

Policy Recommendation for Food Security in Indonesia: Fish and Sea Cucumber Protein Hydrolysates Innovation Based

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Abstract

The development of Fish and Sea Cucumber Protein Hydrolysates (HSPH) is very important in fulfilling the needs of nutrition to boost immunity and prevent malnutrition. The technology to produce HSPH has been classified in Technology Readiness Level (TRL) 9 or equivalent with Innovation Readiness Level (IRL) 3 which is able to provide added value for the product, technology management, thus it is ready for commercialization. The development of HSPH is suggested to conduct through strategic cooperation with cooperatives and multi-stakeholders including government agencies and private companies. The objective of this paper is to put a comprehensive policy recommendation to provide adequate nutritional food from marine product diversification as an alternative option in managing and combating food security challenges in the longer-term.

Keywords: Food Security, HSPH, TRL9, IRL3, policy, Indonesia

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1. Introduction

As the largest archipelagic country in the world, Indonesia has abundant of marine and fishery potentials which contains a wide variety of types of fish resources (Pangestuti et al., 2018). The ocean plays an undeniably central role in Indonesia. With a water area that is nearly four times larger than its land area, the country obtains benefits from the sea for its economy and natural environment. Indonesia has one of the highest levels of marine biodiversity in the world (CEA, 2018). Those benefits to strengthen the resilience of national economy. The Government of Indonesia has a proper direction that has been stipulated in the National Midterm Development Plan (RPJMN) 2020 – 2024 by focusing in development of maritime economy in fishery sector and biotechnology industry. This macro policy is a great weapon to create supply and demand which could create economic transformation by providing added value in innovation and technology. The marine and fisheries sector has been important contributor to national food security and the creation of added value in the food supply chain in Indonesia. Food and nutritional security is extremely linked to efforts to raising the health quality of both the individual and the community, and to strengthened competitiveness of human resources, which in turn will develop into a nation's competitiveness and sustainable economic development, particularly in marine and fisheries sector. A recent study ranked Indonesia as the eighth-most fish-dependent nation in the world, measured by dependence on fish-derived animal protein (CEA, 2018). Because of its high cost, usually fishes that are raised by using this method are type that has high market value (Carballo, et al. 2008). It shows that Indonesian people should increase fish-derived products consumption to reduce stunting and other malnutrition cases (Ngaisyah and Rohman, 2019). Since food and nutrition security are among the key agendas in national development and have direct linkage to the status of community health, the government is also supporting to accelerate creating economic added value in marine and fisheries sector by formulating national policies as stipulated on Government Regulation Number 57 of 2015 (FAO, 2013). Importantly, the fisheries sector plays a particularly valuable role in coastal communities, where people are likely to engage in fishing as a primary or secondary source of employment (Marshall et al., 2010).

2. National Commitment to Nutrition

Based on the basic health research conducted by Ministry of Health (MoH), Indonesia faces challenge relating to nutrition. At national scale, children under five years with malnourished and undernutrition in 2013 record 5.7 percent and 13.9 percent respectively. Compared to national status in 2010, there is an increase in malnourished prevalence from 4.9 percent, while undernutrition prevalence goes up 0.9 percent from 2007 to 2013 (Riskesdas, 2013). A recent study examined that one of underlying causes of malnutrition is inadequate access to food (UNICEF, 2018). Similarly, provinces with poor access of food are related to food insecurity (SMERU, 2015). Another study estimated that adequate access of nutrition could decrease of 10.9 percentage points in the

stunting rate in children under three years of age (World Bank, 2017).

The declining of malnutrition prevalence has been focussing of the government for the past few years. It has pledged to meet the Sustainable Development Goals, which includes child nutrition targets by 2030 (UN, 2015). Some regulations are stipulated to support the action plans. The food and nutritional program policies is formulated in the Law Number 17 of 2007 concerning National Long-Term Development Plan (RPJPN) 2005 – 2025 which includes multi-sectoral agencies to ensure the food consumption with adequate, balanced, and safe nutritional contents. Acceleration of the programs is implemented through community nutrition improvement which is also in line with RPJMN 2020 – 2024 (the last phase of RPJPN 2005 – 2025), focusing to provide innovation and added value in order to improve our Global Competitiveness Index and giving accessible and valuable product to our community (FAO, 2013).

