

Readiness index values of locations designated for the development of seaweed warehouse system in Java

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Abstract. Apart from a number of aspects that still need refining, the warehouse receipt system practiced by seaweed players in South Sulawesi has brought positive impacts to the seaweed commodity trade in the region. Through the issuance of transferable certified proofs of ownership called warehouse receipts, this system provides a number of promising features necessary to promote the development of seaweed industry. These features are the guarantees of seaweed availability, quality and price. Contrary to conditions in South Sulawesi where the quality of seaweed is good and the price is relatively high, seaweed from Java is of poor quality and the price is low. This justified research carried out in 2019, aiming at assessing the opportunity of adopting the same system in Java. Following a multi-dimensional methodological approach, the research assessed the readiness index of the three main potential receipt warehouse locations in the region: Brebes, Serang and Sumenep. The index included six dimensions, each of which consisted of 7 to 13 attributes. The dimensions were: (i) raw materials, (ii) technology, (iii) economy, (iv) infrastructure, (v) socio-cultural, (vi) institutional. The assessment results showed that all three seaweed production centres had an average readiness index classified as 'sufficient', with Sumenep having the highest mean index value. To improve Sumenep's readiness index, the dimensions requiring the most attention were Infrastructure and Institutional; the top leverage attributes were: infrastructure for international delivery, cultivation area, institutional handling of environmental impacts, and cross-sectoral cooperation.

Key Words: Indonesia, multidimensional scaling, readiness index, seaweed, warehouse receipt system.

Introduction. Indonesia contributed almost 38% (11.3 million tonnes) of cultured seaweed in 2015, making this country the second largest producer in the world. The main Indonesian cultured seaweed commodities are *Eucaema* spp., *Kappaphycus* spp. and *Gracilaria* spp. (FAO 2018). Given this background, Indonesia has the opportunity to play a leading role in the world seaweed market (Neish et al 2017). In terms of production volume, seaweed is the top commodity in the country's fisheries sector with the contribution of 70.47% of total fisheries commodities (Fadli et al 2017). However, the data show that the performance of Indonesia in the international seaweed trade is disappointing in terms of value, and Indonesia is ranked below countries with smaller production volumes. One of the major causes of this situation is the plethora of problems associated with poor domestic trade practices. Existing practices have failed to provide fair prices to farmers, and hence to secure the financial capacity needed by seaweed farmers to produce quality products (Nugroho 2015).

Two common problems faced by farmers are obtaining finance for farming and the falling commodity prices during the harvest season. Farmers have difficulties in accessing capital assistance from banks because they lack collateral which is a general requirement for taking out loans (Elias 2016). Almost 90% of the financial capital of seaweed farmers

comes from their own private resources (Ningsih et al 2016). The Indonesian Government implemented the Warehouse Receipt System (WRS) to facilitate farmers in overcoming these problems. The WRS principle is a strategy to enable farmers to delay selling by providing them with temporary storage for their commodities in the warehouse so that they can sell their produce at the right time to get the best possible price (Anugrah et al 2015).

Previous research (BBRPPBKP 2017) has shown that, while Indonesian seaweed products are generally low quality, some products from South Sulawesi had better quality compared to other seaweed centres, in particular compared to production centres in Java. This research reported that the relatively high quality of South Sulawesi seaweed was partly due to the implementation of the WRS. WRS is a system which comprises activities related to the issuance, transfer, guarantee and settlement of warehouse receipt transactions (BAPPEBTI 2014). Implementation of a WRS program can be expected to help farmers to solve the gap between the costs of farming and the low prices which can be expected during the harvest season (Khasanah et al 2017).

