank 1) and good communication and connections between coworkers (RII: 0.85926-rank 2). Setting up your workspace properly RII: 0.85556-rank 3 with adequate and evenly distributed light. RII: 0.85556-Rank 4 improves efficiency and lessens physical strain. Safety precautions include making sure that Personal Protective Equipment (PPE) is available. RII: 0.84815, which ranks 5 and includes training for emergencies; Rank 6 and RII: 0.84815 are very important for reducing hazards and ensuring the workplace is safe.

Another crucial thing is dealing with job-related stress and how it affects mental health. RII: 0.83704, rank 7, reducing physical risks; RII: 0.83704-rank 8, and make sure that people with disabilities can utilise it; RII: 0.83704-rank 9. Making instruments that reduce vibrations, RII: 0.83333-rank 10; and using materials that are easy to wear, RII: 0.82593-rank 11, make it even easier to use and more comfortable. RII: 0.81852-ranks 14 to 16-also important for staying focused and productive are cognitive factors, such as making software and hardware interfaces easy to use and minimising mental burden. Noise levels and other environmental elements; RII: 0.81111 - rank 17, supportive sitting and posture alternatives; RII: 0.80741 - rank 18, and opportunities for postural modifications; and RII: 0.8 - rank 20 all help to ease physical discomfort and tiredness. Comfortable temperature settings (RII: 0.7963, rank 21) and ideal humidity levels (RII: 0.79259, rank 22) are not as important, but they are still important for keeping workers comfortable. Maintaining a good standing posture (RII: 0.77407 - rank 23), even though it is the lowest-ranked factor, helps prevent fatigue when standing for a long time.

A comprehensive approach to ergonomic office design that considers these elements in a comprehensive way leads to a healthier, more productive, and more welcoming work environment. The Relative Importance Index in Figure 5 below shows the relative importance of each factor to workplace ergonomics.

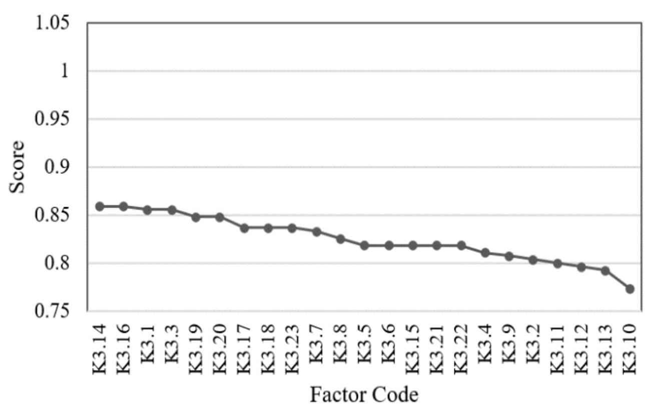

Fig. 5 Relative Importance Index (RII) for ergonomic workplace

The RII values for the factors promoting cargo ports in Tanjung Priok indicate that the Relative Importance Index results fall into two main groups. Scores between 60% and 80% are classified as having a High (H) level of impact and a High (H) chance of happening. Values between 80% and 100%, on the other hand, indicate a Very High (VH) level of impact and a Very High (VH) likelihood of occurrence. Table 6 provides further detail on these categories. It shows the RII scale used in the analysis.

Table 3. Scale used to identify the factor's impact and the probability of occurrence

Scale (%)	Impact	Category Probability of occurrences
>20	Very Low (VL)	Very Low (VL)
20 – 40	Low (L)	Low (L)
40 - 60	Moderate (M)	Moderate (M)
60 – 80	High (H)	High (H)
80 – 100	Very High (VH)	Very High (VH)

5. Conclusion

Cargo port operations, logistics distribution, and cognitive ergonomic workplace are the three primary areas in which the Relative Importance Index (RII) was created to evaluate the efficacy of cargo ports. The findings demonstrate that every one of these factors significantly affects enhancing cargo port performance. When evaluating a port's performance, we must consider all of these interrelated effects. The most crucial aspect of cargo port operations is the port's capacity to manage various kinds of cargo (RII: 0.988889). The quality of handling services, operational effectiveness, vehicle traffic management, loading and unloading expenses, and the simplicity of payment systems come in close second.