According to the Law Number 18 of 2012 on Food, the food supply in Indonesia must be safe, high quality, and affordable. Meanwhile, the Law Number 33 of 2014 concerning Halal Product Assurance will also affect the food business process which states that products must be halal certified. Therefore, halal certification becomes an important instrument in the food business process in Indonesia (Suadi and Kusano, 2019). The government's commitment to support halal industry atmosphere is reflected by the President regulation Number 28 of 2020 on National Sharia Economic and Financial Committee. As the biggest Muslim country in the world, halal product is very essential in the community as the halal symbol signifies that the product meets the requirements stipulated by sharia law, thus it is fit for consumption. The symbol has now become the world's standard and barometer that determines product quality, cleanliness, and security (Bappenas, 2019).

3. Innovation and Business Ecosystem Development

In the coming era of economic development, Indonesia is no longer possible only by relying on conventional industries. It is proven that several countries have also placed technology-based companies as one of the main drivers of their development. Based on the Ministry of Research, Technology and Higher Education that Indonesia became a reference for the growth of start-up companies, particularly digital start-up as the growth of digital start-up in Indonesia reached the highest among the Southeast Asian countries in 2016. The growth and development of innovative industries or technology-based start-up in Indonesia will benefit employment creation, increase the local economy and tax revenues as well as generate foreign exchange from exports (Ristekdikti, 2019). During that moment, production raw materials were rare. Manufacturing industries were pushed to be able to adapt and find an alternative for the raw materials. After the industry switches towards the alternative, they found out that the alternatives they used has lower cost but have similar or even better performance. This then drives the industry to innovating and looking for alternatives, and the method of finding it is the Value Engineering we know today. Seeing the success of manufacturing industries in implementing Value Engineering, other industries than starts following the method, such as in service industry, construction and even agriculture. As mentioned above, Value Engineering has been implemented by multiple industries (Sharma, et al., 2012); (Ismail et al., 2010); (Atabay, 2013 ; Ahmed, 2013), (Apurva, 2013 ; Chavan, 2013) ; (Tom and Gowrisankar, 2015 ; Rad and Yamini, 2016 ; Harini et al, 2018), (Sharma et al, 2012; Sharma and Kumar, 2017 ; Maksud and Yusof, 2013 ; Leber and Majda, 2013 ; Chougule and Kallurkar, 2012).

In order to encourage innovation as the effort to increase productivity, independence, and national competitiveness, the Law Number 11 of 2019 concerning National System of Science and Technology have accommodated these missions. As the mandate of the law, the Board of National Innovation Research must formulate policies to carry out integrated research, development and innovation interventions through technology commercialization. In establishing a climate conducive to the growth and development of technology-based start-up, and to support the commercialization of R&D results in Indonesia, the Ministry of Research, Technology and Higher Education issued the policy instrument in the form of an incubation incentive scheme through technology-based start-up. This program is continued by the Ministry of Research and Technology (Ristekdikti, 2019).

Government support is implemented through this funding program with purpose to increase the commercialization of innovation that have a mature level of technological readiness. According to Regulation of The Ministry of Research, Technology and Higher Education Number 42 of 2016 and Number 29 of 2019, Technology Readiness Level (TRL) is a measure of the level of technological readiness which is interpreted as an indicator that shows how a technology maturity can be applied and adopted by prospective users (Putra and Santoso, 2020). While Innovation Readiness Level (IRL) is a method for estimating the readiness of Innovation from an Innovation program in companies, R&D institutions, and higher education in terms of technology, market, organization, partnership, risk, manufacturing, and investment aspects (Santoso, et.al, 2020; Andrian and Santoso, 2020).