The warehouse receipt concept has been implemented in several developing countries including India, Zambia, and Ghana. Warehouse receipts can be transferred or traded by the warehouse receipt holder to third parties so as to create a more efficient trading system by eliminating the cost component of transferring goods. This creates logistical and distribution efficiency. Another benefit of warehouse receipts is that they can make fiscal contributions through the warehouse receipt transactions that occur (BAPPEBTI 2014). In general, WRS features include quality assurance, standardized warehousing facilities, and fostering the enterprise of receipt holding farmers. WRS provides potential benefits in terms of improving product quality, increasing farmer's income, stabilizing price fluctuations and enabling financial support (Ashari 2011). According to Khasanah et al (2017), WRS receipts have the potential to become collateral credit-enabling documents to obtain farming budget finance through the WRS member program. However, the cooperation can confront various challenges in areas such as the economic empowerment of communities through WRS, the use of warehouse empowerment receipts as an alternative finance system, and integration with other finance instruments and agricultural marketing. These issues make it clear that the effective implementation of the warehouse receipts system requires coordination among stakeholders, in particular the central and regional government agencies involved, the farmers, and financial institutions.

Summing up the above, it can be concluded that three facts provide strong justification for the implementation of WRS schemes in Java. These are: (i) continued production of low quality seaweed in Java; (ii) positive outcomes shown by the WRS practices in South Sulawesi; and (iii) the potentially advantageous features offered by the WRS. Through such schemes, it can be expected that a number of WRS-based operational arrangements could be made available for seaweed farmers that would promote good quality seaweed products and fair prices for farmers. Such arrangements could include the provision of credit to farmers with inventory (e.g. goods stored in warehouses) as collateral and enable the delay of seaweed sales while waiting for good market prices. By storing the seaweed in an WRS, the farmers would receive a document of proof of ownership of stored goods that could also be used as collateral for credit from banks, non-bank financial institutions, or investors through warehouse receipt derivatives. Therefore, the objectives of this research were twofold. They were: (i) identification of the readiness index values of potential locations for the development of warehouses operating such receipt systems; and (ii) identification of leverage factors to increase the readiness index values of these locations.

Material and Method

Description of the study sites. This study was conducted from March to September, 2019 at three prospective sites for the development of WRS in Java, Indonesia: Serang, Brebes and Sumenep. Sumenep was selected to represent the most prominent eucheumatoid seaweed production centre in Java (Fatmawati & Wahyudi 2015). Brebes

was chosen to represent the most prominent *Gracilaria* production centre in Java (Ningsih et al 2016) and Serang was chosen to represent one of the most prominent eucaumatoid and *Gracilaria* production centres in Java. Serang is the largest producer of seaweed in Banten Province. The seaweed production volume in 2011 was 16,887 tonnes, comprised of *Gracilaria* (around 71%) and *Eucauma* (29%) (KKP 2013). Serang is two hours to the west of Jakarta and Brebes is 7 hours to the east of Jakarta by land transport, while Sumenep is two hours to the east of Jakarta by air. In addition to their roles as production centres, the three locations also function as trading hubs for seaweed commodities and products (BBRPPBK 2017). Figure 1 shows the geographical locations of the study sites.

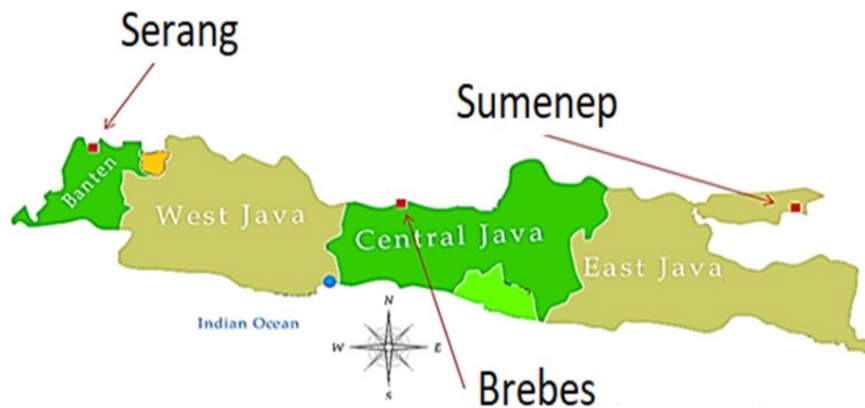


Figure 1. The study sites in Java Island, Indonesia: Serang, Brebes, and Sumenep.

