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PROSPECTIVE ANALYSIS OF THE KEY ACTORS AND SUPPORTING INSTITUTIONS ROLE IN THE CRAB AGRO-INDUSTRY IN REMBANG DISTRICT, CENTRAL JAVA

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Abstract

Rajungan (Portunus pelagicus) contributes over 50% of Indonesia's exports. Since 2016, Indonesia has begun conducting studies to monitor, evaluate, and report on its commitment to using the concept of Sustainable Development Goals (SDGs). The Government of Indonesia, through the Decree of KP RI No. 83/Kep Men-KP/ 2022, has established the Indonesian Fisheries Management Plan for Rajungan in the Indonesian Fisheries Management Area (WPP) 712 (Java Sea), including Rembang Regency in Central Java. With the existing problems in sustainable crab management, research is needed to analyze the perspective of key actors and supporting institutions in the crab agro-industry in the Rembang Regency. The method of analysis was carried out by collecting structured data questionnaires submitted to key actors and supporting institutions involved in the crab agro-industry in Rembang District on objects that support sustainable crab management. An in-depth review of the questionnaire results was collected, then data processing was done using the MACTOR application. The results describe the goal object that activates many actors as SDGs 14: life below water, where actors give their entire opinion on the goal object. There is a strong connection between the four goals, namely SDGs 1: No poverty, SDGs 12: Responsible consumption and production, SDGs 14: Life below water, and SDGs 17: Partnership and goals in the crab agro-industry in Rembang Regency. The success of sustainable management of the crab agro-industry in Rembang Regency is determined by the cooperation between crab fishermen, collectors, Miniplants, Fish Processing Units (UPI) that export crab, the Central Java Provincial Marine and Fisheries Service and the Rembang Regency Marine and Fisheries Service.

Keywords*: Crab; Sustainability; Rembang; Stakeholder; Agro-industry; MACTOR*

Introduction

The Ministry of Maritime Affairs and Fisheries (KKP) wants to boost marine and fisheries commodity exports to US$7.6 billion by 2023. Several major countries, namely the United States (US), China, and Japan, are the leading destinations for Indonesia's fisheries exports.

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Commodities supporting Indonesia's capture fisheries exports include tuna, cuttlefish, crab, and octopus, while aquaculture, such as shrimp, crab, and seaweed [1]. Crab (Portunus pelagicus) contributes more than 50% of Indonesia's exports to export destination countries such as the United States, Singapore, Malaysia, Taiwan, the European Union, China and Japan. According to the data from the Central Bureau of Statistics in 2020, the export volume of crabs and crabs in January-February 2020 was 4,462 tonnes (USD 70,065 thousand), which increased at the same time in 2019, namely 6.81% (USD 65,599 thousand) [2]. But crab exports have decreased in quantity with the Covid-19 pandemic since March 2020.

Indonesia began conducting studies to monitor, evaluate, and report on Indonesia's commitment to the use of the Sustainable Development Goals (SDGs) concept through the Central Bureau of Statistics (BPS), the Ministry of National Planning and Development (Kemen PPN), and in collaboration with other relevant agencies since 2016. The SDGs contain 17 indicators and 169 goals that must be achieved and become national development priorities by 2030, thus requiring collaborative planning policies at the national, provincial, and district/city levels. Indicators in the SDGs are grouped into four pillars: the Social Development Pillar, the Economic Development Pillar, the Environmental Development Pillar, and the Legal and Governance Development Pillar [3].

The link between the marine and fisheries sector and the SDGs is in indicator/goal 14 (fourteen): maintaining marine ecosystems by conserving and sustainably utilizing marine and oceanic resources for sustainable development. Sustainable management of crab fisheries has objectives that include maintaining the balance of the overall main aspects of crab fisheries, including biological, environmental, economic, and social factors [4]; if it has been appropriately implemented, it can ensure that the crab supply chain in Indonesia becomes safe and controlled. The crab fisheries supply chain is the flow of crab meat from catcher fishermen to exporting companies/local buyers. The components of the export crab supply chain are fishers, miniplants (separating meat from shells), exporting companies, and buyers [5].

Meanwhile, sustainable crab fisheries management aims to maintain marine resources and improve the welfare of coastal communities by implementing management approaches based on Indonesian Water Management Areas (WPP) [6]. Through Decree No. 83/Kep Men-KP/ 2022, the Indonesian government established the Indonesian Fisheries Management Plan for Crab in the Indonesian Fisheries Management Area (WPP). The Fisheries Management Area is divided into eleven, including the Java Sea (WPP 712), which supports the largest share of 46.6% of crab production. In the Java Sea, especially in Central Java, Rembang Regency is among the areas with great potential in fisheries [7].

Rembang Regency has a crab landing site, Karanganyar Fishing Harbor (PP), with fourteen Fish Landing Places (TPI); there are eleven TPIs actively operating and spread in six sub-districts, including Kaliori, Rembang, Lasem, Sluke, Kragan and Sarang. The Rembang sub-district supports 60% of fish production for the Rembang Regency [8]. Bubu (traps) or Wuwu fishing gear is commonly used for crab-catching activities. The Gross Regional Domestic Product (GRDP) of Rembang Regency accounts for 6.27 percent of the fisheries sub-sector. Marine fisheries production, one of which is crab. The potential development of crab exports in the Rembang region is supported by five Fish Processing Units (UPI) exporting crab. Recorded until 21 January 2020, 161 crab tones with IDR 30.37 billion have been successfully exported to the United States and Hong Kong [9]. In Rembang, catching crabs is the fisherman's primary job, and the family helps him by peeling the crabs. Crab generally has been boiled or steamed on board.

However, there are typical problems faced by fishermen in Rembang Regency, such as the fact that the marine and fisheries sector in Rembang Regency has not become a leading sector and needs to receive adequate attention. Meanwhile, crab fishermen include small gross tonnage (GT) vessels and restrictions on crab processing on board, which result in fishermen only being able to go out to sea at a distance of 1-40 m from the shore and only one day at sea, resulting in

crab catches that are usually less than 13 cm in length [10]. Another problem occurs with trap fishing gear. Sometimes, the traps become torn. The traps are often lost when dragged by the troll trawl or payang fishing gear of fishermen with larger boats. Even though one trap can get 1-2 crabs [11]. According to *Zarochman and Ari* [12], crab fishing vessels are generally < 30 GT. Fishing activities in Rembang waters are also not well recorded, especially for crab resources, both monthly and annually [8].