The TRL 1 – 3 is equivalent with IRL 1 which means the technology is still being experimented in the laboratory, whereas TRL 4 – 6 equivalent with IRL 2, the technology has been prototype, but not certified yet. In the TRL 7 – 9 which is equivalent with IRL 3, the technology has been standardized, certified, and ready to enter

the market. In this stage, the technology has provided an added value from the raw material to valuable product. Based on the minister's regulation, for the start-up companies with IRL 3 measurement, it is recommended that they make collaboration with commercialization institutions or investors, such as incubators, accelerators, and intermediation institutions as well as to maintain product sustainability according to continuous research to fulfill the market needs.

Technology Readiness Level (TRL) is a measure of the level of technological readiness which is interpreted as an indicator that shows how ready or mature a technology can be applied and adopted by users/prospective users. TRL is a system of systematic measurement that supports the assessment of the maturity or readiness of a particular technology and the comparison of maturity or readiness between different types of technology. It is a measure that shows the level of technological maturity or readiness on a scale of 1-9, which between one level with another level are interrelated and become the basis for the next level.

The following is a ranking of technological readiness indicated by TRL scores:

- TRL 1: Basic principles of technology have been researched and recorded
- TRL 2: Formulation of technology concepts and their applications
- TRL 3: Proof of concept (proof-of-concept) functions and / or important characteristics analytically and experimentally
- TRL 4: Validation of codes, components and / or collections of components in a laboratory environment
- TRL 5: Validation of codes, components and / or components in a relevant environment
- TRL 6: Demonstration Model or System / Subsystem Prototype in the relevant environment
- TRL 7: Demonstration of system prototypes in the actual environment / application
- TRL 8: The system is complete and qualified (qualified) through testing and demonstration in the actual environment / application
- TRL 9: The system is truly tested / proven through successful operation

Furthermore, the description of each TRL level is explained as in the following table:

Table 2.0.1 TRL Level Description

TKT 1	The basic principle of a technology has been investigated	At this level, scientific research begins to be translated into applied research and development. Example: basic study of the nature or characteristics of a material (for example: tensile strength as a function of temperature of a new fiber material).
TKT 2	The concept of technology and its application has been adopted	Formulation At this level the technology has been formulated in the form of concepts according to its application. At this level, the application is still speculative and there is no proven experimental evidence or detailed analysis that supports the hypothesis
TKT 3	Important concepts and characteristics of a technology have been proven analytically and experimentally	At this level is the process of technology maturation, new research and development (R&D) activities begin, covering both analytical studies to determine technology in an appropriate context and basic laboratory studies to physically validate that the analytic hypothesis is correct.
TKT 4	The technology component has been validated in laboratory environment	At this level the basic concepts have been tested, basic technology components are integrated to establish that a technological concept is feasible. This endorsement must be thought to support the concept that was formulated earlier and must also be consistent with the needs of the application.
TKT 5	The technology component has been validated in relevant environment	At this level, the accuracy of the technology components is carried out relevant environmental testing so that the validation of the functions and characteristics of the technology components is in accordance with the expected application. The basic elements of technology must also be integrated with the supporting elements, forming a realistic prototype so that the total application (component level, sub-system level, or system-level) can be tested in a simulation or its original environmental conditions.
TKT 6	Model or Prototype has been tested in relevant environment	At this level, a prototype model or system or systems that will continue to develop the following are tested in a relevant environment.
TKT 7	The prototype has been tested in the environment in fact	At this level, prototypes are tested in the actual environment. The prototype size must be similar or scale in accordance with the planned operational system and demonstrations must take place in the actual environment.

TKT 8	Technology System is complete and fulfilling requirements (qualified) through testing and demonstration in the actual environment/ application	At this level, the technology system is complete, where the technology has been tested and demonstrated in an actual environment, fulfilling the requirements and the development of the system from all elements of technology has been terminated
TKT 9	Technology truly tested / proven through successful operation	At this level, technology has truly been tested/proven through successful operation. This stage is the end of overall technological development.

