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POTENTIAL FACTORS IN THE BONDED LOGISTICS CENTER DEVELOPMENT: THE EVIDENCE FROM INDONESIA

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Abstract

Free trade has brought a rapid change which then impacted supply chain activities. Both international and domestic trading sectors heavily rely on logistics and transportation performances. The development of the logistics center as the driving force in business has influenced the operational cost and revenue. Realizing the importance of reducing logistics costs, Indonesia has created a breakthrough by issuing a bonded logistics center policy. The bonded logistics center has emerged as a multifunctional logistic warehouse that positioned imported goods and local productions to be exported. In recent years, the development of the bonded logistics center has been quite difficult to be implemented due to some limitations in defining factors. This study is aimed at evaluating the opportunity of bonded logistics enter development by identifying potential factors and obtaining the final weight value using the fuzzy AHP method. In this research, the main input was filling in the expert questionnaires. The numbers of expert respondents were nine people, sorted by their expertise and their significance in regard to the bonded logistics center. The fuzzy existence was used to obtain the relative weight value of each factor. The result of the study indicated the factors of regulation, accessibility, costs, property, infrastructure, and economic growth influenced the development of bonded logistics center. The findings in this study contributed significantly to both practical and academic aspects of the development of bonded logistics center.

Keywords: supply chain, logistics, bonded logistics center, fuzzy AHP

1. INTRODUCTION

The advancement of globalization has shifted the direction of the business environment. The change in procurement of goods on the global market is one of the main trends in logistics (Eckhardt & Rantala, 2012). The logistics has become anintegral part of the business economic system and global economic activities in the past few years. Logistics performance and transportation services expedite international trading and it holds a pivotal role in accelerating economic growth (Kabak et al., 2020). The development of logistics triggers growth in productivity, social welfare, a nation's success, and competitiveness (McKinnon, 2009; Kabak

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et al., 2020). Achieving a high-level performance in the logistics sector is significant to obtaining profitability, efficiency in the national economy, and the global economy (Brewer, 2001). A competitive global logistics network is the core of international trade. It proves to be an opportunity for a company that operates globally by acquiring more market areas and expanding its procurement network and customers (Eckhardt & Rantala, 2012).

Improving the logistics performance has become the objective of construction policy in recent years because logistics has a huge impact on economic activities (Pupavac & Golubovis, 2015). The advancement in the logistics sector has increased alongside the advancement in the industrial sector and trading. The logistics centers first time appeared in the United States during the industrial revolution. It had been an integral part of this strategy, that the logistics center was established in Europe in the 1960s with various objectives (Fedorenko & Pokrovskaya, 2022). The development of the logistics center has given a lot of purposes and benefits (Çakmak et al., 2021).

The logistics center connected a set of economic activities globally and locally (Zak & Węgliński, 2014), supported an effective and efficient goods movement, consolidated intermodal goods delivery (Erkayman et al., 2011), and increased the additional value of service within logistics chains of value (Pham et al., 2017).Then the activity development of bonded logistics and bonded logistics zone around the world started in 2012 (Fedorenko & Pokrovskaya, 2022). The logistics center grew more important and strategic both upstream and downstream of the supply chain process of many industries (Yavas& Ozkan, 2020). There were plenty of scales used to measure the logistics performance of a nation (Rezaei et al., 2018). The measurement and the logistics performance benchmark in a macro scale used Logistics Performance Index (LPI) issued by the World Bank. LPI gave a benchmark analysis between countries that were rated from the logistics cost, customs procedure, and both land and sea transportation infrastructures (Marti et al., 2014).

The achievement of the ranking component of LPI Indonesia during 2014-2018 was lower than Singapore, Malaysia, and Thailand. One of the components of LPI Indonesia that received the lowest rating was customs. Improvement in the logistics sector and customs had become the priority for Indonesia to accelerate the flow of goods and services. One of the customs facilities given by the Indonesian government regarding logistics distribution flow was bonded logistics center. The essence of bonded logistics center policy was the creation of a domestic warehouse for imported goods, especially raw materials located near the industrial areas. Since it's unveiling in 2016, Indonesia had eight types of bonded logistics centers. Those bonded logistics centers were the bonded logistics center that supports large industry, small and medium-sized enterprises, air cargo hub, e-commerce, finished goods, staple goods, floating storage, and bonded logistics center for commodity goods.