Based on the above data and information showing the high potential of crab fishing and the use of peeled boiled crab meat as an export commodity in Rembang Regency, Central Java, it is necessary to conduct this study to conduct a perspective analysis to obtain information on the role of key actors and support institutions in the crab agro-industry in Rembang Regency, Central Java. Some previous studies on the role of actors in the management and use of fishery resources are [13-18].

Experimental part

Materials

The study used both primary and secondary data. Primary data was obtained by collecting structured questionnaires from key actors and supporting institutions in the Rembang district, Central Java shrimp agro-industry. The key actors and supporting institutions were 10 (ten) divided into three categories: small economy, business, government, association, and research. The small economy included crab fishermen (Crab_fishe) and collectors (Collector) at TPI Tanjung Sari. Crab fishermen use Bubu for fishing trips lasting four to eight days. Businesses were Miniplants that processed frozen peeled crab meat (Miniplants) and Fish Processing Units (UPI) that exported crab (SMB). The government was the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia (KKP), the Central Java Provincial Marine and Fisheries Agency (DKP_Jateng), and the Rembang Regency Marine and Fisheries Agency (DKP_Remban) (Fig.1.).

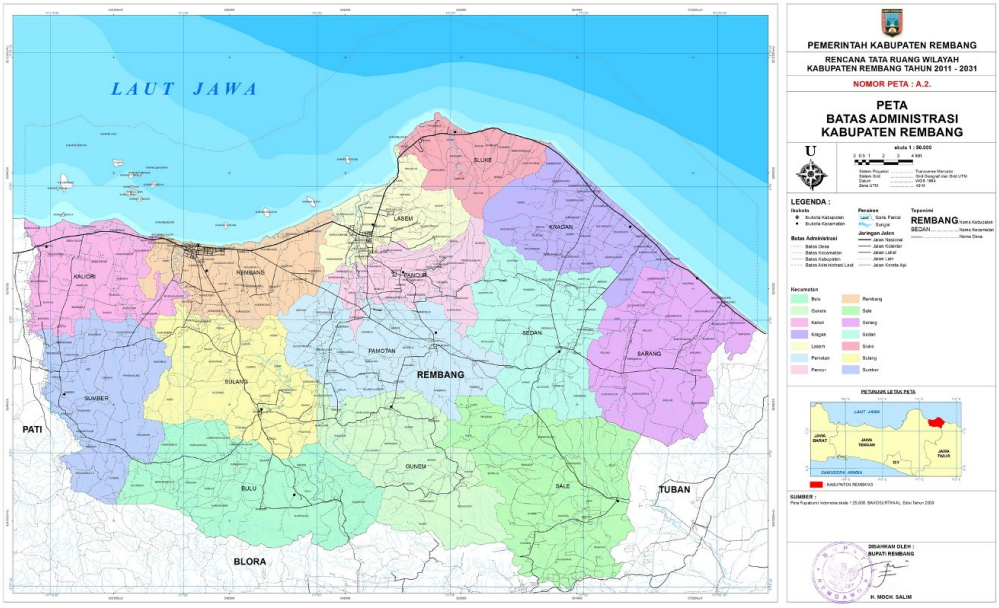

Fig. 1. Map of administrative boundaries of Rembang Regency [19]

The association is the Indonesian Blue Swimming Crab Association (APRI). The National Research and Innovation Agency (BRIN) and the University of Diponegoro (Undip) were the research institutions.

The objects associated with the key actors and supporting institutions involved were:

1. SDG 1: Zero poverty;
2. SDG 2: Zero hunger;
3. SDG 8: Decent work and economic growth;
4. SDG 12: Responsible consumption and production;
5. SDG 14: Life on water;
6. SDG 17: Partnership for the Goals.

The definition of the above objects is based on the grouping of the development pillars, namely social, covering Goals 1 and 2; economic, covering Goals 8 and 17; and environmental, covering Goals 12 and 14.

The collected questionnaires were subjected to an in-depth review of the completion results to acquire the ultimate outcomes for further data processing with the interaction approach between actors and indicators or sustainability variables, "actor-factor interaction," using the MACTOR application. Meanwhile, data and information from relevant government agencies and the results of previous research are used as secondary data.

Methods

A mixed-methods approach was used for information gathering using a survey, interviews with questioners, and in-depth review. The data analysis was carried out using the Matrix of Alliances, Conflicts, Tactics, Objectives, and Recommendations (MACTOR) application, which aims to analyze the strengths between actors and explore similarities and differences on various issues and goals to be achieved. Actors are entities with a position in the system and play a role in mobilizing existing resources to influence outcomes directly or indirectly through their influence on actors. Factors/objects are variables or issues that trigger discussion [20]. The entire analysis refers to the methodological framework developed by *M. Godet* [21].

Data collection

Based on an in-depth review, the results can be expressed in the Matrix of Direct Influence (MDI), defined in Table 1. The construction of the Matrix of Valued Positions - 2MAO in this case - is shown in Table 2.

Table 1. Matrix of Direct Influence (MDI) between Actors

MDI	KKP	Undip	BRIN	APRI	DKP_Jateng	DKP_Remban	Crab_Fishe	Miniplants	SMB	Collector
KKP	0	2	2	3	4	2	3	3	3	3
Undip	2	0	2	2	2	2	2	2	1	2
BRIN	2	2	0	1	2	2	2	1	1	1
APRI	3	2	2	0	2	2	4	4	3	4
DKP_Jateng	3	2	2	2	0	3	4	3	3	3
DKP_Remban	3	2	2	2	3	0	3	3	2	3
Crab_Fishe	1	2	2	4	4	2	0	3	4	3
Miniplants	2	2	2	2	3	3	3	0	4	3
SMB	3	2	2	4	3	3	4	4	0	4
Collector	2	2	2	2	3	3	3	3	4	0

Note: Influences are graded from 0 to 4 according to the importance of the actor's possible jeopardy:
0: No influence; 1: Operating procedures; 2: Projects; 3: Missions; 4: Existence

Table 1 The MDI matrix is read from row to column. For example, in the row, crab fishermen (Crab_Fishe) had a weak influence on the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia (KKP). This is based on field conditions where the role of fishermen is operating procedures. Policies issued by the government affect crab fishermen's ability to go to sea and catch crabs.