These elite metrics show how crucial operational and financial effectiveness are to efficient port management. Strong road infrastructure, efficient queuing systems, efficient waste management, well-planned operations, and strong security systems are a few examples of mid-level factors. These factors highlight how crucial it is to incorporate technology and improve operational efficiency. Conversely, lower-priority factors include environmental concerns and strategic alliances. These include establishing international shipping routes, collaborating with logistics companies, working with other ports, and attempting to reduce carbon emissions. Although people are aware of how crucial these are, they are currently viewed as less significant than pressing operational and financial concerns. Overall, the findings demonstrate that cargo port management is still primarily concerned with improving efficiency, lowering costs, and providing adequate infrastructure. Long-term growth objectives include sustainability and international cooperation. Integrating information systems with logistics service providers (RII: 0.87037) is a top priority in the logistics distribution context. This demonstrates the significance of technology in enhancing logistical procedures. This shows how important it is for technology to improve logistical processes. The cost of maintaining equipment, the availability and quality of cranes and forklifts, and the use of tracking and monitoring technology are all other highly listed criteria.

These all indicate the importance of operational reliability and technological infrastructure. Mid-level elements show how important it is to be able to change to meet new needs, how much energy costs, and how well a business can serve customers, such as by delivering personalised services and processing orders quickly. Spatial factors, such as how close a place is to ports and how easy it is to get to key transit routes, are also quite important. On the other hand, lower-ranked factors include worker availability, training, productivity, reducing carbon impact, and using renewable energy sources. Although these features are still crucial, the need to enhance operations and technology is currently seen as more pressing. The pattern of priorities generally indicates that the primary forces behind logistics distribution are technological integration, efficiency, and flexibility. However, sustainability and the development of human resources are considered long-term strategic objectives.

Lastly, the analysis ranks ergonomic office design elements that affect employees' health and productivity using the Relative Importance Index (RII). Good ventilation systems that keep air flowing and reduce the risk of being near pollutants, as well as how well coworkers get along and communicate, are the best-rated factors (RII: 0.85926). These findings highlight the importance of fostering social interactions and having a healthy physical environment in order to enhance both work productivity and health. The organization's lighting and availability of personal protective equipment (PPE) are all important aspects of ergonomic office design. These factors all show how important physical layout and safety are to improving operations and ensuring public safety. Mid-tier factors include things like work-related stress, the possibility of injury from hazardous situations, accommodating employees with special needs, minimizing tool vibration, and utilizing body-friendly materials.

These items show how important it is to reduce physical and mental fatigue at work. Environmental controls like temperature and humidity control, ergonomic sitting and posture, and noise reduction are less important. These tasks improve people's moods, but they are not as important as safety and productivity concerns. In summary, the findings show that ergonomic efficacy depends on environmental quality, supportive interpersonal relationships, and intentional workspace design. Factors linked to physical comfort and stress reduction remain important but are considered supporting components.