Multidimensional analysis using the RAPFISH methodology. The method applied in this research was Multi Dimensional Scaling following the Rapfish methodology (Pitcher & Preikshot 2001). Figure 2 shows a graphical representation of the adopted analytical framework with 6 (six) dimensions to be evaluated: (A) raw material, (B) technology, (C) economy, (D) infrastructure, (E) institutional, and (F) Social.

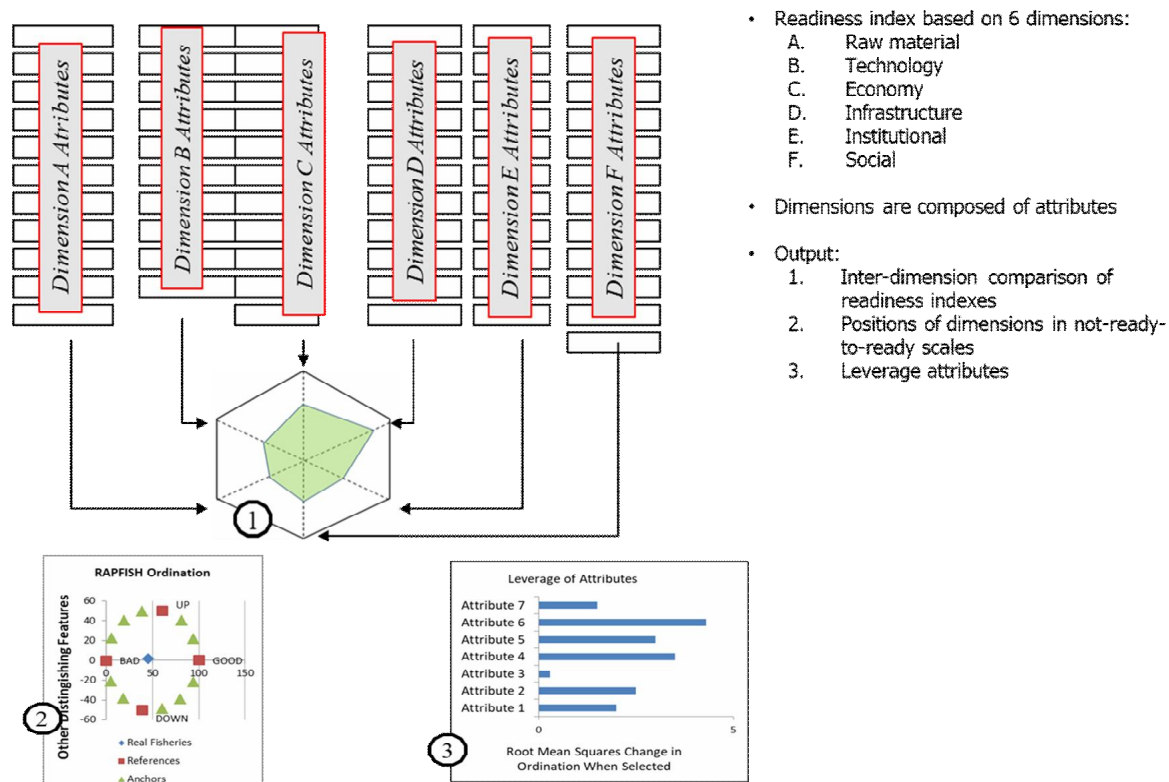


Figure 2. Framework of multidimensional scaling following the Rapfish technique.

Each of these dimensions comprised several attributes. Expert respondent interviews were used to produce scores for these attributes, which were input into the Rapfish software to produce the ordination values of each dimension. Rapfish ordinations, which show index values for each dimension, can be plotted to form a multi-dimensional index kite or spider diagram like the example marked (1) in Figure 2. In addition to ordinations, the analysis also produced information regarding leverage factors for each dimension, where small interventions on such factors will significantly change the level of the index for the dimension in question.

Referring to this methodological approach, the potential of each site for the development of warehouse receipt systems was analysed and mapped based on a number of dimensional criteria. Data for this analysis were collected through a review of related documents and questionnaire-guided interviews with expert resource persons in each location.

