Current status of sustainability of Belawan Port toward SDG program

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Abstract. Belawan Port is one of the main ports in Indonesia whose role and function are important in the national logistics system. Belawan Port is a gateway for the Province of North Sumatra. The port must have sustainability in carrying out its role and function as transportation and economic infrastructure. In this research, Belawan Port sustainability will be evaluated from several aspects or dimensions, namely ecology, economy, social culture, technology, and institutions and law. Belawan port sustainability analysis using the Multidimensional Scaling method, using the modified Rapfish program. The analysis is carried out on five dimensions and 49 attributes/factors, which are used as a reference in the SDGs program. Not every SDG will be relevant for every business, however, every SDG should be considered. SDGs no.4 and no.5 are not directly related to port management activities, while SDGs no.8,9,11,14,17 are directly related. From the analysis obtained Ecology sustainability index = 48.38 (less-sustainable), Economic sustainability index = 42.89 (Less-Sustainable), Socio-Cultural sustainability index = 52.47 (Fair-Sustainable), Technological sustainability index = 54.11 (Fair-Sustainable), Institutional and Legal sustainability index = 50.74 (Fair-Sustainable). With policy and program interventions, the sustainability of the existing Belawan Port in the short term can be improved to be fair-sustainable for all dimensions (ecology, economy, social & culture, Technology, Institution & Law) evaluated.

1. Introduction
Indonesia is an archipelagic country where the port performance stands as a compulsory parameter to ensure not only the national logistic chain distribution but also the sustainability of its millennium development goal achievement effort as indicated by the roadmap SDGs Indonesia. Belawan Port is one of the most strategic ports in Indonesia located in the North Sumatera Coastal area of Medan City. This location is geographically very strategic, as it is closed to the Malacca Strait international shipping lane. Belawan Port is the gateway not only for the economy of North Sumatra but also for the west part of the Indonesia Area as defined by the Indonesia Government in 2011. Belawan Port has under jurisdiction and management of PT PELINDO I.

With its role and function as the gateway to the economy of the North Sumatra region, Belawan Port must be ready to anticipate the demands of operation needs in the form of facilities and equipment to improve the smooth port services. The port must have sustainability in carrying out its role and function as transportation and economic infrastructure.
The issue of sustainability is now a global issue, which is the concern of the United Nations. United Nations has launched the SDGs in September 2015 as a global agenda for sustainable development, 193 member countries have agreed on 17 goals for global change towards 2030. All activities are expected to refer to SDGs in Figure 1, including port business activities. As a hub for activities and centers of key economic activities, the port sector in the world has an important role to play in contributing to the global agenda of the SDGs. Based on the above problem, this study was prepared to find out the sustainability of Belawan Port in supporting the SDG program.

Figure 1. Sustainable Development Goal (United Nation)

In this research, Belawan Port sustainability will be evaluated from several aspects or dimensions, namely ecology, social, economy, technology, and institution and law. Belawan port sustainability analysis based on the Multidimensional Scaling method and the modified Rapfish program. The analysis was carried out on five dimensions and 49 attributes, which were used as a reference in preparing the SDGs program.

### 2. Materials and Method

#### 2.1. Description of study area

The location of Belawan Port is geographically very strategic as it is located not only approximately 27 km from the Centre of Medan City, the provincial capital of North Sumatera but also located on the coastal line of the international shipping lanes of Malacca Strait (see Figure 2). This location has the best access to the main shipping lanes toward the other bigger National and International harbor likewise Singapore Port, Penang Port, Tanjung Priok Port, Shanghai Port, etc.

The Belawan Port, as the largest port in Sumatera, is situated at approximate location Latitude 030 47’ N and Longitude 980 42’ E on a low-lying peninsula bounded by the Belawan and Deli Rivers. The surrounding country is flat and typical of the eastern coastal region of Sumatera. Belawan presently consists of the port together with mainly residential areas and some industrial developments on the south bank of the Belawan River. It is connected to Medan by a dual 2-lane Toll Road, a single line rail track, and a road. The terminal of Belawan Port consists of Conventional Terminals and Container Terminals. Conventional Terminals serve passengers, vehicles, Dry Bulk, Liquid Bulk, and Breakbulk. The Container Terminal serves Domestic and International Containers.
2.2. Data collection and analysis

Secondary and Primary data were used in the analysis. The secondary data likewise for data carriers, passenger, social-economic condition, environmental condition, etc., were collected from the related stakeholder. Primary data was collected based on-site visit work during the study. Belawan Port sustainability analysis is carried out using the Multidimensional Scaling (MDS) method, using a modified Rapfish program. MDS analysis is carried out on 5 dimensions/aspects of sustainability, namely: the ecological dimension, the economic dimension, the social & cultural dimension, the technological dimension, and the legal & institutional dimension.