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Appendix 1

Table A1- Cargo Port RII

No	Code	Cargo Port Factors	Cargo Port	
			RII	Rank
1	K1.12	The port's ability to handle various types of cargo	0,988889	1
2	K1.42	Handling services	0,981481	2
3	K1.15	Operational efficiency	0,981481	3
4	K1.18	Vehicle flow management	0,981481	4
5	K1.40	Charges imposed by the port for loading and unloading	0,977778	5
6	K1.45	Ease and options for paying port fees	0,977778	6
7	K1.8	Lifting and operational capacity	0,977778	7
8	K1.20	Quality of road infrastructure leading to the port	0,977778	8
9	K1.14	Availability of 24-hour labor	0,977778	9
10	K1.41	Storage services	0,974074	10
11	K1.17	Includes queuing systems	0,974074	11
12	K1.13	Quality and quantity of labor available at the port	0,974074	12
13	K1.36	Security patrols to protect port areas	0,97037	13
14	K1.46	Includes the possibility of obtaining discounts	0,966667	14
15	K1.33	Security systems implemented at the port	0,966667	15
16	K1.16	Systems used to manage vehicle traffic within the port	0,962963	16
17	K1.21	Road conditions	0,962963	17
18	K1.5	Storage capacity available at the port	0,962963	18
19	K1.48	Systems used for waste management at the port	0,962963	19
20	K1.11	Average time required to load or unload cargo from or to a ship	0,962963	20
21	K1.19	Operational scheduling	0,959259	21
22	K1.37	Procedures and systems used to ensure cargo security while at the port	0,959259	22
23	K1.7	Warehouse security level	0,959259	23
24	K1.35	Access control	0,959259	24
25	K1.9	Speed of cranes used to load and unload cargo	0,955556	25
26	K1.43	Additional costs for document processing	0,955556	26
27	K1.39	Sealing facilities	0,955556	27
28	K1.44	Additional costs for cargo insurance	0,951852	28
29	K1.10	Technology used to improve operational efficiency	0,951852	29
30	K1.49	Includes solid and liquid waste treatment and recycling systems	0,951852	30
31	K1.38	Includes cargo inspection	0,948148	31
32	K1.47	Flexible payment terms	0,948148	32
33	K1.31	Includes real-time cargo tracking	0,948148	33
34	K1.34	CCTV surveillance	0,944444	34
35	K1.23	Distance of the port to toll roads or other major routes	0,944444	35
36	K1.3	Water depth	0,944444	36
37	K1.50	Energy efficiency at the port	0,940741	37
38	K1.51	Includes the use of renewable energy	0,937037	38
39	K1.6	Refrigerated storage facilities	0,933333	39
40	K1.52	Efforts to reduce the port's carbon footprint	0,933333	40
41	K1.22	Level of congestion	0,933333	41
42	K1.53	Impact of port operations on the surrounding environment	0,92963	42
43	K1.1	Physical condition of the dock	0,92963	43
44	K1.24	Port connectivity to rail networks	0,92963	44
45	K1.25	Transportation speed	0,925926	45
46	K1.4	Capacity of the dock to handle various types of ships	0,925926	46
47	K1.29	Availability of navigation aids for ships	0,922222	47
48	K1.54	Includes impacts on marine ecosystems	0,922222	48

49	K1.55	Emission management	0,914815	49
50	K1.32	Automation of operational processes	0,914815	50
51	K1.26	Rail freight capacity	0,907407	51
52	K1.56	Conservation area protection	0,903704	52
53	K1.27	Depth of approach channels to the port	0,903704	53
54	K1.28	Distance to major shipping lanes	0,896296	54
55	K1.30	Technology systems used for cargo management	0,892593	55
56	K1.2	Length of the dock	0,885185	56
57	K1.60	Port relationships with shipping companies	0,874074	57
58	K1.62	Other port operators to ensure efficient and reliable services	0,866667	58
59	K1.65	Availability of direct routes and service frequency	0,862963	59
60	K1.61	Logistics providers	0,851852	60
61	K1.58	Partnerships with other ports	0,844444	61
62	K1.59	Frequency of international services	0,82963	62
63	K1.57	Number and range of international routes available at the port	0,825926	63
64	K1.63	Port access to major markets	0,811111	64
65	K1.64	Includes proximity to major distribution centers	0,807407	65

Table A2 - Logistics Distribution Factors

No	Code	Logistics Distribution Factors	Logistics Distribution	
			RII	Rank
1	K2.46	Integration of information systems with logistics service providers	0,87037	1
2	K2.37	Equipment maintenance costs	0,86667	2
3	K2.15	Availability and quality of crane equipment	0,86296	3
4	K2.21	Tracking and monitoring technology	0,86296	4
5	K2.13	Availability and quality of forklift equipment	0,85926	5
6	K2.20	Systems and processes used to manage inventory	0,85926	6
7	K2.18	Automation technology	0,85556	7
8	K2.36	Costs of energy required for distribution center operations	0,85556	8
9	K2.42	Relationships with transportation service providers	0,85556	9
10	K2.47	Time required to deliver orders to customers	0,85556	10
11	K2.51	Distribution center’s ability to handle requests from customers	0,85556	11
12	K2.10	Warehouse size	0,85185	12
13	K2.28	Access control	0,85185	13
14	K2.26	Ability to adapt operations according to changes in volume or demand	0,84815	14
15	K2.2	Proximity to ports	0,84444	15
16	K2.40	Costs of moving goods out of the distribution center	0,84444	16
17	K2.45	Integration of information systems with customers	0,84444	17
18	K2.52	Ability to customize services to meet specific customer needs	0,84444	18
19	K2.12	Hazardous material storage	0,84074	19
20	K2.27	Security systems such as CCTV	0,84074	20
21	K2.30	Protection of sensitive data through firewalls, encryption, and other technology	0,84074	21
22	K2.6	Distance to customer centers	0,83704	22
23	K2.11	Refrigerated storage	0,83704	23
24	K2.17	Transportation Management System (TMS)	0,83704	24
25	K2.32	Energy efficiency	0,83704	25
26	K2.43	Connectivity and partnerships with key suppliers	0,83704	26
27	K2.1	Proximity to major highways	0,82963	27
28	K2.4	Proximity to rail lines	0,82963	28
29	K2.16	Warehouse Management System (WMS)	0,82963	29
30	K2.22	Labor efficiency	0,82963	30
31	K2.29	Security patrols	0,82963	31