This research was identified from the differences that established the emergence of logistics center. The previous studies indicated that Indonesia might be considered relatively new in implementing the logistics center under the name of bonded logistics center compared to Finland, Turkey, Iran, South-eastern Europe, and China. Despite being relatively new in this affair, the Indonesian government hoped that Indonesia would be a logistics hub in Asia.

Looking at its advantages and benefits, the interest in bonded logistics center kept increasing. This study was aimed at measuring quantitatively the potential factors in the development of bonded logistics center that supports the large industry. Therefore, this study sought to answer the following two research questions:

1) What are the prominent factors in developing the bonded logistics center?
2) How is the order of factors in the development of bonded logistics center quantitatively?

Regarding the first research question, the investigation was held comprehensively according to the literature review and focus group discussion. The Fuzzy Multi-Criteria Decision Making (FMCDM) method, Fuzzy AHP, was used to answer the second research question by presenting the questionnaire to the expert respondents.

2. LITERATURE REVIEW

2.1 Logistics and Supply Chain

The supply chain was a collection of three or more entities or organizations that were directly involved in the product flow activity, service, finance, and information both upstream and downstream from a source to a consumer (Mentzer et al., 2001). The supply chain was the whole organization network, starting from the supplier to its final users. This activity was related to the flow and transformation of goods, information, and money (Handfield& Nichols, 2002). The management of the supply chain had been focusing on organizational network coordination starting from the supplier, manufacturer, and delivering goods to the end customers (Croom et al., 2000). The supply chain management serveda certain strategy to integrate the separated organizations into one cohesive operation system. The general benefits of effective supply chain management were the low level of inventory, high productivity, agility, shorter lead time, bigger profit, and a high level of consumer loyalty (Stevenson& Spring, 2007).

Logistics was the management of the flow of goods, moving from one point of its origin to a point of consumption to fulfill certain demands. The logistics management was a part of supply chain processes whose function was to plan, execute, and control the follow of goods efficiently and effectively, storage of goods, customer service, and the information related to the point of origin to the consumption’s point to fulfill the customer’s demands (Stock & Lambert, 2001). The mission of logistics management was to deliver the goods and services accurately, at the precise location, at the exact time, and at the expected quality that would give a huge contribution to the company (Ballou, 1999).

Logistics activities could be distinguished into key activity and supporting activity. The key activity was an activity that gives a huge contribution to the total cost of logistics. While the supporting activity was an activity that has little contribution towards the total cost of logistics (Ballou, 1999). According to Bowersox (2002), to make a logistic activity run according to its function, there were some supporting components within that logistics system. Those components were:

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1. **The facility of location structure**

   A facility network of a company was the set of locations of 'where to', 'through which materials', and 'which product should be transported'. For planning purposes, these facilities covered factories, warehouses, and retail stores.

2. **Transportation**

   Transportation was a crucial component and it costed a lot in its physical distribution management. The speed of transportation service was the time needed to complete the transport.

3. **Inventory**

   The procurement of materials was held within logistics system for different reasons with the procurement of finished goods. A balanced system would not hold an overflowing inventory. In such a situation, inventory safety needed to be maintained at a minimum level based on transportability.

4. **Communication**

   The speed of information flow was related directly to the integration of facility, transportation, and inventory. The more efficient the logistics system design of a company, the more sensitive it would be to disruptions in the flow of information.

5. **Handling and storage**

   Handling and storage covered the movement, packaging, and containerization. When integrated effectively into the logistics operation of a company, handling and storage could reduce the problems related to the promptness and convenience in transporting the goods.