Respondents. For each of the three study sites, expert respondents were selected. The selection was based on consultation with fisheries officers. The main criterion for selection of these respondents was the knowledge of the respondent regarding the items addressed through the questionnaires. Whenever considered possible, one respondent in each study site could be sufficient as long as the knowledge criterion would be met. However, in this research more than one respondent was interviewed at each site, in case each selected respondent was not able to answer all the questions set out in the questionnaire.

Based on this approach, data collection in Brebes, focusing on *Gracilaria* sp., was carried out through interviews with five respondents. These were: one fisheries extension worker who was also a seaweed collector (middleman/trader), one academician who was both a farmer and a collector, one pioneering cultivator (farmer), one aquaculture official from the local government, and one aquaculture extension worker. Data collection in Sumenep, focusing on eucaumatoid seaweeds (genera *Eucauma* and *Kappaphycus*), was carried out through interviews with eight respondents: four collectors, an institution and the Entrepreneurial Protection Division official of the District Fisheries Service, an aquaculture official from the local government, the head of the District Fisheries Service, and an extension worker. Meanwhile, in Serang, data collection covered both eucaumatoid seaweeds and *Gracilaria* sp., and was carried out through interviews with seven respondents: three academicians, three extension workers, and one district fisheries officer responsible for aquaculture development.

Results. The multidimensional analysis carried out using data from the three study sites resulted in readiness index values for the 6 dimensions (Table 1). All three sites had some dimensions in the Poor category (≤ 55). Only eight index values were equal to or greater than 60.

Table 1

Readiness indexes of three prospective SRG sites, by dimension

Dimension	Location		
	Serang	Brebes	Sumenep
Raw material	59.7	56.6	56.9
Technology	47.7	54.9	59.0
Economy	54.4	55.9	56.4
Social	54.1	51.0	64.3
Infrastructure	45.8	45.4	52.2
Institutional	48.7	60.2	48.7
Combined index	51.7	54.0	56.3

Classification: ≤ 55 = poor; 55-75 = sufficient; ≥ 75 = good.

The results show that there is a need for substantial improvements to be made before any of the sites will be ready for the development and implementation of the seaweed

warehouse receipt system. Although all three sites had similar combined index scores, the Sumenep site had the highest readiness index, and was the only site in the sufficient category. The kite diagram (Figure 3) shows that, with the exception of the institutional dimension, Sumenep had higher dimensional index values compared to Serang and Brebes.

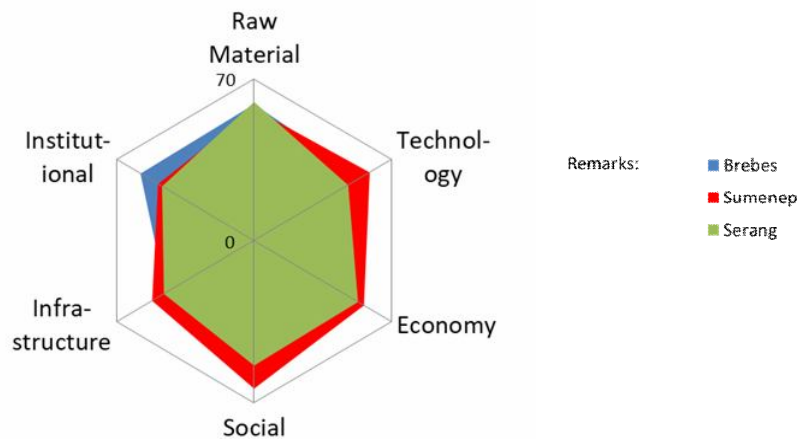


Figure 3. Rappfish multi-dimensional scaling framework for the three study sites.

Given this result, Sumenep was considered for further analysis. This involved a further exploration of the data to identify which dimensional attributes could be considered as leverage attributes for each dimension.

Raw material dimension. Figure 4 shows the Rappfish results of ordination and leverage analysis for Raw Material Dimension. The ordination value of 56.9 categorizes the WRS readiness of Sumenep as sufficient with respect to raw materials. Within this dimension, three attributes were identified as leverage attributes: (i) price fluctuation, (ii) supply chain complication, and (iii) quality fluctuation.