Table 2 illustrates the relationship between the actor and the objective of the sustainable development program for crabs in Rembang Regency. Positive and more significant values

indicate that the actor agrees with the objectives of the sustainable development program. For example, crab fishermen actors indicate zero poverty, decent work, and economic growth, responsible consumption and production, life underwater, and partnership for goals as objects of sustainable development program goals that cannot be ignored for their existence. However, zero hunger as a Sustainable Development Goal is crucial to the success of his work as a crab fisherman.

Table 2. Valued Position Matrix – 2MAO

2MAO	SDGs 1	SDGs 2	SDGs 8	SDGs 12	SDGs 14	SDGs 17
KKP	4	4	4	4	4	4
Undip	3	3	3	3	3	3
BRIN	3	3	3	4	4	3
APRI	4	4	3	4	4	4
DKP_Jateng	4	4	4	4	4	3
DKP_Remban	4	3	4	3	4	3
Crab_Fishe	4	2	4	4	4	4
Miniplants	4	2	3	4	4	4
SMB	4	3	3	2	4	4
Collector	4	2	3	4	4	4

Note: The sign indicates whether the actor is likely to reach the objective: 0: The objective has a bleak outcome; 1: Objective jeopardizes the actor's operating procedures (management etc.) / is vital for its operating procedures; 2: Objective jeopardizes the success of the actor's projects / is vital for the success of its projects; 3: Objective jeopardizes the accomplishment of the actor's mission / is indispensable for its missions; 4: Objective jeopardizes the actor's existence / is indispensable for its existence

Results and discussion

The findings and discussion are separated into five sections. The first explains the degree of influence of interdependence between actors. Second, describe the competitiveness between actors; third, describe the interaction between actors and goals; fourth, describe the potential for cooperation and conflict between actors; and fifth, explain the proximity between goals and between actors in the agro-industry of king crab in Rembang Regency.

Degree of influence of inter-actor dependency

The components of the crab export supply chain in Rembang Regency, Central Java, include blue swimming crab fishermen, miniplants (processors of frozen peeled king crab meat), export companies, and the government as a policy maker. The strength of direct and indirect impacts based on the analysis's findings are visible in Table 3. From the MDII results, it can be seen that the role of the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia (KKP) has a strong direct and indirect influence on crab fishermen, with a score of 20. In contrast, if we compare it with the baseline data (MDI), this influence is small, with a score of 1.

Table 3. Matrix of Direct and Indirect Influence (MDII) between Actors

MDII	KKP	Undip	BRIN	APRI	DKP_Jateng	DKP_Remban	Crab_Fishe	Miniplants	SMB	Collector	Ii
KKP	20	18	18	20	24	22	25	23	22	23	195
Undip	16	17	17	16	17	17	17	16	16	16	148
BRIN	13	14	14	14	14	14	14	14	13	14	124
APRI	19	18	18	21	24	21	24	23	24	23	194
DKP_Jateng	20	18	18	21	25	22	25	23	22	23	192
DKP_Remban	19	18	18	19	23	21	23	22	21	22	185
Crab_Fishe	20	17	17	20	22	21	25	23	21	23	184
Miniplants	20	18	18	20	23	22	24	23	21	23	189
SMB	21	18	18	22	25	22	27	26	25	26	**205**
Collector	20	18	18	20	23	22	24	23	21	23	189
Di	168	157	160	172	195	183	**203**	193	181	193	1805

Table 3 shows that the largest value of li - net direct and indirect influence (in the last column on the right) (li = 205) is found in the role of the crab exporting fish processing unit, which shows a large influence on the crab agro-industry in Rembang Regency. Indeed, the crab exporting fish processing units are the main actors in determining the economic value of crab (frozen peeled meat) and providing foreign exchange for the country. The largest value of Di - net direct and indirect dependence (in the last row) (Di = 203) is on the role of crab fishermen. On the ground, shrimpers are indeed the first victims of government policies.

The fisheries policy in Indonesia, set by the Ministry of Marine Affairs and Fisheries (MMAF), impacts the crab fishery, especially the crab fishermen. The policy is the Regulation of the Minister of KP RI No. 12/PERMEN-KP/2020 on the Management of Lobster (*Panulirus* spp.), Mud Crab (*Scylla* spp.) and Blue Swimmer Crab (*Portunus* spp.) in the Territory of the Republic of Indonesia, which stipulates the catch and/or release of shrimp (Portunus spp.) based on the Harmonized System Code 0306.39.10 in or from the Republic of Indonesian territory may be carried out by the guidelines below: not laying eggs, can be seen on the outer abdomen and carapace width > 10cm or weight > 60g/head [7]. Through Permen KP Nomor 02/Permen KP/2015, KKP issued a policy on the sustainable management of crabs in Indonesia by imposing a ban on using trawls and nets to catch crabs in all Indonesian waters management areas.

The crab fishermen in Rembang Regency use vessels < 10 GT with bubu gear. With the current capacity of the vessel, they can only reach the catch area about 1-40m from the shore and catch crabs that are mostly < 10cm in size with only one day at sea. In contrast, it takes more than one day to reach areas beyond 40m to catch crabs > 10cm [12]. Bubu gears in Rembang waters have low productivity compared to trammel nets. Because the design and construction of bubu gears are not yet in line with the target biota's behavior, gear design adjustments are needed to increase fishing efficiency. *B.B. Jayanto et al.* [22] found that bubu with four funnels produced more catch than bubu with two funnels.