2.2 Logistics Center

Plenty of terms were given to illustrate the logistics center, such as logistics hubs, distribution centers, logistics parks, freight villages, logistics nodes, inland and intermodal terminals (Tsamboulas & Kapros, 2003; Rimiené & Grundey, 2007; Notteboom & Rodrigue, 2009). The bonded logistics was a system to manage the flow of cross-border trade through customs and tax regulations, the swiftness of exchange of export and import of goods, and transit (Fedorenko & Pokrovskaya, 2022). The logistics center was an intermodal terminal, which was the main component from the intermodal transportation chains and the node where goods were delivered from one mode to another (Erkayman et al., 2011). The definition of logistics center (Rimiené & Grundey, 2007) was a specific intermodal hub within a transportation system, including various logistics facilities, in which the operator separately provided a number of services that were connected to transportation, logistics, and distribution within the geographic coverage.

The logistics center was split into two categories (Meidutė, 2005). The first category was that the logistics center as part of transportation infrastructure. The logistics center was a focus

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point for the material flows within the logistics chain. The logistics center provided access to various modes of delivery, carried a broad logistics function, served various users, provided a solution for information technology, and offered added value services. The second category described the logistics center as a stimulus to generate business. The logistics center acted as a booster for the development of business and the economy. The service provided by the logistics center referred to size, main function, and operational coverage. The logistics center stored much wider and more distinctive products at numerous points within the supply chain, while the distribution center stored the finished goods on their way to the end customer (Rimiené & Grundey, 2007).

According to the Regulation of the Minister of Finance of the Republic of Indonesia Number 28/PMK.04/2018, the bonded logistics center was a place of bonded storage to store goods from outside of the customs area and the goods from other places within the customs area, and it could be accompanied by one or more simple activities within a certain timeframe to be reissued. The organizer of the bonded logistics center was a legal entity that conducts an activity that was related to providing and managing a certain area for the bonded logistics center's business.

3. METHOD

This research used a rationalistic approach, derived from a theory and empirical truth. In the scope of research, the bonded logistics center was the expansion of the function of the bonded warehouse, which was the customs area and it was fully under the supervision of the Directorate General of Customs and Excise. The methodology used in this research was the expert respondent's assessment to obtain the quantitative data. The weight value of factors, which influenced dependence and interdependence as a potential factor in the development of the bonded logistics center, used fuzzy AHP.

In this research, the sample collection technique used the judgement sampling technique because the Fuzzy AHP method required dependency on the group of experts based on their types of specifications. The first step in this study was identifying model elements of the bonded logistics center development. A literature review was conducted to outline the theory and previous studies about logistics center. Then, the result of the literature review would be offered in a focus group discussion involving academics, businessmen, and government members.

The second step was to build a model and obtain the end weight from the normalizing weight vector by using the Fuzzy AHP method. Figure 1 showed the flow chart of this study. The Fuzzy AHP method was used to fix the weakness of AHP method, which main input was from an expert's opinion or perception that tended to be vague. In the real world, the process of decision-making should involve quantitative and qualitative aspects. However, the qualitative aspect was imbued with uncertainty and inconsistency when it came to accuracy (Wang & Chen, 2008; Zhang& Chu, 2009).To solve the aforementioned problems, fuzzy logic was given to untangle the uncertainty and inaccuracy (Naghadehi et al., 2009).