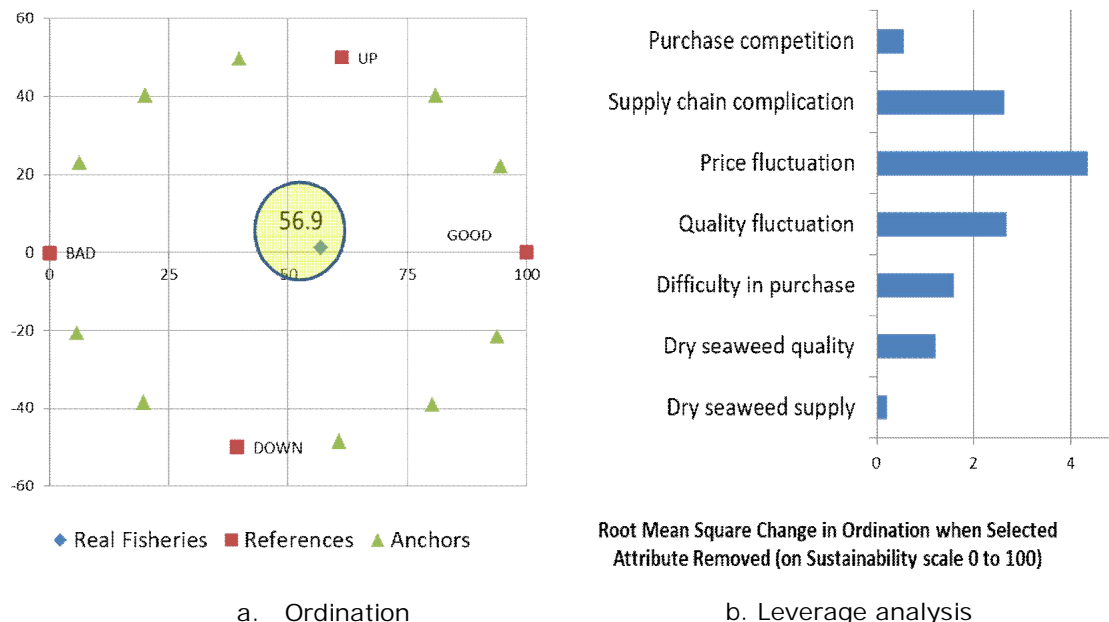
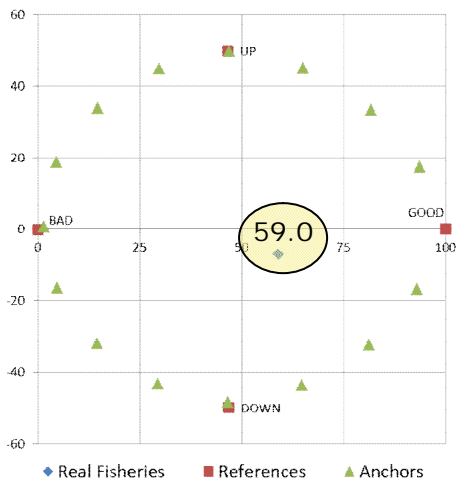


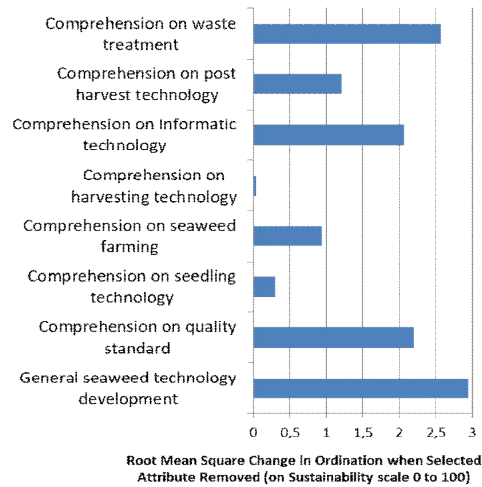
Figure 4. Rappfish ordination and leverage analysis: Raw Material Dimension.

