

Mitigation of Wetland Conversion Risk in Post-Harvest Phase to Optimize Staple Food Availability

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Abstract: The wetland conversion is completely a risk which induces staple food scarcity and needs proper mitigation. This research was conducted in Indonesia, aims to decide a complete Wetland Conversion Risk (WCR) mitigation, majorly in post-harvest phase, to optimize staple food availability. Following, House of Risk (HOR) logical analysis, the research identified qualitatively the event of WCR based on farmer condition, WCR agents and finally, the probable WCR mitigation. The Likert scale measurement revealed five main WCR events. The HOR-1 analysis pointed out, the absence of control mechanism to get balance profit between agricultural and non-agricultural sectors is the main agent needs priority to mitigate. In light of HOR-2 analysis, the main WCR mitigation is controlling rice distribution from farmer to consumer, improving the aids for farmer and purchasing rice from the farmer by reasonable price. The agricultural extension should be based on such mitigations.

Key words: WCR event, WCR agent, WCR mitigation, HOR-2, distribution, agricultural extension

INTRODUCTION

The Indonesian effort to get a status of food secure country should have to pass through the steep and winding path. Based on the indicator of food affordability, availability and quality, The Economist (2012 and 2013) placed Indonesia at the rank of the 64th and the 66th as the less food secure state from 105 countries in 2012 and from 107 countries in 2013 selected by the Economist. In the year of 2014 and 2015 the same institution and based on the same indicators, put Indonesia at the rank of the 72th in 2014 and dropped to the 74th from 109 countries in 2014 and 2015 (The Economist, 2014 and 2015). The Indonesian position got significant progress in 2016 in which Indonesia got back to the rank of the 71st from 113 countries. The Economist (2016) recognized the Indonesian effort with the score of 2.7 as the higher improvement in the world. However, the appreciated effort of Indonesia has not succeeded to bring the country penetrating the rank of the 30's. For a comparison within the period of 5 years (2012-2016), Malaysia has gotten position of the big 30's as the food secure country and has left Indonesia far behind. Within the ASEAN countries minus Singapore in which it has become the big five of food secure countries in the world and Laos which has gotten the lowest position by its rank of the 103th the

Indonesian position got the rank of the 5th and the 4th after Malaysia, Thailand, Cambodia and Vietnam in 2012 and after Malaysia, Thailand and Vietnam in 2016 (Table 1). By the fact, Malaysia has gotten the upper position in ASEAN after Singapore; and Vietnam surprisingly will be a new comer as food secure country.

For the food unsecure state, The Economist (2015) emphasized the importance of "mitigation" as valuable key word to get food availability in affordable condition. The suggestion of course brings the critical question up about the major crisis in food agricultural field in Indonesia. Relevant with the context, FAO (2014) pointed out, the wetland use change is the main critical point that would disturb Indonesian food availability. It is right, the Indonesian wetland has decreased from 16704 272 in 1983 to 14139895 in 2003 and dropped to 8685888 in 2013 (NDPA., 2014). The growth need of infrastructure, housing and industrial estate are the risk induce the wetland conversion as the external factor outside the farmer. But the risk should also be traced to the farmer socio-economic condition as internal factors, especially in post-harvest phase that gives significant effect to the farmer attitude toward the land that will bring to the wetland use change.

The main reason for the risk of wetland use change, referring to Rahardjo (2014) is the peasants are in the

Table 1: Rank of global food security index in ASEAN countries

Countries	Global Food Security Index (GFSI)										Global food security improvement index				
	2012		2013		2014		2015		2016		2012	2013	2014	2015	2016
	R	I	R	I	R	I	R	I	R	I					
Indonesia	64	46.8	66	45.6	72	46.5	74	46.7	71	50.6	-	-	0	0.1	2.7
Malaysia	33	63.9	34	64.5	34	68.0	34	69.0	35	69.0	-	-	2.0	0.7	0.1
Cambodia	51	52.3	89	31.3	96	33.1	96	34.6	89	39.8	-	-	0	0.7	2.2
Myanmar	78	37.2	74	40.1	86	37.6	78	44.0	80	46.5	-	-	-4.1	7.7	2.7
Thailand	45	57.9	45	58.9	45	58.9	52	60.0	51	59.5	-	-	0.5	-0.3	0.5
Vietnam	55	50.4	60	48.6	67	49.1	65	53.3	57	57.1	-	-	-0.2	4.2	1.2
Philippines	63	47.1	64	46.9	65	49.4	72	49.4	74	49.5	-	-	0.3	0.3	0.4