The measurement of TRL is carried out using a Techno-Meter. Techno-Meter is a spreadsheet-based software from Microsoft Excel that collects several standard questions for each level and displays TRL graphically. This software is quite helpful in the TRL measurement process (which can be done repeatedly). Techno-Meters can provide a snapshot of the state of technological maturity at a particular time. Besides that, it is also possible to evaluate the historical process of achieving technological readiness / maturity of the development program carried out in a technology.

The measurement of TRL can also be done independently (self-assessment) to map the capacity and capability of technology. This effort was first initiated by William Nolte and his team at AFRL United States (Air Force Research Laboratory) in 2005, developing a "calculator" calculator called the TRL Calculator. This tool is software to apply the concept of technological readiness developed by NASA in its technology development programs.

TRL Calculator tries to measure technological readiness in "multi-dimensional" (although it is recognized that it still ignores many other important dimensions regarding technological maturity). TRL Calculator uses two other dimensions namely:

- Manufacturing readiness level (MRL), which basically involves the readiness of technology related to its application in manufacturing, and
- Programmatic readiness level (PRL) related to "program" interests. This tool was then developed and as far as possible adjusted to the conditions of Indonesia and then modified into a Techno-Meter.

According to Ming (2011) in its concept that Innovation Readiness Level (IRL) is understood as a lifecycle of innovation consisting of two phases: technology development and market evolution. While the innovation process management explicitly contains 5 key aspects: technology, market, organization, partnership and risk. The IRL concept can be mapped in relation to the innovation process theory (TRL, Diffusion of Innovation Theory, Market Adoption Model and Product Life Cycle of Innovation) as shown in the table below:

Table 2.2 Mapping of TRL Relations and IRL Concepts

Phase / Aspect	Technology Development			Market Evolution		
	IRL 1 Concept	IRL 2 Component	IRL 3 Completion	IRL 4 Chasm	IRL 5 Competition	IRL 6 Changeover/ Closedown
Technology	TRL					
Market				Diffusion of Innovation Theory Market Adoption Model Product Life Cycle of Innovation		

While Tao illustrates the relationship of IRL with the concept of innovation process theory (technology evolution - the S curve, Market Adoption Model or Diffusion Process) as shown below where the IRL concept is sometimes also known as the concept of Six "C" Scale (Concept, Component, Completion, Chasm, Competition, Changeover / Closedown) is a concept that describes the development or journey of a technology or research results from starting at the Concept level to becoming an innovation that is utilized and entering the market domain, which needs to think about the sustainability of the technology / product. Illustrations of a technology or research results that are still at the concept level can be aligned with the starting point of a technological evolution. Continuous improvement is very effective to increase competitive advantage. Continuous improvement should also pay attention to the level of final customer satisfaction (Simbolon and Santoso, 2021)

Innovation Readiness Levels	IRL 1	IRL 2	IRL 3	IRL 4	IRL 5	IRL 6
Title	Concept	Components	Completion	Chasm	Competition	Changeover/ Closedown

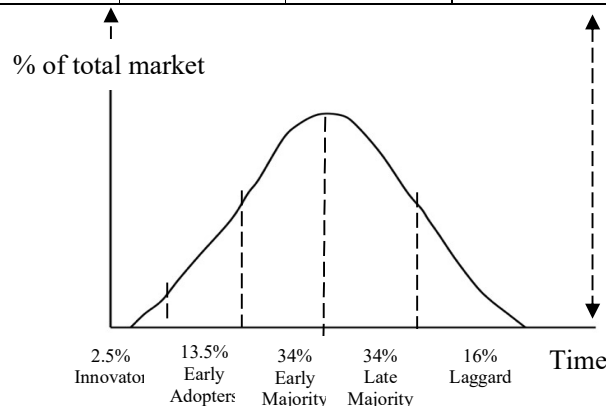


Figure 2.0.1. IRL Relations with S-Curve and Market Adoption Model
 Source: Tao (2008)

4. Material and methods

The objective of this paper is to put a comprehensive policy recommendation to provide adequate nutritional food from marine product diversification as an alternative option in combating food security challenges in the longer-term. The methodology includes primary and secondary data. Primary data is obtained from observation, questionnaires as well as in-dept interviews with related parties and documentation. While the secondary data is gained from systematic review on governments publications, reference books, journals, theses, internet, or other sources related to the issues. Furthermore, researchers conducted a series of studies and investigations in the field.