Technology dimension. Figure 5 shows the Rappfish ordination and leverage analysis for the Technology Dimension. The ordination value of 59.0 categorizes the technological readiness of Sumenep for a WRS as sufficient. Four leverage attributes were identified:

(i) general seaweed development technology; (ii) comprehension on waste treatment; (iii) comprehension on quality standard; (iv) comprehension on information technology.



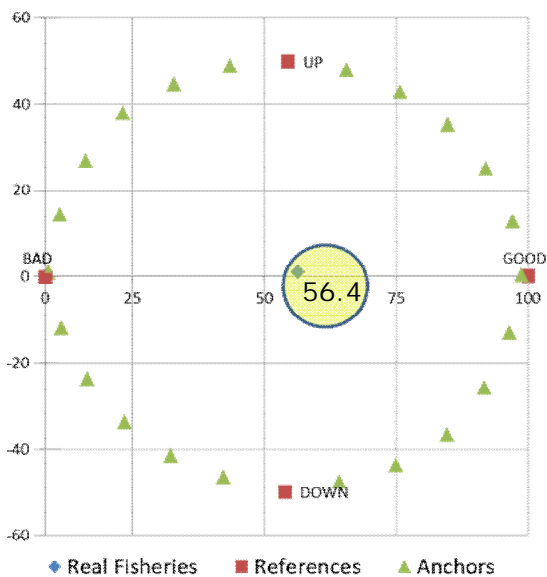
a. Ordination



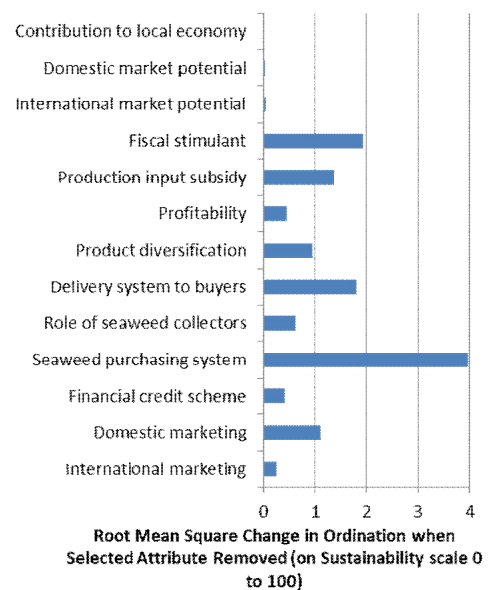
b. Leverage analysis

Figure 5. Rappfish ordination and leverage analysis: Technology Dimension.

Economy dimension. Figure 6 shows the Rappfish ordination and leverage analysis for the Economy Dimension. The ordination of this dimension at 56.4 is within the sufficient category. Within the economy dimension, the only leverage attribute identified was the seaweed purchasing system.