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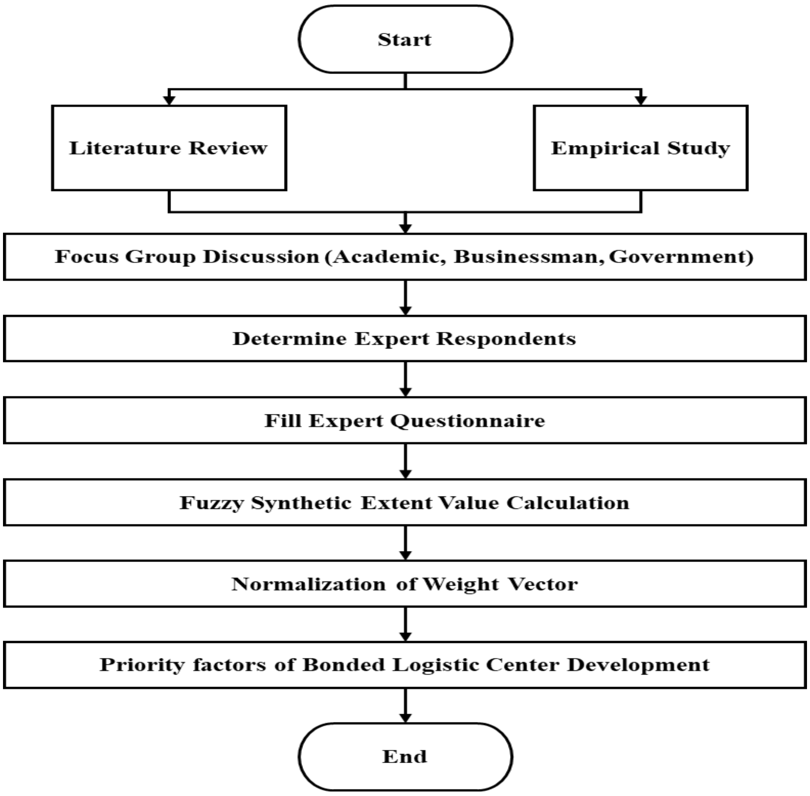

Figure1: Research Methodology Flow Chart

This study used FAHP development, which was conducted by Chang (Chang, 1996), to acquire the quantitative value of each factor. The following were the steps in processing TFN (Triangular Fuzzy Numbering) weighting data with FAHP:

1) **Designing a hierarchical model of the problem and comparing among factors with the TFN scale.**

$$M_1 \oplus M_2 = (l_1 + l_2, m_1 + m_2, u_2 + u_2) \quad (1)$$

$$M_1 \ominus M_2 = (l_1 - l_2, m_1 - m_2, u_2 - u_2) \quad (2)$$

$$M_1 \otimes M_2 = (l_1 . l_2, m_2 . m_2, u_2 . u_2) \quad (3)$$

$$\frac{M_1}{M_2} = \left(\frac{l_1}{l_2}, \frac{m_1}{m_2}, \frac{u_1}{u_2}\right) \quad (4)$$

2) **Calculating fuzzy synthesis value (S_i)**

The fuzzy synthesis value was used to obtain the expansion of certain objects, which resulted in extent analysis M that could be shown as $M_{gi}^1, M_{gi}^2, M_{gi}^3, \ldots, M_{gi}^m$, $i =$

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$1,2,3,\ldots,n$ where M_{gi}^{j} with $j=(1,2,3,\ldots,m)$ were the triangular fuzzy numbers. The followings were the method to calculate extent analysis using equation (5).

$$S_i = \sum_{j=1}^{m} M_{gi}^{j} \otimes \left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]^{-1} \qquad (5)$$

To obtain the M_{gi}^{j} value, a summation of fuzzy extent value of M analysis was done by adding on each TFN value within each matrix row. This could be shown by the following equation (6):

$$\sum_{j=1}^{m} M_{gi}^{j} = \left(\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j\right) \qquad (6)$$

To obtain the value $\left[\left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]^{-1}\right]$, a summation was employed for the entire number of TFN M_{gi}^{j} with $j=(1,2,3,\ldots,m)$.

$$\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j} = \left(\sum_{i=1}^{n}\sum_{j=1}^{m} l_i, \sum_{i=1}^{n}\sum_{j=1}^{m} m_i, \sum_{i=1}^{n}\sum_{j=1}^{m} u_i\right) \qquad (7)$$

As a result, an inverse calculation from equation (8) was obtained by using:

$$\left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]^{-1} = \left(\frac{1}{\sum_{j=1}^{m} u_i}, \frac{1}{\sum_{j=1}^{m} m_i}, \frac{1}{\sum_{j=1}^{m} l_i}\right) \qquad (8)$$

3) Calculating the vector value (V) and the ordinate value defuzzification (d').