The sustainability index calculation uses the Rapfish (Rapid Appraisal for Fisheries) software developed by the Rapfish Group Fisheries Center University of British Columbia, Canada[1]. This MDS method was chosen because it can provide comprehensive, fast, and objective results related to aspects affecting port sustainability. This MDS method has been widely used to identify the level of sustainability of natural resource management. Sustainability status is stated in the Sustainability index values developed by Columbia University, Canada [2] are illustrated in Table 1.

| Index       | Category        |
|-------------|-----------------|
| 0.00-25.00  | Not sustainable |
| 25.01-50.00 | Less sustainable|
| 50.01-75.00 | Fair sustainable|
| 75.01-100.00| Sustainable     |

Procedures carried out in the MDS method as shown in Figure 2, namely the determination of dimensions and attributes through expert discussion, ordinal scoring in the range of 0 (bad) to 3 (good) by the characteristics of attributes by selected respondents or based on data obtained (both primary and secondary). The next step is to carry out the MDS ordinance on the leverage factor dimension of the attribute based on the Root Mean Square (RMS) on the X-axis. The final stage is to conduct a Monte Carlo analysis to determine the effect of the error in scoring. Collecting research data was carried out on selected respondents from Belawan Port stakeholders.
3. Results and Discussion

Based on the assessment of attributes by selected respondents from Belawan Port stakeholders and an analysis of secondary data collected, the results of the MDS analysis with the modified Rapfish are illustrated in table 2, table 3 and table 4. The kite diagram of the Belawan Port sustainability index is illustrated in Figure 3.

Table 2. The result of a sustainability index

| Dimension   | Sustainability Index | Remark          |
|-------------|----------------------|-----------------|
| Ecology     | 48.38                | Less Sustainable|
| Economy     | 42.89                | Less Sustainable|
| Social & Culture | 52.47          | Fair Sustainable|
| Technology  | 54.11                | Fair Sustainable|
| Institution & Law | 50.74            | Fair Sustainable|

Table 3. MDS analysis result and Monte Carlo analysis

| Dimension       | MDS     | Monte Carlo | Difference | RMS    | Stress |
|-----------------|---------|-------------|------------|--------|--------|
| Ecology         | 48.38   | 49.03       | 0.65       | 0.9515 | 0.1417 |
| Economy         | 42.89   | 42.34       | 0.55       | 0.9449 | 0.1538 |
| Social & Culture| 52.47   | 52.34       | 0.13       | 0.9477 | 0.1491 |
| Technology      | 54.11   | 53.48       | 0.63       | 0.9505 | 0.1384 |
| Institution & Law | 50.74  | 51.68       | 0.94       | 0.9452 | 0.1501 |

From the results of the MDS Analysis, the ecological and economic sustainability index is less sustainable, while the socio-cultural, technological, and institution and law sustainability index status are fair sustainable. To enable each port business to positively contribute to ‘Agenda 2030’, a detailed analysis of the SDGs against key business drivers and objectives needs to occur.

Not every SDG will be relevant for every business, however, every SDG should be considered. Considering sustainability at the Port against SDGs, we must pay attention to the map of the SDG program's as shown in figure 1 linkages to the Port's management activities both directly or indirectly related, so that the achievement of sustainability can be achieved effectively. SDGs no.4 and no.5 are not directly related to port management activities, while SDGs no.8,9,11,14,17 are directly related.
Table 4. Leverage sensitive attributes to sustainability

| Dimension       | Attributes                                           |
|-----------------|------------------------------------------------------|
| Ecology         | - Availability land for development                  |
|                 | - River quality and pollution                        |
|                 | - Green belt area                                    |
| Economy         | - Corporate income contribution                      |
|                 | - The potential hinterland of the constellation      |
|                 | of Sumatera                                          |
| Social & Culture| - The role of community in the environment management|
|                 | - Unemployment level                                  |
| Technology      | - The productivity of general cargo                  |
|                 | - Implementation of Management Information System    |
| Institution & Law| - Legal education & counseling                      |
|                 | - Law enforcement in the environment                 |

Figure 4. Belawan Port sustainability diagram (existing)

To move towards SDGs implementation, the status of sustainability should be in a fairly sustainable position, so that in the short term there needs to be an intervention in policies and programs on aspects related to sensitive leverage attributes. The intervention of policies and programs that are internal (directly related to port) can increase the port sustainability index, especially for ecological and economic dimensions. An overview of the Belawan Port sustainability index after policy and program interventions is illustrated in Table 5 and Figure 5.