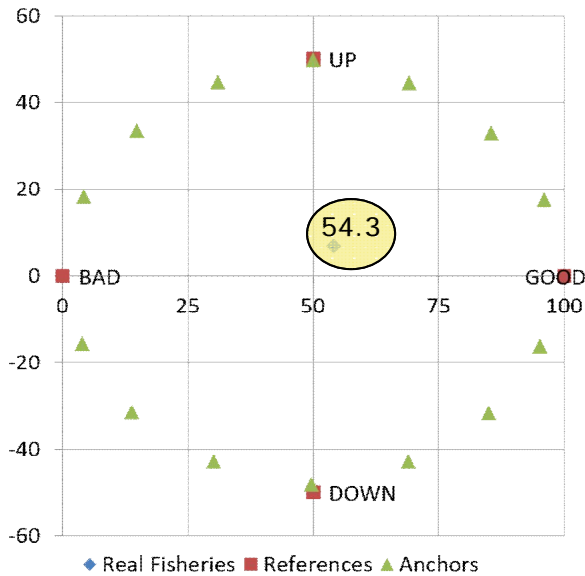
a. Ordination



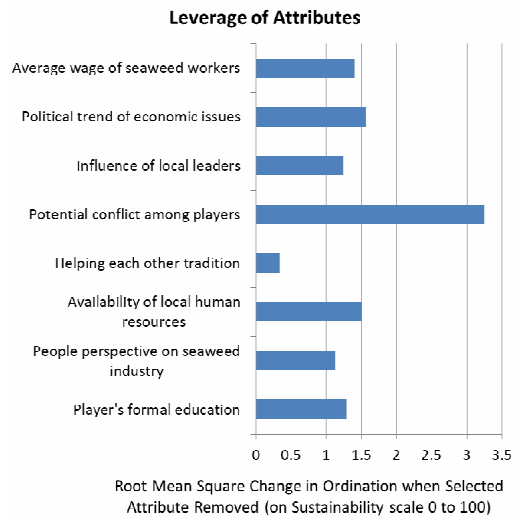
b. Leverage analysis

Figure 6. Rappfish ordination and leverage analysis: Economy Dimension.

Social dimension. Figure 7 shows the Rappfish ordination and leverage analysis for the Social Dimension. The ordination of this dimension was 64.3, in the sufficient category. Within this dimension, two leverage attributes were identified: (i) political trends in economic issues and (ii) people's perspectives on the seaweed industry.



a. Ordination



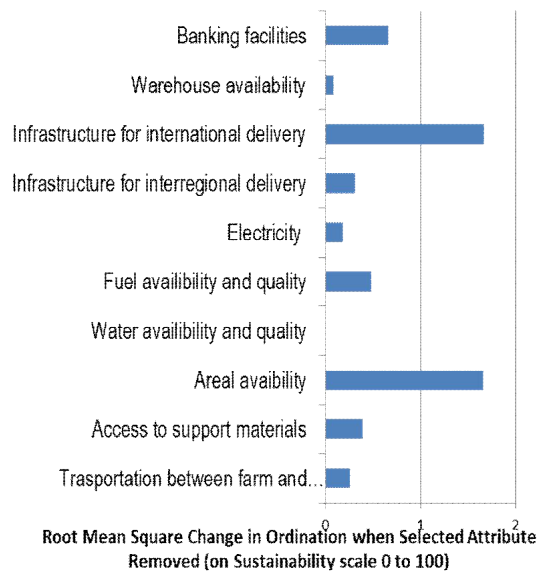
b. Leverage analysis

Figure 7. Rapfish ordination and leverage analysis: Social Dimension.

Infrastructure dimension. Figure 8 shows the Rapfish ordination and leverage analysis for the Infrastructure Dimension. The ordination of 48.8, in the Poor category, indicates that Sumenep is poorly prepared for a WRS in terms of infrastructure. Within this dimension, two leverage attributes were identified: (i) infrastructure for international delivery and (ii) farming area availability.



a. Ordination



b. Leverage analysis

Figure 8. Rapfish ordination and leverage analysis: Infrastructure Dimension.

Institutional dimension. Figure 9 shows the Rapfish ordination and leverage analysis for the Social Dimension. The ordination of this dimension at 48.7 is in the Poor category, indicating that the institutional readiness of Sumenep is low. Within this dimension, two

leverage attributes were identified: (i) institutional arrangement for environmental impact handling and (ii) inter-sectoral cooperation.