The data analysis was conducted through triangulation which involved researchers, business actors, government and experts in Focus Group Discussions (FGD). Technological Readiness Level (TRL) and Innovation Readiness Level (IRL) was analysed using TRL-Meter dan IRL-Meter to examine the maturity and readiness of a technology. The final ultimate of the research is to provide policy recommendation to related stakeholders regarding the development of FSPH by strategic partnerships with cooperatives and multi-stakeholders.

The method used is qualitative for public policy. Denzin K. Norman; Lincoln S. Yvonna (2009: 714), argues that the policy process is a form of qualitative method with the aim of discussing how the relationship between science appears in research and action is made. Policy making is a multi-dimensional action which has various aspects, so it requires adequate resource persons. Various literatures describe that decision-making related to policy as an event of a group of decision makers at a certain time and place to review a problem (or opportunity), consider a number of alternative patterns of action by taking into account the advantages and disadvantages of each option explicitly, weighing various alternatives accordingly. with the goals and priorities, and finally choose an alternative that is most suitable and is considered the best for realizing the goal. In research using quantitative methods here is more an attempt to fulfill the "function of enlightenment" than "function of engineering" (Janowitz, 171; Patton, 1988; Weiss, 1988 in Norman (2009: 716). Validity is carried out to strengthen qualitative research and is also used with expectations determine the findings accurately (Creswell & Miller, 2000 in Creswell, 2003: 196). Qualitative literature is used to explain the belief in "trustworthiness", "authenticity", "credibility". The data collection method that is also used in this research is the survey method because questionnaires and interviews are used to get the responses from the respondents who are sampled and to report the existing conditions according to the reality (Santoso, 2010).

This research is conducted through the following stages:

1. Conducting literature review, particularly related to Fisheries Sector Management, Protection and Recovery Program for Micro, Small, and Medium Enterprises, Creative Economy Sector Management, Innovation and Business Ecosystem Development: Technology Readiness Level (TRL) and Innovation Readiness Level (IRL)

2. Collecting data:
 - a. Primary data: through conducting direct observation, field study, interviewed and coordination with related stakeholders. Due to Coronavirus outbreak, several activities that are previously planned to be conducted directly is now done virtually through virtual conference meetings, which coordinated and implemented by partners, namely the Fishery Product Downstream Sector, the Coordinating Ministry for Maritime Affairs and Investment.
 - b. Secondary data: through documentations, records, and publications
3. Conducting data analysis, through:
 - a. Data Presentation. It is done through processing the results of interviews and data collection and reviewing the FGD resource persons for the continuation of the FGD results.
 - b. Triangulation. Triangulation in credibility testing is conducted through checking the data from various sources in various ways and at various times. Triangulation of multiple researchers involve several researchers in the analysis process in Focus Group Discussion (FGD) which generates several inputs for the solutions of the problems under study. After that, the triangulation is conducted through recommendation analysis of the previous several alternatives of solution about Fisheries Sector Management, Protection and Recovery Program for Micro, Small, and Medium Enterprises, Creative Economy Sector Management, Innovation and Business Ecosystem Development.
 - c. The next step is to measure the technological readiness with Technology Readiness Level (TRL) measurement. TRL is a systematic measurement system that supports the assessment of the maturity or readiness of a particular technology and the comparison of maturity or readiness between different types of technology.
 - d. After determining the TRL, then we measure the Innovation Readiness Level (IRL).
4. The last step it to formulate policy recommendation for establishing co-operation with the extract innovation industry value chain.