Table 5. Sustainability Index by Intervention

| Dimension       | Sustainability Index |
|-----------------|----------------------|
|                 | Existing | Intervention |
| Ecology         | 48.38    | 53.30        |
| Economy         | 42.89    | 51.26        |
| Social & Culture| 52.47    | 52.61        |
| Technology      | 54.11    | 57.08        |
| Institution & Law| 50.74   | 54.56        |
4. Conclusions

The current status of the sustainability development progress of Belawan Port was presented based on secondary and primary data analysis. The results provide an illustration that shows the arisen complexity of several issues regarding the sustainability parameter of Belawan Port. The results of the analysis of the sustainability of existing conditions (2019), ecological and economic sustainability indexes are less sustainable, while the socio-cultural, technological, institutional, and legal sustainability indexes are fair sustainable. To achieve the basis for SDGs implementation, the sustainability index status of all dimensions must be sufficiently sustainable. With intervention policies and programs that are internal and external, the port can achieve a fairly sustainable sustainability index. To implement SDG effectively, the port must synergize and collaborate with all stakeholders, because of the broad scope of SDGs. Several SDGs activities are direct and indirect to port activities.

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References

[1] T. J. Pitcher and D. Preikshot, “RAPFISH: A rapid appraisal technique to evaluate the sustainability status of fisheries,” *Fish. Res.*, vol. 49, no. 3, pp. 255–270, 2001.

[2] A. S. Fauzi A, *Pemodelan Sumberdaya Perikanan dan Kelautan Untuk Analisis Kebijakan*. Jakarta: PT Gramedia Pustaka Utama, 2005.

[3] M. Jansen, R. Van Tulder, R. Afrianto, M. Jansen, and R. Van Tulder, “Exploring the conditions for inclusive port development: the case of Indonesia case of Indonesia,” *Marit. Policy Manag.*, vol. 00, no. 00, pp. 1–20, 2018.

[4] P. Kavanagh and T. J. Pitcher, “Implementing Microsoft Excel Software For,” *Fish. Cent. Res. Reports*, vol. 12, no. 2, p. 75pp, 2004.

[5] Kholil, T. A. Dharoko, and A. Widyatini, “Pendekatan multi dimensional scaling untuk evaluasi keberlanjutan waduk Cirata - Propinsi Jawa Barat,” *J. Mns. dan Lingkung.*, vol. 22, no. 1, pp. 22–31, 2015.

[6] I. Kotowska, “Policies Applied by Seaport Authorities to Create Sustainable Development in Port Cities,” *Transp. Res. Procedia*, vol. 16, no. March, pp. 236–243, 2016.

[7] E. T. Lawer and J. Herbeck, “Selective Adoption: How Port Authorities in Europe and West...
Africa Engage with the Globalizing ‘Green Port’ Idea,” 2019.

[8] P. T. W. Lee, O. K. Kwon, and X. Ruan, “Sustainability challenges in maritime transport and logistics industry and its way ahead,” *Sustain.*, vol. 11, no. 5, pp. 1–9, 2019.

[9] N. Özispa and G. Arabelen, “Sustainability issues in ports: content analysis and review of the literature (1987–2017),” *SHS Web Conf.*, vol. 58, p. 01022, 2018.

[10] PIANC, “*Sustainable Ports* A Guide For Port Authorities.” Bruxelles Belgique: PIANC Secretariat General, 2014.

[11] S. Roh, V. V. Thai, and Y. D. Wong, “Towards Sustainable ASEAN Port Development: Challenges and Opportunities for Vietnamese Ports,” *Asian J. Shipp. Logist.*, vol. 32, no. 2, pp. 107–118, 2016.

[12] C. A. Schipper, “Understanding the Sustainable Development Goal Approach for Port of The Future,” no. September 2019.

[13] Syamsul Alam Ali, “Rapfish Analysis to Assess the Status of the Sustainability of Capture Fishery System in Bone Bay,” *J. Sci. Res.*, 2015.

[14] X. Wang, “A conceptual model for oil port sustainability policy research: A case of Chinese ports.”

[15] I. F. Widiatmaka, Santun RP Sitorus, “Appraisal keberlanjutan multidimensi penggunaan lahan untuk sawah di karawang -jawa barat,” no. August, 2015.

[16] P. PELINDO I, *Sustainability Report 2017*. 2017.