According to *P.E. Anaesthesia et al.* [23], the blue swimming crab fishing business run using a folding tray (bubu) in Tunggul Sari, Rembang, is feasible. *I.G. Yudha et al.* [24] stated that crab fishermen cannot rely on fishing activities. Several factors cause fishermen not to have a side business, such as not having access to capital to do business and not having enough time to do a side job. They need additional income from side jobs to fulfill household needs [25].

Actors play a crucial part in figuring out the sustainability of a program or system. Actors in influence and dependency maps help to understand how actors interact to achieve goals and how to mobilize actors to achieve goals [20]. The strength of influence and level of dependency of each actor can be described according to its location in the quadrant (Fig. 2). The Ministry of Maritime Affairs and Fisheries (KKP) and the Indonesian Blue Swimming Crab Association (APRI) are actors with high influence and low dependency because they are in quadrant I (top left). Meanwhile, actors such as crab fishermen, collectors, frozen crab peeled meat processing mini plants, crab exporting fish processing units (UPI), the Central Java Provincial Marine and Fisheries Office, and the Rembang Regency Marine and Fisheries Office are the main players in this context. All these actors are in quadrant II (top right), with high influence and dependency. Meanwhile, the National Research and Innovation Agency (BRIN) and Diponegoro University (Undip) are in a passive position (small dependence and small influence), as shown by their presence in quadrant IV (bottom left).

The Fishery Improvement Project (FIP) for Indonesian king crab is industry-driven, with the Indonesian Blue Swimming Crab Association (APRI) collectively controlling about 85 percent of the market, with the complete promotion of the National Fisheries Institute Crab Council (NFI Crab Council) in the United States. FIPs face many of the same challenges as developing countries (and many small-scale fishers). These include limited or no reliable data, no control over access to/fishing rights to manage, carrying capacity, no effective crab fishermen' organizations, lack of government capacity to promote the social health of fishing villages, as

well as industry's insufficient grasp of these concerns. Other crab fisheries in Asia face similar problems [7].

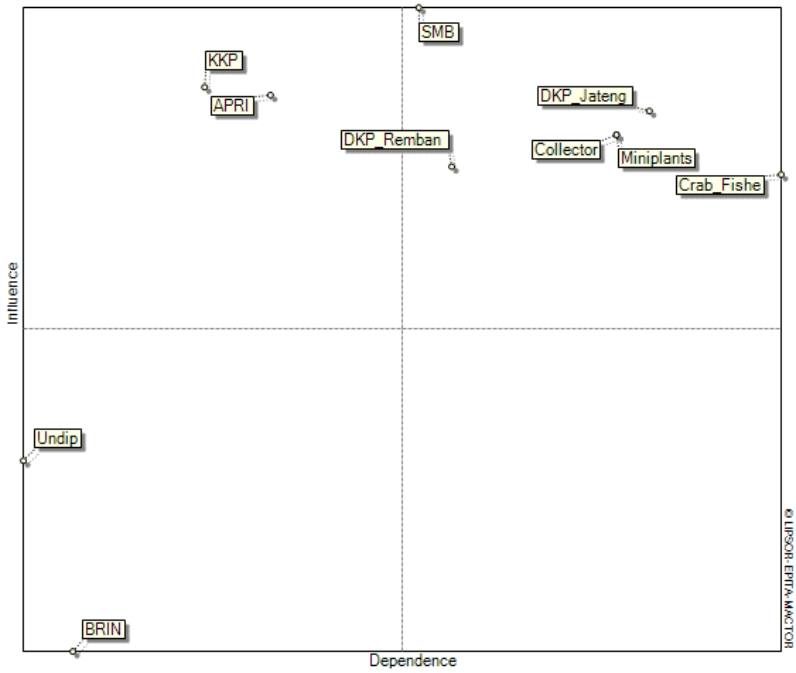

Fig. 2. Map of Influences and Dependences between Actors

Small-scale crab fishermen in Rembang Regency generally use vessels < 30GT [12]. Indonesian Law No. 2 of 2015 states that vessels < 30GT are under the accountability and authority of the provincial government, so the provincial government must manage crab fisheries. According to this law and the mandate of the crab fisheries management plan (FMP), each provincial government must be able to expand and implement the action plan concerning the national plan [26]. Based on the Law of the Republic of Indonesia No. 23/2014 on Regional Government, provinces are authorized to manage marine natural resources in their territory. The authority of provincial regions to manage natural resources in the sea as intended includes Exploration, exploitation, conservation, and management of marine resources other than oil and gas; administrative and geographical structures; participation in preserving marine security; and participation in preserving state sovereignty. The authority of the provincial regions to manage natural resources in the sea up to 12 (twelve) nautical miles calculated from the shoreline toward the high seas and/or archipelagic waters.

Decree of the Governor of Central Java Province no. 523/93/2017 on the Establishment of the Facilitation Team and the Management/Conservation Team for Crab Fisheries in Central Java Province 2017-2022 regulates the tasks of the Crab Fisheries Management Team at the provincial level, such as: Identifying and inventorying the status of fisheries management issues in the respective province, compiling and preparing an action plan for crab fisheries management at the provincial level, facilitating the implementation of the action plan for crab fisheries management at the provincial level, conducting crab fisheries management activities at the provincial level and reporting the results of the implementation to the Governor.

DKP of Rembang Regency faces the challenge of managing the fishery and marine sector under its jurisdiction, such as using fishery resources, which must be directed as much as possible for the prosperity and welfare of the people. Still, in its utilization, it always tries to maintain sustainability. The usage of fishery and marine resources must be balanced against their carrying

capacity and potential so that they can continue to provide benefits on a sustainable basis. So regulatory support is very important. The existing regulation is also the basis for promoting people's business in the fisheries and marine sector, both individual businesses (miniplants) and legal entity businesses (UPI exporting crab), so that all fisheries and marine companies will be facilitated through a retribution payment mechanism. The people can also access the fisheries and marine resources owned by Rembang, and the government of Rembang Regency also gets benefits, namely regional income from retribution in the fishing and marine business sector, so that the principle of symbiotic mutualism is established [27].