The main writing strategies:

1. Triangulate or examine data from various sources in various ways and times to build a coherent justification.
 - Data sources: Business Actors - Government - Experts
 - Data and information collection techniques are obtained through: semi-structured interviews and questionnaires. Semi-structured interview is a type of interview in the category of in-dept interview questionnaire, and FGD
2. Qualitative data accuracy checks are carried out: Observation to the field & Stakeholder-supported meetings; Exposure from business actors, Local Government (Pemda) and community leaders
3. The description of the findings is obtained from the report which contains an explanation regarding each creation factor in the fisheries supply chain in the development of fish protein hydrolyzate clusters such as technological readiness and readiness for innovation in both written form and visual presentation. Business actors, local governments and community leaders have empirically expressed the elements conveyed in formal and informal talks.
4. Environmental conditions that are less supportive are also found in field reviews, formal talks, and informal talks as expressions of honesty on facts in the field which are also recorded by the researcher. Companies in Indonesia can improve operational management by using corporate facilities in an environmentally friendly way and regulate supply chain system that carries a green concept (Dewi, et.al, 2021)
5. Negative information found in the field that is inconsistent with or against the theme: The quality of supply of seafood products is low, National fish logistics operations need to be improved, Limited supporting infrastructure in fish production centers causes a high cost economy in the fishing industry, High logistics costs, High price disparity.
6. In-depth understanding of the phenomena studied is carried out through fisheries business actors in the field and local government and fisheries community leaders with which researchers communicate intensively and conduct field observations, conduct interviews, hold discussion forums to present stakeholders and experts.
7. In order to improve the accuracy of the data, the researcher tries to get a second opinion from parties who are not directly involved in the field of fisheries operations. Researchers ask questions about qualitative studies as a second opinion to people who are deemed worthy to enrich the findings. Researchers use personnel who serve as external auditors to review the entire project and provide project appraisals during the process and research.

Assessment on the value of TRL or IRL is performed using the Indonesian Minister of Research, Technology and Higher Education regulatory instruments regarding TRL and IRL. Conceptual definition is a limitation of problem variables to be used as guidelines in this research to simplify the research process in the field later on. To understand and facilitate the interpretation of many theories in this study, several conceptual definitions related to what will be examined will be determined are based on Regulation of the Minister of Research and Technology Republic of Indonesia Number 42 of 2016 concerning Measurement and

Determination of the Level of Technology Readiness and Regulation of the Minister of Research and Technology Republic of Indonesia Number 29 of 2019 concerning Measurement and Determination of the Level of Innovation Readiness.

5. Results and Discussion

Fish Protein Hydrolyzate, a fish and sea cucumber derived animal protein which is a progressive example on how MSMEs business develop. The hydrolyzate is produced from the breakdown of fish protein containing smaller peptides and amino acids due to the hydrolysis process by enzyme (Venugopal, 2016). To increase the added value of low economic value fish, such as tilapia (*Oreochromis mossambicus*) is by utilizing it into Fish Protein Hydrolyzate (Ariyani et al., 2003). The use of fish protein hydrolyzate in the food industry, among others, is for fortification into non-allergenic food formulations for infants and dietary food supplements, as well as emulsifying agents (Nurhayati et al., 2007). Pedersen (1994) suggested that protein hydrolyzate can be used as a flavor enhancer for various food products. The study showed significant improvements in malnourished children by using the Amizate, a protein hydrolysate from a salmon fish (Nagalakshmi et al., 2011). The results of in vitro and in vivo study show that fish protein hydrolyzate can improve digestibility and provide a significant contribution to weight gain, digestibility, and protein absorption (Chasanah, 2020).