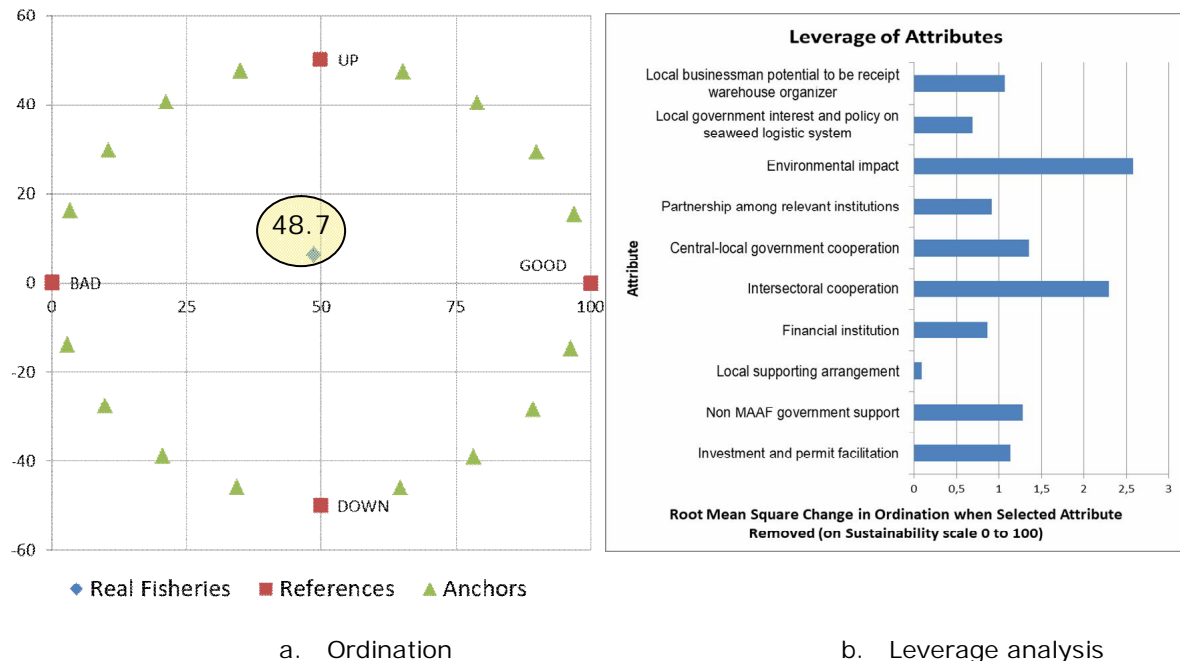


Figure 9. Rapfish ordination and leverage analysis: Institutional Dimension.

Discussion. Even though Sumenep has higher readiness index values in all but one dimension when compared to the two other sites, several aspects require immediate improvements. As seen from the Rapfish ordination analyses (Figure 4a to 9a), two dimensions had index values in the Poor category: Infrastructure (score 48.8) and Institutional (score 48.7). These results seem to match with the observation of Gunawan et al (2019) that a lack of facilities was among the main problems for WRS implementation in Indonesia. The findings presented in our paper are also consistent with research by Ashari (2011) which found that weak farmer institutions and lack of support from the banking sector were two of the constraints impeding WRS implementation. Therefore, conducive government policies are important to support the implementation of the WRS.

Further investigation through discussions with resource persons revealed that the poor performance of these two dimensions could be linked to facts found in the field, as a number of attributes were found to be unconducive and hence were scored low. Among the institutional dimension attributes, the following scored poorly: (i) local businessmen with the potential to be WRS organizers; (ii) non-MMAF government participation; (iii) institutional arrangements to handle environmental impacts; (iv) inter-sectoral cooperation; and (v) investment and permit facilitation. Meanwhile, the infrastructure dimension attributes in poor condition included: (i) electricity; (ii) infrastructure for international shipping; and (iii) farming area availability.

Among the low scoring attributes, the leverage analyses (Figures 4b to 9b) indicate that some are sensitive, meaning that small interventions on these attributes can improve the index of the corresponding dimension. These attributes were infrastructure for international shipping and farming area availability in the infrastructure dimension and institutional arrangement to handle environmental impacts and inter-sectoral cooperation in the institutional dimension.

Conclusions. There are several conclusions that can be drawn from this study. (1) None of the three proposed seaweed production centres in Java had a high overall mean readiness index. (2) Among the three locations, Sumenep had the highest overall index, and was the only site with a 'sufficient' overall mean readiness index. (3) If Sumenep is

chosen as a seaweed receipt warehouse location, the infrastructure and institutional dimensions require particular attentions. (4) The leverage attributes identified for these two dimensions were: (a) infrastructure for international shipping; (b) farming area availability; (c) institutional arrangements to handle environmental impacts; and (d) inter-sectoral cooperation.

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