Processed from The Economist (2012, 2013, 2014, 2015 and 2016), R = Ranking, I = Index

process of change from the social to economic rationality and they have strong tendency to the commercial-capitalistic on their view on farmland. Actually, the trend of changes has been existing since 1980's or even earlier. Garcia (1985) has described the penetration of money economy in paddy production centers of Indonesia as part of the trend of Southeast Asian villages. Quoting Smelser, Garcia (1985) revealed, the subsistence peasant have started decaying and replaced by market-oriented farmer. Dwipradnyana's research in Tabanan, Bali revealed, more than 75% of respondent-farmers agree and strongly agree that agricultural land is an economic commodity. The research itself indicated a strong tendency of the farmer to leave the agri-field to sell their wetland and let it converted by the other sides. More than 75% of respondents agree and strongly agree that land conversion is able to solve the economic problem faced the farmers (Dwipradnyana, 2014).

The small income of the peasant and the imbalance revenue between agricultural and industrial workers could probably let the peasant feel dissatisfied and disappointed, especially in post-harvest process. In the period of 2004-2014, for the macro level referring to NDPA (2014), the agricultural sector's contribution to GDP is about 14% whereas in the same period the number of workers who depend on the agricultural sector is about 35%. It is a strong indicator of the existed gap income between agri-field worker and the other sectors. For more detail, the trend of revenue imbalances has occurred since 1970s. Krisnamurthi (2006) exposed the income of the Agricultural Sector Workers (ASW) in 1970's is not much different from the income of Industrial Sector Worker (ISW). However, within 30 years, the income of ISW increased three-fold compared to the ASW. This trend is based on the fact that the agricultural sector's contribution to GDP declined from 70% in 1970s to 30% in early 2000s. However, the decreasing contribution of agricultural sector to GDP is not followed by a declining of ASW number. Therefore, working on paddy farmland has no appeal for farmers or landowners who are profit

and business-oriented. More than 80% of sample-farmers in Dwipradnyana's research agree and strongly agree that paddy-agri-land is unable to provide an expected income.

The income dissatisfaction encourages more farmers to leave the farmland. More than half of respondent-farmer agree and strongly agree that the land for housing is more benefitted (Dwipradnyana, 2014). It is not amazing, referring to Irawan (2016) exposed that the revenue ratio between land for agriculture and other usage in 1996 by indicator of rental value is 1:622 for housing estate; 1:500 for industrial estate and 1:14 for tourism area. Many researches also indicated that the farmers have earned more income after wetland conversion (Asmara, 2011; Barokah *et al.*, 2012; Handari, 2012). For such reason, the risk identification and the risk mitigation is inevitable, especially in post-harvest process as the main source of farmer dissatisfaction and disappointed. The identification should be conducted in paddy production center which gets experience of massive wetland conversion.

The research objective: By the fact and condition, the flow of wetland conversion is most likely unstoppable and Indonesia will face the risk of farmland sustainability and staple food insecure. Therefore, the aim of the research is to decide the priority of WCR mitigation, mainly in post-harvest phase which directly could be applied to get a status of Indonesia as food secure state within the ASEAN countries as well as in the world.

The framework analysis: This study aims to maximize the effort to get high level of staple food availability and food quality in affordable condition by identifying Wetland Conversion Risk (WCR) and probable mitigation. The WCR could be identified in Supply Chain (SC) approach in which the risk is detected in each stage of SC process. According to Chim *et al.* (2017), SC is the effort of organization to produce and deliver a finished good from supplier's supplier to customer's customer. For more clear, referring to Chim *et al.* (2017) emphasized, SC is a network consist of all parties involved such as

manufacturer, supplier, retailer and customer-directly or indirectly in manufacturing and delivering products or services to ultimate consumers both in upstream or downstream sides through physical distribution, flow of information and finances. The optimization of SC process will get succeed to provide right product at the right cost, right time, right quality and right quantity (Chim *et al.*, 2017). Another research indicates that the steps of SC management have significant effect on total production, competitiveness and organizational performance (Nozari and Mojdehi, 2016).