The policy of sustainable crab management in terms of agro-industrial and crab quality from upstream to downstream levels has also been implemented by the KKP, namely with the requirements for the implementation of traceability (Kepmen KP Nomor 52A/Kepmen KP/2013), the implementation of quality certification/processing feasibility certificate (SKP) in mini-plants and pasteurized crab processing units (Permen KP Nomor 72/Permen KP/2016), the development and implementation of SNI standards (SNI 4224: 2015 for cold cooked crab meat and SNI 6929:2016 for pasteurized crab meat in cans). According to KKP data, in 2022, the crab and shrimp processing industry amounted to 128 fish processing units (UPI) with a total volume of processed products of 21,942 tons and an export value of 482.81 million US dollars. Products are exported as 74 percent chilled fresh, 16 percent frozen, 5 percent canned, and 5 percent other processed. The variety of diversified crab products produced includes frozen-in cans. Canned pasteurized crab products have the largest market in the United States. Meanwhile, non-food forms are chitin and chitosan [28].

Research on crab has been conducted by *A. Zamroni et al.* [29], which resulted in a proposal to implement the open-closed season (OCS) model to ensure the sustainability of resources and businesses in the Java Sea (Cirebon, Rembang, and Demak) and Lampung. Another research is *R. Triyanti et al.* [30], which states that to manage crab sustainably, a community-based management policy is needed through socialization of the status of the condition of the crab caught, training on gear diversification and support to fishermen in terms of awareness of sustainable crab fishing, monitoring the utilization of fishing gear and the size of the crab caught, controlling the season and fishing area and developing alternative livelihoods for coastal communities when the policy is implemented. *C. Ummaiyah et al.* [31] analyzed the environmental friendliness of crab traps modified with escape slits in the waters of Rembang Regency.

Competitiveness between actors

The competitiveness of actors, which is determined by the level of the Matrix of Direct and Indirect Influences (MDII) of these actors on other actors, can be seen in Fig. 3. Actors with a value greater than 1 (100%) have high competitiveness and conversely, actors with a value less than 1 (100%) have low competitiveness [15]. Based on Fig. 3, it is known that actors with high competitiveness in the crab agro-industry in Rembang Regency are the Ministry of Maritime Affairs and Fisheries (KKP), APRI, DKP of Central Java Province, DKP of Rembang Regency, Miniplants, UPI exporter and collector. Meanwhile, the actors that have very low competitiveness are Undip, BRIN, and crab fishermen.

Crab exporting UPIs, Miniplants, and Collectors should play an active role in the crab agro-industry about their business interests. Currently, there are common obstacles for miniplants and exporters of Indonesian crab fishery products. Miniplants still need to be disciplined in terms of registration and certification. The number of Indonesian crab fishing industries that need to be managed and the need for quotas for catch limits because fishing is still free. In contrast, the constraints on exporters are that they cannot meet the requirements set by export destination countries, especially in terms of quality standards, food safety, traceability, environmental friendliness, and certifications such as Marine Stewardship Council (MSC), Seafood Watch and Sustainable Fisheries Partnership (SFP) rating [32]. Based on data from the US Food and Drug Administration (FDA) as of December 2020, there have been 97 cases of

rejection of fishery exports, including crab products from Indonesia, by several countries such as the European Union, the US, Canada, and China. Examples of rejection cases are due to the presence of chloramphenicol (171 cases), bruising (138 cases), poisonous (88 cases), and dirty (77 cases). These cases are closely related to food safety, such as discovering unsafe add, col, salmonella, listeria, nitrofuran, unsanitary, misbranding, and off-odor. Another cause is contamination of the crab during the shipping process. The competitiveness for crab exports, besides the quality of the crab, is the percentage of meat, which must exceed 15%. The importance of the meat percentage requires a sustainable crab management process, including its relationship with fishing gear [33].

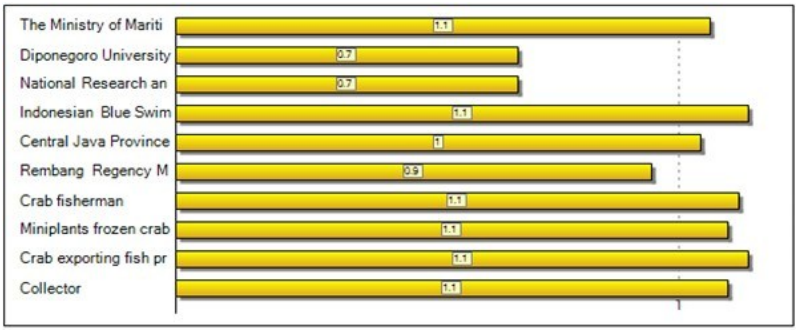

Fig. 3. Histogram of MDII's Competitiveness

Cases of chemical and microbiological contamination require the application of absolute quality references to meet the requirements of quality and food safety to meet market demands. Along with the goal of buyer protection, Indonesia has similar requirements for the promotion system and quality control of fishery products [34]. Another effort is to optimize traceability in an integrated manner, from tracking and following all stages of crab handling, from post-catch crab on board, distribution, and processing in mini-plants and UPI, until it becomes a food product that can meet the standards of export destination countries. The European Union has introduced a catch certificate by Council Regulation (EC) 1005/2008. The United States has also implemented a new regulation, the U.S. Seafood Traceability Program. Permen KKP RI No. PER.13/MEN/2012 has established the Fish Catch Certification (SHTI) to increase export trade activities of catches, supporting measures to combat IUU fishing, traceability of catches, and implementing conservation regulations. The challenges faced by APRI in managing crab fisheries in Indonesia are the need for data to support responsible fisheries management, the improvement program for crab fisheries is mandatory to sustain the resource, and APRI must be able to involve mini-farms and fishermen as strategic partners for the implementation of the improvement program in crab management [35].