The process was conducted by comparing two numbers of TFN $M_1=(l_1,m_1,u_1)$ and $M_2=(l_2,m_2,u_2)$ by probability level of $M_2 \geq M_1$ which could be defined as:

$$V(M_2 \geq M_1) = \sup\left[\min\left(\mu_{M_1}(x), \mu_{M_2}(y)\right)\right] \qquad (9)$$

Below was the equation to determine the probability to obtain a fuzzy convection number:

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$$V(M_2 \geq M_1) = \begin{cases} 1 \\ 0 \\ \dfrac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} \end{cases} \quad (10)$$

To obtain better fuzzy convection of M compared to the numbers of k fuzzy convection $M_i = (1,2, \ldots k)$, the study used maximum and minimum operations as follow:

$V(M \geq M_1, M_2, \ldots, M_k) = V(M \geq M_1)$

and (11)

$(M \geq M_2), \ldots, (M \geq M_k) = \min\big(V(M \geq M_1)\big), i = 1,2,3, \ldots, k$

If $\text{the} d'(A_i) = \min\big(V(S_i \geq S_k)\big) \text{for} k = 1,2, \ldots, n; k \neq i \text{then}$, the weight vector was defined as:

$W' = (d(A_1), d(A_2), \ldots, d(A_n))^T$ (12)

4) **Normalizing the fuzzy vector weight value (W).**

4. RESULTS AND DISCUSSION

The formulation of the factors for the development of the bonded logistics center was obtained through an intensive literature review, which was then offered, and it became a stimulus for focus group discussion (FGD) participants. In this research, the implementation of triple helix FGD (academics, businessmen, and government members) was aimed at collecting opinions. The criteria of experts in this interview and brainstorming were the ones who had knowledge, experience, and expertise in giving out the interpretation about the bonded logistics center, and their experience should be more than ten years. The data collection was conducted in 2021.

According to the focus group discussion (two academics, four businessmen, and two government members), there were 24 factors found. Table 1 showed the result of the formulation of potential factors in the development of the bonded logistics center.The accessibility factor was the one that related to the ease of reaching the logistics center warehouse through the transportation network system. The cost factor was the expenditure in implementing the bonded logistics, which was divided into the capital industry and operating expenditure. The property factor showed the condition of land and building along with the ownership. The regulation factor was the set of rules accompanied by a mechanism to monitor the compliance with the regulations of the bonded logistics center implementation.

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Table1: Factors of the bonded logistics center development

Symbol	Factors
F1	**Accessibilities**
SC1	Proximity to Toll Roads
SC2	Proximity to Ports
SC3	Proximity to Highways
SC4	Proximity to Customers
F2	**Costs**
SC5	Land and Buildings
SC6	Transportation
SC7	Storage
SC8	Human Labour
F3	**Property**
SC9	Land Size
SC10	Layout
SC11	Ownership
F4	**Regulation**
SC12	Bonded Stockpile
SC13	Space Utilization
F5	**Infrastructure**
SC14	Road
SC15	Communication Technology
SC16	Electricity
F6	**Economic Growth**
SC17	Processing Industry
SC18	Transportation of Goods

The infrastructure factor was required as a fundamental facility for the operational activity of the bonded logistics. Then, the economic growth factor indicated the percentage growth of gross regional domestic product over time.

4.1 Weighting by Using the Triangular Fuzzy Number

In this research, eight respondents filled the expert questionnaire. A consistency ratio of $\leq 10\%$ was obtained after using a software expert choice, which meant that the comparative matrix was considered to be consistent.

Then, the data processing had been conducted by calculating the average from the changes in triangular fuzzy numbers for the accessibility, cost, property, regulation, infrastructure, and economic growth. The average value of the triangular fuzzy number based on the expert respondents could be seen in Table 2.