32	K2.34	Waste processing and recycling systems at the distribution center	0,82963	32
33	K2.48	Error rates in order fulfillment	0,82963	33
34	K2.49	Distribution center’s ability to handle inquiries	0,82963	34
35	K2.50	Distribution center’s ability to handle complaints	0,82963	35
36	K2.9	Storage capacity	0,82593	36
37	K2.19	Time required to receive, process, and ship orders	0,82222	37
38	K2.44	Integration of information systems with suppliers	0,82222	38
39	K2.5	Distance to major markets	0,81852	39
40	K2.14	Availability and quality of conveyor equipment	0,81481	40
41	K2.8	Security level in the area surrounding the distribution center	0,81111	41
42	K2.35	Wages and benefits for distribution center workers	0,81111	42
43	K2.23	Availability of labor	0,80741	43
44	K2.41	Relationships with logistics service providers	0,80741	44
45	K2.24	Labor training	0,8037	45
46	K2.25	Labor productivity	0,8037	46
47	K2.38	Facility maintenance costs	0,8037	47
48	K2.33	Carbon footprint reduction	0,8	48
49	K2.31	Use of renewable energy	0,7963	49
50	K2.39	Costs of moving goods within the distribution center	0,79259	50
51	K2.3	Proximity to airports	0,78889	51
52	K2.7	Land costs in the area surrounding the distribution center	0,78148	52

Table A3 - Ergonomic Cognitive Factors

No	Code	Ergonomic Factors	Ergonomic Workplace	
			RII	Rank
1	K3.14	Good ventilation to ensure adequate air circulation and reduce exposure to pollutants	0,85926	1
2	K3.16	Quality of relationships and communication between coworkers affects well-being and productivity	0,85926	2
3	K3.1	Organization of the workspace, spacing between equipment, and ease of access to support work efficiency	0,85556	3
4	K3.3	Intensity and distribution of light to ensure good visibility without causing eye strain	0,85556	4
5	K3.19	Availability and adherence to the use of personal protective equipment (PPE) to prevent injuries	0,84815	5
6	K3.20	Availability of procedures and training to handle emergency situations	0,84815	6
7	K3.17	Factors contributing to job-related stress and its impact on mental health	0,83704	7
8	K3.18	Potential hazards that can cause physical injury during work	0,83704	8
9	K3.23	Availability of features to support users with special needs or limitations	0,83704	9
10	K3.7	Reduction of vibrations in tools used to avoid injury or discomfort	0,83333	10
11	K3.8	Selection of materials and textures that are comfortable to use and do not cause injury	0,82593	11
12	K3.5	Design of tools to minimize the effort and time required for their use	0,81852	12
13	K3.6	Size of tools that fit the user’s hands or body for comfort and efficiency	0,81852	13
14	K3.15	Cognitive load faced by workers while performing certain tasks	0,81852	14
15	K3.21	Ease of use and navigation of software and hardware interfaces	0,81852	15
16	K3.22	System responsiveness to user input	0,81852	16
17	K3.4	Noise levels that can affect worker concentration and comfort	0,81111	17
18	K3.9	Support for the back, arms, and legs while sitting to prevent muscle strain and pain	0,80741	18
19	K3.2	Suitability of desk and chair height with user height to prevent poor posture	0,8037	19
20	K3.11	Opportunities to change posture while working to prevent injuries from prolonged static positions	0,8	20
21	K3.12	Comfortable and appropriate temperature settings for the activities performed	0,7963	21
22	K3.13	Optimal humidity levels for worker comfort and health	0,79259	22
23	K3.10	Workplace design that allows for proper standing posture without causing fatigue	0,77407	23