Interaction of Actors and Objectives

The Weighted Valued Position Matrix (3MAO) describes each actor's position on each goal, considering the degree of opinion on each goal, the hierarchy of goals, and the competitiveness among actors. Two outputs are generated from this matrix: the first is the degree of mobilization, which describes the goal/objective that most mobilizes actors and the second is mobilization, which represents the actors that are most mobilized (active) to use resources to achieve the goal/objective [14]. Table 4 shows that the most active actors are KKP, APRI, DKP Central Java Province, and UPI crab exporters, with values of 28.3, 26.4, 24.0, and 23.9, respectively. On the other hand, the degree of mobilization of 39.2 indicates that SDG 14: living under water is the goal that activates the stakeholders the most. The degree of mobilization can also be seen in Fig. 4, where the degree of mobilization of 39.2 is a fully agreed opinion of the actors on SDGs 14: life below water.

Table 4. The degree of mobilization between stakeholders with objective goals

3MAO	SDGs 1	SDGs 2	SDGs 8	SDGs 12	SDGs 14	SDGs 17	Mobilization
KKP	4.7	4.7	4.7	4.7	4.7	4.7	28.3
Undip	2.4	2.4	2.4	2.4	2.4	2.4	14.3
BRIN	1.8	1.8	1.8	2.4	2.4	1.8	12.0
APRI	4.6	4.6	3.4	4.6	4.6	4.6	**26.4**
DKP_Jateng	4.2	4.2	4.2	4.2	4.2	3.1	23.9
DKP_Remban	4.1	3.1	4.1	3.1	4.1	3.1	21.7
Crab_Fishe	3.8	1.9	3.8	3.8	3.8	3.8	20.8
Miniplants	4.1	2.1	3.1	4.1	4.1	4.1	21.6
SMB	4.8	3.6	3.6	2.4	4.8	4.8	24.0
Collector	4.1	2.1	3.1	4.1	4.1	4.1	21.6
Number of agreements	38.6	30.4	34.2	35.8	39.2	36.5	
Number of disagreements	0.0	0.0	0.0	0.0	0.0	0.0	
Degree of mobilisation	38.6	30.4	34.2	35.8	**39.2**	36.5	

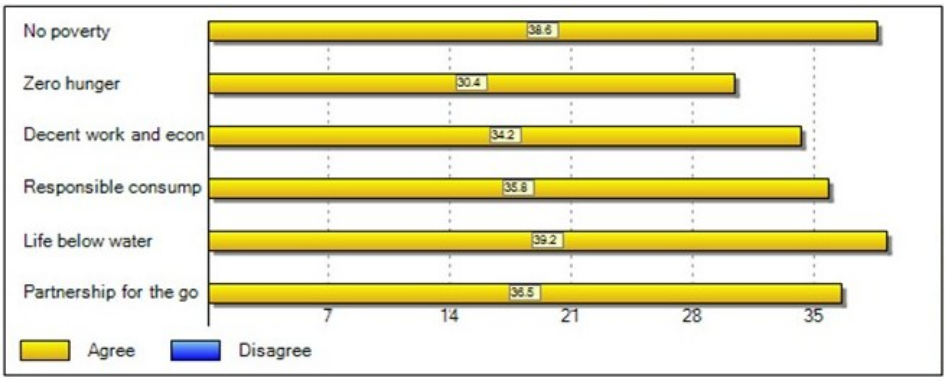

Fig. 4. Histogram of Actor's Mobilization towards its Objectives 3MAO

High mobilization of KKP, APRI, and DKP Central Java Province in issuing policies and programs to support sustainable crab management KKP with several regulations such as Permen KP No. 02/Permen KP/2015 banning the use of trawlers and trawls to catch crabs in all Indonesian waters management areas and Regulation of the Minister of KP RI No. 12/PERMEN-KP/2020 on the Management of Lobsters (*Panulirus* spp.), Shrimps (*Scylla* spp.) and Crabs (*Portunus* spp.) in the Territory of the Republic of Indonesia. DKP of Central Java Province organized dissemination activities of the crab fleet development program in Central Java in 2022. APRI promotes the Fishery Improvement Project (FIP) with full support from the National Fisheries Institute Crab Council (NFI Crab Council) in the United States for Indonesian crab, together with other industries to control about 85 percent of the market [7].

In addition to those engaged in the stakeholders' supply chain of crab in Rembang Regency, the central and local government must now pay close attention to the crab stock in WPP NRI 721. The decline in crab production as one of the leading commodities has occurred for some time. *S. Ambarwati* [28] stated that the Blue Swimming Crab (BSC) Fishery Report reported that the crab stock in the Republic of Indonesia State Fisheries Management Area (WPP NRI) 712, which includes the Java Sea, experienced a decline in production in 2019-2022. The crab stock in WPP NRI 712 is in a state of overexploitation. The value of the spawning potential ratio has decreased in several waters. Fishing operations and the fishing gear used must be a concern to maintain the existence of the commodity (supply). One of the efforts to preserve the small-scale production of crab is the government's effort to develop a quota-based measured fishing program (PIT) [36]. Due to *N.D. Yanti et al.* [38], the status of BSC fisheries management

can yet be enhanced and improved. Tactics were taken to restore BSC fisheries management and gradually improve indicator circumstances. To make fishery activities more sustainable, recommendations include strengthening supervision, improving seagrass cover, improving coordination among institutions on BSC fisheries management, and increasing stakeholder participation in the effort to manage the BSC fisheries.

Potential Cooperation and Conflict among Actors

The degree of divergence (agreement and convergence) between actors can be seen in Fig. 5 below. The highest convergence relationship is between KKP and APRI. The relationships show that these two actors will likely form an alliance or cooperation. Other information also shows high convergence between KKP and shrimpers, collectors, DKP Central Java, UPI shrimp exporters, Miniplants, and DKP Rembang Regency, which shows that cooperation among these actors in the shrimp agro-industry in Kab. Rembang is very important. The establishment of cooperation between actors to achieve synergy in achieving economic goals and maintain the sustainability of the availability of crab in nature.