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Table2: The average results of triangular fuzzy number

		F1	F2	F3	F4	F5	F6
F1	**l**	1.00	1.29	1.29	0.68	2.14	1.57
	m	1.00	2.14	3.00	1.01	3.86	3.57
	u	1.00	4.14	5.00	0.77	5.86	5.57
F2	**l**	0.25	1.00	1.17	0.16	2.03	1.74
	m	0.70	1.00	2.05	0.25	4.14	3.19
	u	0.90	1.00	3.86	0.60	6.41	5.00
F3	**l**	0.21	0.35	1.00	0.15	0.77	1.00
	m	0.41	0.98	1.00	0.22	1.95	1.86
	u	0.90	1.48	1.00	0.54	3.57	3.86
F4	**l**	2.50	2.43	3.29	1.00	3.29	3.29
	m	4.05	4.43	5.29	1.00	5.29	5.29
	u	5.57	6.43	7.29	1.00	7.29	7.29
F5	**l**	0.18	0.18	0.46	0.15	1.00	0.66
	m	0.35	0.28	1.29	0.22	1.00	1.28
	u	0.62	0.71	2.14	0.49	1.00	2.71
F6	**l**	0.18	0.30	0.26	0.15	0.57	1.00
	m	0.30	0.75	0.71	0.22	1.67	1.00
	u	0.81	1.29	1.00	0.54	2.71	1.00

The fuzzy numbers were displayed in the form of three numbers: l, m, and u. Those parameters represented the smallest possible value, the promising value, and the largest value representing the fuzzy problem. Furthermore, the calculation of fuzzy synthetic extent (S_i) was carried out by determining the fuzzy synthesis value. Table 3 showed the component values of the fuzzy extent equation.

Table3: Component value of the fuzzy extent equation

	L	m	u	l	m	u	l	m	u
F1	7.96	14.58	22.34	38.67	66.74	101.09	0.01	0.01	0.03
F2	6.35	11.33	17.50						
F3	3.48	6.42	11.35						
F4	15.79	25.33	34.86						
F5	2.62	4.42	7.68						
F6	2.47	4.65	7.35						

After fuzzification of the AHP scale to the TFN scale, the next step was to calculate the fuzzy synthesis value towards the TFN comparative value. The fuzzy synthesis value of S_i was used to obtain the expansion of an object so that the analysis of the extent value could be obtained.

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The result of fuzzy synthesis on each factor was shown in Table 4.

Table 4: Fuzzy synthesis value (Si)

	S_i		
	l	m	u
F1	0.08	0.22 0.58	
F2	0.06	0.17	0.47
F3	0.03	0.10	0.39
F4	0.15	0.38	0.91
F5	0.03	0.07	0.20
F6	0.02	0.07	0.20

After obtaining the fuzzy synthetic extent, the next step was to determine the degree of probability between the fuzzy synthetic extent values ($M_2 > M_1$). It was followed by comparing the synthetic extent value and the minimum value. The results of the minimum value could be seen in Table 5.

Table5: The comparison of synthetic extent value and the minimum value

	S1	**S2**	**S3**	**S4**	**S5**	**S6**
S1		0.88	0.64	1.00	0.44	0.43
S2	1.00		0.76	1.00	0.57	0.56
S3	1.00	1.00		1.00	0.85	0.85
S4	0.72	0.59	0.33		0.16	0.10
S5	1.00	1.00	1.00	1.00		1.00
S6	1.00	1.00	1.00	1.00	0.98	
Min	0.72	0.59	0.33	1.00	0.16	0.10

Based on Table 5, the next step taken would be calculating the weight vector from the minimum value. Determining the normalized value of the vector weight by using the equation (12), in which each vector weight element was divided by the cumulative value of the total weight of the vector itself. Overall, the number of vector weights from the normalized result was 1. The result of the weight vector calculation was then normalized, and it resulted in each weight factor that was displayed in Table 6.

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Table6: The normalized results of vector weights

	F1	F2	F3	F4	F5	F6
W	0.72	0.59	0.33	1.00	0.16	0.10
W'	0.25	0.20	0.11	0.35	0.06	0.03

Based on Table 6, the regulation (F4) had the biggest score from the normalized vector weight. It was followed by the accessibility factor (F1), which obtained smaller normalized results compared to regulation (F4). The cost factor (F2) placed third. While the normalization result of factor property (F3) was under the cost factor (F2) value. The normalized result for infrastructure (F5) was placed fifth, under the factor property (F3). The economic growth factor (F6) acquired the smallest value of normalized results of the weight vector.