Several important points in Strengthening the Coordination of Fish Protein Hydrolyzate and Other Fish Raw Materials (FGD note)

- Strengthening coordination in the context of developing and industrializing fishery and marine products based on partnerships
- Diversification of high protein products made from fish and their advantages
- It is necessary to develop clusters in the fisheries sector and the biotechnology industry. In the context of upscaling and industrializing HPI and other fish-based products, it is necessary to measure the Technology Readiness Level (TKT) and the Innovation Readiness Level (IRL).
- According to research conducted by researchers from the Ministry of Marine Affairs and Fisheries, HPI has a higher content of essential amino acids when compared to proteins derived from milk and soy. So far, PMT food ingredients use protein derived from milk, soybeans and have not included elements of fish.
- Another study by IPB University researchers stated that fish-based products have similar benefits that can be diversified into nutritious, high-protein biscuits to help malnourished children and as supplementary feeding.
- Innovator Partners (KF) welcomes and fully supports the inclusion of fish protein as an alternative source of protein in the community. KF will absorb 80 tons of HPI per month (strengthened by the MoU), so that the HPI market is guaranteed where the HPI supply is still 2 tons per month in the Riau Islands. In addition, Kimia Farma welcomes the innovation of fishery products, but until now Kimia Farma only absorbs concentrate.
- PT. IMK as a company that carries out upscaling and industrialization of HPI is ready to collaborate with fisheries cooperatives and other potential areas interested in carrying out HPI development through a partnership scheme (upstream to downstream integrated model).
- Utilization of fish raw material (trash) into HPI can increase the added value with the potential to increase the income of each fisherman of Rp. 1.5 - 2 million per month. Besides, the company buys raw materials at a price of Rp. 3000 - 5000 per kg (Rp. 1000 - 2000 per kg) at the Indramayu factory.
- The Ministry of Cooperatives and SMEs supports a partnership model that is built between business actors (corporations / companies) and fisheries cooperatives in developing HPI in Indramayu Regency so that it can increase the added value of fishermen's catch, where the company will absorb fishermen's fish at prices above market prices.
- The Ministry of Cooperatives and SMEs convey the need for a cooperation model that synergizes business actors, cooperatives, ministries / institutions / agencies / local governments. The Ministry of Cooperatives and SMEs hopes that by offering various schemes by the company it can attract cooperatives who want to partner in developing HPI products.

In order to produce a high valuable product of Fish and Sea Cucumber Protein Hydrolyzate (FSPH), the technology application is required to ensure the aspect of safety and nutrition. The technology for producing FSPH is currently being developed by PT. Aruna Industri Bintan. After TRL and IRL assessment of the technology, conducted by questionnaire and interviews, the machine is classified into TRL 9 or equivalent with IRL 3 which means this machine has added value for the products. For that reasons, the technology is stable and ready to be commercialized for full production of the FSPH. In supporting the development of marine and fisheries industry, the Coordinating Ministry of Maritime Affairs and Investment (CMMAI) has coordinated with related ministry and institution to formulate strategy in building innovation-based entrepreneurship of FSPH. Furthermore, the coordinating ministry also proposed policy recommendation to include FSPH as an additional meal to prevent stunting in the Ministry of Health Regulation Number 51 of 2016 concerning Standard Nutrition Supplementation Products. The Ministry of Cooperatives and Small and Medium Enterprises (SMEs) also supports the development of FCPH through establishment of the potential fisheries cooperatives,

strengthening institutions, conducting coaching and training, also facilitating access to financing.

The Ministry of Cooperatives and SMEs supports a partnership model that is built between Aruna Industri Bintan and fisheries cooperatives in developing FSPH in Indramayu Regency. Hence, it will increase the added value of fish obtained by fishermen where company will buy the fish with a higher prices. In addition, the ministry conveyed the need of collaboration between business actors, cooperatives and government agencies as well as the village-owned enterprises. This scheme is expected to attract the cooperatives which have intention in partnering to develop FCPH. The Ministry of Health also encourages the utilization of FCPH in integrated healthcare center (Posyandu) and promoting the importance of fish meal-based snacks for preventing stunting. The Ministry of Villages, Underdeveloped Regional Development and Transmigration (MVURDT) support the products from private company is thus processed by village-owned enterprises to produce cakes / snacks for children. The ministry also facilitates the use of village-owned enterprises funds to become a center for integrated fisheries areas.