In contrast, the level of divergence between actors showed that there is no level of divergence between actors. This information indicates a low possibility of conflict among the actors involved. According to *H.A. Kusumawardhani et al.* [17], a resilient environment and a coastal community's adaptability can safeguard small-scale fishermen and coastal community residents and avert conflict. *R.M. Naser and G. Philipp* [37] state that combining the results of participatory stakeholder analysis (SA) and social network analysis (SNA) can contribute to a better understanding with a careful conceptualization of power and meaningful interpretations.

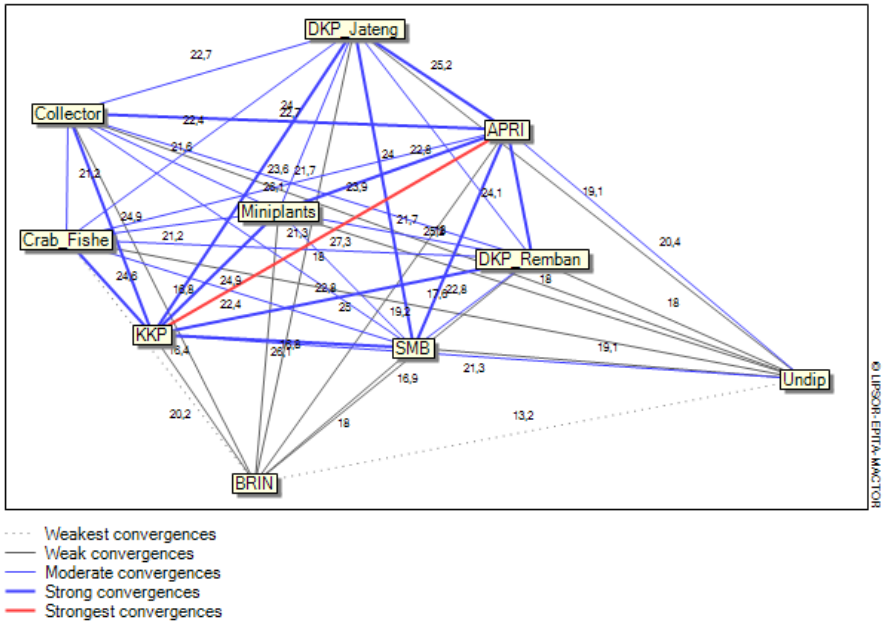

Fig. 5. Graph of Order 3 Convergences between Actors

According to *R. Triyanti et al.* [30], to manage crabs sustainably, synergy between the government and the actors involved in crab agro-supply is needed, namely by establishing a community-based management policy through socialization of the status of the condition of the caught crab, training on diversification of fishing gear and assistance to fishermen related to sustainable crab fishing awareness, monitoring the use of fishing gear, the size of the caught crab, control of the season and fishing area and development of alternative livelihoods for coastal communities when the policy is implemented.

The proximity between Objectives and Actors in the Agro-Rabbit Industry in Rembang Regency

The proximity or distance between objectives provides an overview of the interrelationships between program objectives, as graphically illustrated in Fig. 6. The Net Distance between Objectives Graph is used to identify objectives where actors take the same position (either for or against). This graph depicts objectives in scale value (the difference between the convergence matrix value and the divergence matrix value). The Net Distance between Objectives Linkages Graph provides an overview of the links between program objectives. Red and blue colors represent the possible levels of closeness between objectives. The red color indicates a stronger linkage distance than the blue color. Fig. 6 shows the distance between the goals/objectives of SDG 1: No poverty and SDG 14: Life under water is very strong. Meanwhile, the distance between the goals/objectives of SDG 1: No poverty, SDG 12: Responsible consumption and production, and SDG 17: Partnerships and goals is strong. The distance shows the strong interrelationship between the four goals in the shrimp agro-industry in Rembang Regency.

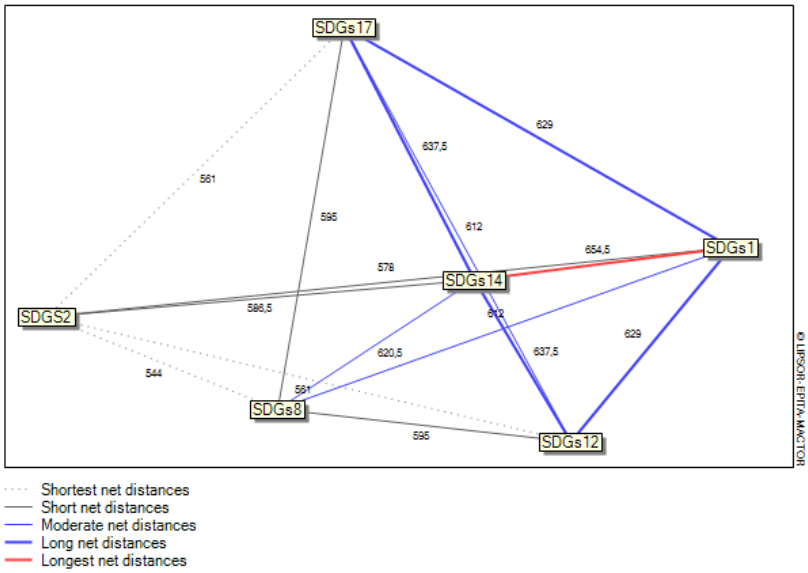

Fig. 6. Graph of Net Distance between Objectives

The management of marine areas will continue to be based on the principles of sustainability and responsibility, and it is an effective method for conserving marine areas and their ecosystems. This method will also emphasize the role of small fishermen and coastal communities, the main actors. They will be helped to improve their economic level (without poverty) to be better. Coastal communities and small-scale fishermen will be guided to change their behavior in managing marine areas and, at the same time, be educated about implementing coastal and marine ecosystem protection. The government will also synergize to improve the relationship and communication with fishermen in line with efforts to increase economic benefits for fishing communities, especially the welfare of small-scale and traditional fishermen throughout Indonesia's coastal areas [39]. According to *I. Herman et al.* [40], Addressing sustainability concerns necessitates a multifaceted approach that includes accurate fishing methods, strong regulatory enforcement, and enhanced monitoring. Government officials, fishing communities, and conservation groups must work together to balance commercial interests with the long-term ecological health of blue swimming crab (BSC) populations in a certain location.