4.2 Model elements

Some potential factors as the model element should be fulfilled to conduct an evaluation towards the bonded logistics center development which supported large industry. The factors obtained to answer the empirical matters and to support the present theories in accommodating the problems found in the bonded logistics center development which supported large industry.

- **F1. Accessibility Factor**

SC 1 The proximity to toll roads. The shortest distance and travel time from the toll road that connected to the bonded logistics center warehouse.

SC 2 The proximity to ports. The shortest distance and travel time from the ports to the bonded logistics center.

SC 3 The proximity to highways. The shortest distance and travel time from the highways to the bonded logistics center.

SC 4 The proximity to customers. The shortest distance and travel time from the bonded logistics center to the industrial center location.

- **F2. Cost Factor**

SC 5 Land and building. The expenditure to purchase or to rent the land that would become the bonded logistics center warehouse.

SC 6 Transportation. The cost of goods movement both imported and exported, including the cost of moving goods from the port to the bonded logistics center (import), the costs from the bonded logistics center to the manufacturing industry, the costs of goods movement from the bonded logistics center to the port (export).

SC 7 Storage. The costs of holding inventory for a certain period. These costs were related to the physical possession of goods in the storage.

SC 8 Human Labor. The costs provided for services using human labor who worked in the bonded logistics center, including the costs of providing certification to employees.

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- **F3. Property Factor**

SC 9 Land size. The standards applied to the land size. The land should have at least 10.000 m^2 in the expanse.

SC 10 Layout and clear bounds. Physically, it had a layout/ site plan as well as boundary signs according to the stipulation.

SC11 Ownership. The proof of ownership or control or lease of a place should be proven by a notarial act.

- **F4. Regulation Factor**

SC12 Bounded stockpile. Rules that must be fulfilled as a customs area were in the forms of buildings, places, or areas that met certain requirements used to store goods for certain purposes through obtaining a suspension of import duties.

SC13 Utilization of space. The rules that must be met related to the provincial spatial planning in the regional design for optimizing the development of the industrial area.

- **F5. Infrastructure Factor**

SC 14 Road infrastructure. Land transportation infrastructure that could be traversed by a cargo container from its point of origin to the bonded logistics center.

SC15 Communication technology infrastructure. The underlying structure of an excellent communication network was to support long-distance communication with the stakeholders of the bonded logistics center.

SC 16 Electricity infrastructure. The availability of electricity in sufficient amount of quantity and quality.

- **F6. Economic Growth Factor**

SC 17 Processing industry sector. The contribution of the manufacturing sector to the gross regional domestic product.

SC 18 Goods transportation sector. The contribution of the goods transportation sector to the gross regional domestic product.

The result of the calculation of the weight vector and normalization obtained the final weight value of each factor could be seen in Table 7 below.

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Table7: The results of the weighting of each factor

Symbol	Weight vector (W)	Final weight (W')
SC1	0.59	0.22
SC2	0.67	0.25
SC3	0.43	0.16
SC4	1.00	0.37
SC5	0.93	0.35
SC6	1.00	0.37
SC7	0.33	0.12
SC8	0.41	0.15
SC9	1.00	0.39
SC10	0.80	0.31
SC11	0.79	0.31
SC12	1.00	0.46
SC13	0.79	0.36
SC14	1.00	0.42
SC15	0.91	0.38
SC16	0.46	0.19
SC17	1.00	0.65
SC18	0.53	0.35

According to Table 7, the weighting value of the accessibility factor, which was the proximity to the customer (SC4) obtained the final weight value of 0.37. The raw materials for industrial purposes were not solely obtained domestically but they could be obtained from abroad with many eases. The proximity to customer factor was related to the distance and the shortest travel time from the toll roads, ports, and industries leading to the location of the bonded logistics center. The acceleration of the flow of goods is a significant success factor in global logistics operations (Çakmak et al., 2021), creating opportunities to expand the network of potential suppliers at the lowest cost (Assist et al, 2014). The proximity to customers could accelerate the flow of distributions of raw materials to be then utilized by manufacturing industries. The transportation cost factor (SC6) was the factor that influenced the logistics costs reduction. The development of the logistics centerencouraged innovation and lowered transportation costs that focused on intermodal operations (Kayikci, 2010).