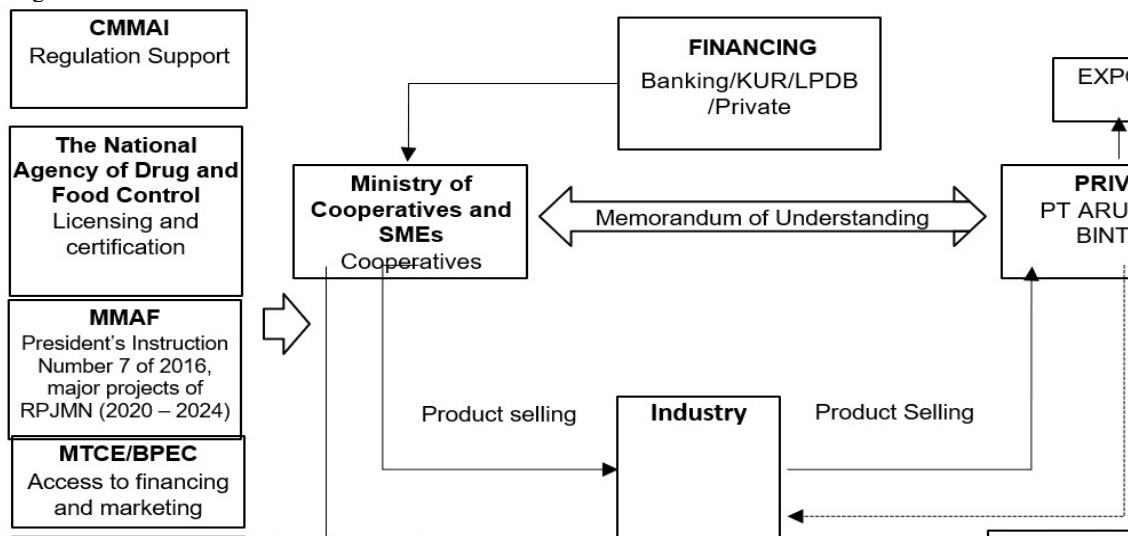


Figure 6.2. Example of Fish and Sea Cucumber Protein Hydrolyzate partnership (modified)

The Ministry of Maritime Affairs and Fisheries (MMAF) provides regulatory and management support for fisheries and marine products and certification for Good Fish Processing Methods (CPIB). The National Agency of Drug and Food Control provides licensing support and product certification as well as business assistance for FCPH products in order to meet the requirements for food product distribution permits and export opportunities. The Ministry of Tourism and Creative Economy (MTCE) provides access to financing for working capital and investment in business expansion and existing market access. Furthermore, the local governments have a big role in providing business licenses, institutional development, and cooperative businesses, and looking for opportunities for cooperation between local governments and the private sector in expanding the FCPH market in their respective regions.

6. Conclusion

Strengthening coordination in the context of developing and industrializing fishery and marine products based on partnerships, the need of collaboration between business actors, cooperatives and government agencies as well as the village-owned enterprises. This scheme is expected to attract which have intention in partnering to develop FSPH as Model Development of Fish and Sea Cucumber Protein Hydrolysates in Indonesia. It is necessary to develop clusters in the fisheries sector and the biotechnology industry. In the context of upscaling and industrializing HPI and other fish-based products, it is necessary to measure the Technology Readiness Level (TKT) and the Innovation Readiness Level (IRL). The business actors have successfully developed the technology with TRL 9 or equivalent to IRL 3 that is able to increase the added value in the processing of fish into hydrolysate.

7. Recommendation

The decision makers that the development of FSPH innovation based - entrepreneurship is best conducted through strategic partnerships by multi-stakeholders from central to local government in conducive ecosystem to accelerate the national economic growth. the local governments have a big role in providing business licenses, institutional development, and cooperative businesses, and looking for opportunities for cooperation between local governments and the private sector in expanding the FCHP market in their respective regions.

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