The new Indonesian government is expected to build the fishermen's independence towards the Golden Indonesia 2045. Fishermen will be empowered as partners in development and allowed to play a role that is not limited to economic aspects but also includes social and environmental factors. The implementation of environmentally friendly fishing practices (crabbing), wise management of marine resources, and infrastructure development that supports the economic sustainability of fishermen. Fishermen can conduct their business without damaging the marine ecosystem, thus ensuring the sustainability of their income. However, fishermen and the marine sector will continue to face major challenges such as climate change, overfishing, and marine environment degradation. Better access to technology and innovation in the fisheries sector, such as information technology to obtain weather information, market opportunities, and fish stock monitoring, can help fishers increase productivity and reduce the risk of loss [41].

The red line shows the strongest relationship based on Fig. 7 Map of Net Distances between Actors. KKP, DKP Prov Central Java, and APRI have a strong distance relationship, indicating a possibility of cooperation between these actors. A strong co-management structure of the fishery management area (FMA) governance is at the heart of EAFM implementation. It is also critical to mention the governance or institution structure of the Fishery Management Council of FMA in Indonesian waters in the new proposed fishery law [42].

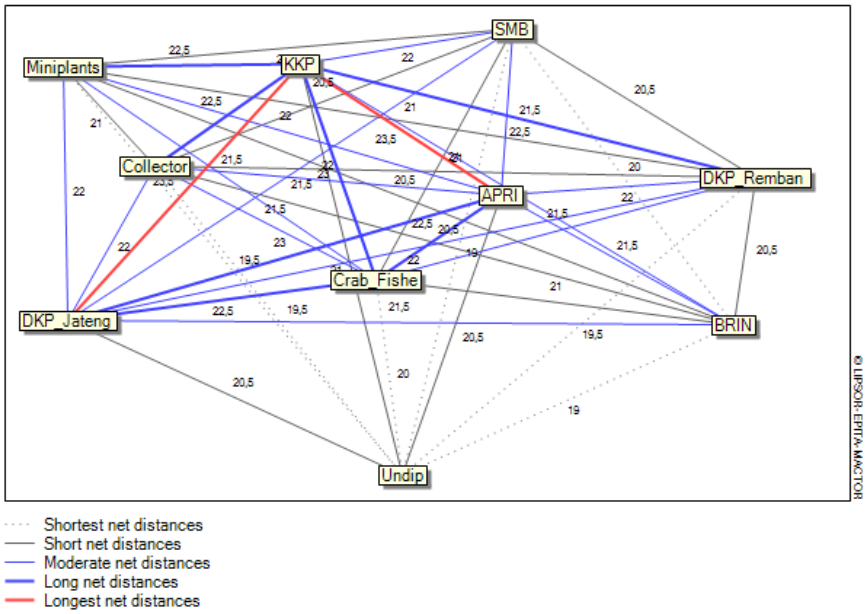

Fig. 7. Graph of Net Distances between Actors

The synergy that needs to be built between central and local governments and the private sector/industry can also be key to improving the welfare of fishers. This cooperation could include partnership programs with fishermen's associations, companies, or related industries to ensure fishermen receive a fair price for their catch. Thus, fishermen and the marine environment are the determinants of Indonesia's economic success and the guardians of its precious cultural and natural heritage [43]. Among the associations that support the crab agro-industry in Indonesia is APRI. APRI currently consists of 19 members of crab export companies spread throughout Indonesia [44]. According to *M. Yusuf et al.* [44], the Indonesian crab industry's strategy, structure, and competition require further improvement. Other aspects, notably those

relating to circumstances, government, and opportunity, are also significant. The competitiveness of Indonesian crab products must be increased to positively impact the Indonesian economy and encourage a more prosperous society. *M. Yusuf and T. Trondsen* [45] state that the sustainability of crab resources is currently very threatened due to a lack of attention to environmental exploitation. To maintain supply stability from harvesting crab resources, efforts are needed to develop sustainable resource management and value chains and conventions supported by the government, the Indonesian crab industries, the Indonesian Crab Processing Association, and fishermen.

Conclusions

The results showed that the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia (KKP) has a strong direct and indirect influence on crab fishermen. The crab exporting fish processing unit greatly influences the crab agro-industry in Rembang Regency. The largest net direct and indirect dependence on the role of crab fishermen. The Ministry of Marine Affairs and Fisheries (KKP) and the Indonesian Blue Swimming Crab Association (APRI) are actors that have high influence and low dependence. Meanwhile, other actors, such as crab fishermen, collectors, frozen crab peeled meat processing mini plants, fish processing units (UPI) exporting crab, the Central Java Provincial Marine and Fisheries Service, and the Rembang Regency Marine and Fisheries Service are the main actors in the context of crab agro-supply in Rembang Regency. Meanwhile, the National Research and Innovation Agency (BRIN) and the University of Diponegoro (Undip) are in a passive position.

Actors with high competitiveness in the crab agro-industry in Rembang Regency are the Ministry of Marine Affairs and Fisheries, APRI, DKP of Central Java Province, DKP of Rembang Regency, Miniplants, UPI exporters and collectors. Meanwhile, actors with very low competitiveness are Undip, BRIN, and Crab Fishermen. KKP, APRI, DKP Central Java Province, and UPI exporters are the most active actors. The target that activates the actors the most is SDG 14: Life under water, where the actors give a fully agreed opinion on the target object. KKP and APRI have the highest convergence relationship, and there is no divergence among the actors, so there is only a low possibility of conflict among the actors involved in the shrimp agro-industry in Rembang Regency. Strong linkages between the four goals of SDG 1: No poverty, SDG 12: Responsible consumption and production, SDG 14: Life under water, and SDG 17: Partnership and goals in the crab agro-industry in Rembang Regency. The success of sustainable management depends on cooperation between Fishermen catching crab, Collectors, Miniplants, UPI exporting crab, the Central Java Provincial Marine and Fisheries Service, and the Rembang Regency Marine and Fisheries Service.

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