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4.3 Final Weight Value

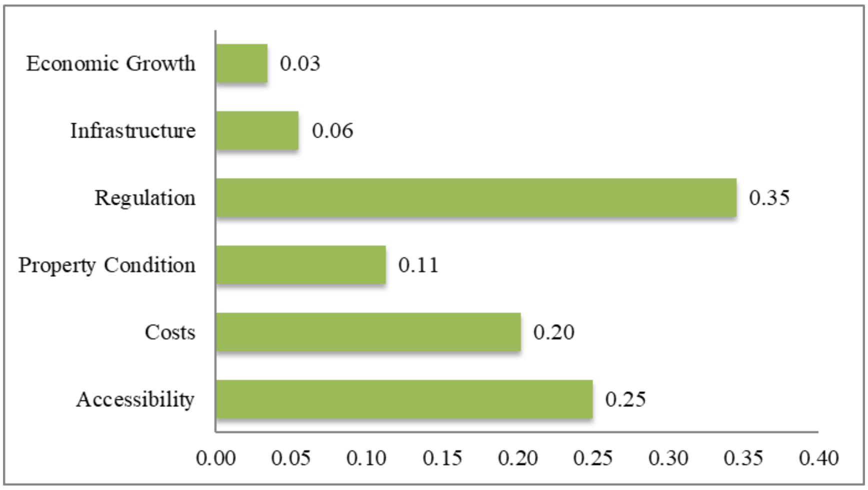

Figure2: Final weight value

The potential factors should be fulfilled to evaluate the development of the bonded logistics center that supported large industries. Factors of regulation, accessibility, costs, property, infrastructure, and economic growth were the potential factors that impacted the development of the bonded logistics center for emerging countries like Indonesia. Figure 2 showed the final weight value of the development factors of the bonded logistics center.

The regulation factor had the biggest weight with a value of 0.35. The regulation of the bonded storage and zoning regulation became the main factors that gained attention in the bonded logistics center development. The bonded logistics center was a multifunction warehouse that was equipped with fiscal and procedural facilities. Empirically, the bonded logistics center was an area used to store imported goods and the goods that wereobtained domestically. Therefore, the implementation and the development of the bonded logistics center required coordination from every institution. The coordination was aimed at the delay of import duties, incoming, and outgoing goods.

The accessibility factor had an impact on the delivery to the customers. The supplier was upstream of logistics while the users were downstream of it. Therefore, accelerating the supply to users and fulfilling the orders were expected to be punctual. The accessibility factors had a weight value of 0.25. Furthermore, the cost factor placed third,and this factor influenced the bonded logistics center development with a final value of 0.20. The property factor placed fourth with the weight value of 0.11. The fifth and sixth positions were the infrastructure factor with a weight value of 0.06 and the economic growth factor with a weight value of 0.03.

5. CONCLUSION AND FUTURE WORK

In this study, we present the opportunity forthe logistics center to grow, as an important node in the supply chain. An excellent logistics performance is important to increase the added value of services and to improve the efficiency of the operational cost of the transportation system. The approach using the Fuzzy AHP methodology was used to obtain the quantitative score on the potential factors of the bonded logistics center development that supported large industries. The results obtained based on the final weight value showed that the sequences of potential factors were regulation, accessibility, costs, property, infrastructure, and economic growth. Conceptually, the result of this study contributed to the improvement of the bonded logistics center management. Empirically, it could develop a policy establishing the bonded logistics center near the industrial area. This study, for the academics, might add to their knowledge insight on the bonded logistics center, which in turn, could spawn new studies by adding novelties to the use of smart technology for a logistics center in the future.

This research does not have a complete hierarchical structure. Future research might add options for the locations that would be turned into the bonded logistics center warehouse. The development of the bonded logistics center should consider social factors related to the responsibility to society. Therefore, future research could involve more stakeholders which then tested on the area, and there should be a larger perspective to be used.

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