The above mentioned definition and the benefit of SC are originally and commonly used in logistic management to optimize product processing and distributing. However, the SC could innovatively be implemented as an approach to optimize certain consciousness in related field. Maman and Mahbubi (2016) got succeed to adopt the SC model to identify halal risk and its mitigation to guarantee the halal status in abattoir beef manufacturing. The recent research let the SC stages to detect the environmental risk and its mitigation to encourage the mindset of green environmental consciousness (Kit and Jamal, 2017). For such innovation, the risk identification is a valuable keyword in each stage of SC process and mitigation could possibly be decided by considering the weight of each identified risk. Related with the context, the SCRLC (2011) emphasized the importance of risk identification, risk analysis, risk evaluation and finally risk treatment.

Based on the above innovation, the SC Model is a proper approach to mitigate WCR in which the detail of risk could probably be detected in three phases of paddy cultivation process in the pre-cultivation, the cultivation and plant maintenance and in the post-harvest phase. But previously, the risk in this context should be clearly defined. Unfortunately, Baranoff *et al.* emphasized, the risk is not easy to define but in general, the risk contents the meaning of uncertainty that affects the unexpected condition, such as a damage of asset, loose of the company and unsuccessful target from the low to upper situation. Sotic and Radenko (2015) exposed rather the same phrase that the risk could be defined based on the probability, expected value, uncertainty and the objective of the action in which it comes to unpleasant condition. Related to previous expression, Ajupov *et al.* (2016) pointed out, the risk is the action or condition that has a possible adverse effect and could happen in all condition. For Omar and Din (2017), the important keyword of the risk is the existence of "a negative impact". However, the level of unpleasant and the volume of disadvantage is relating to the decision making based on the specific condition. The level of lose for certain people is

extraordinary but for the other, the grade of lose is still reasonable. The risk level, according to Sotic and Radenko (2015) is sometime based on people perception in which the outcome is different with planned, desire and expected result.

About the scope of the risk indirectly can be categorized into the macro and the micro level based on its coverage to the national stage and the individual, family and the small company. The shortage of staple food as the risk aroused by wetland conversion covered the nation (FAO., 2014). The risk of the nation is, of course, a gradual accumulation of risk on the all sides related to the life of the nation. The research by Fujimoto (1996), Neef (1999), Nabangchang and Srisawalak (2008) and Susilawati and Maulana (2016) which is strengthened by NDPA (2014) affirmed the thesis that the agri-food in Indonesia is a family farming which is indicated by the small size of paddy wetland farming. The small farmers are responsible for food availability. The source of food crisis as a national risk and caused by wetland conversion, therefore should be detected in farmer condition. The farmer condition and tendency to leave the farming land is serious risk that needs a complete mitigation.

Mitigation could be defined as a program or certain activity to reduce negative impact (Hasan *et al.*, 2017). Referring to Pujawan and Geraldin (2009) suggested that mitigation action could be in form avoidance of risk, control, cooperation and flexible action. The flexible way of risk mitigation as the last alternative in the Juttner's perspective (Pujawan and Geraldin, 2009) is mostly a suitable way to mitigate the WCR due to close to human awareness and behavior. The WCR mitigation can flexibly be in the form of encouraging certain awareness, innovativeness, behavior and changing of farmer behavior as well as combination between promoting and changing awareness and behavior consistently along the SC flow.

Following the SC flow and logic, paddy production is begin by germination and nursery and tillage as a phase of pre-cultivation in which it is followed by the phase of cultivation and plant maintenance. The final phase is harvesting, post-harvest processing and production selling (Fig. 1). The WCR of course should be traced in each stage of paddy production process, especially in post-harvest phase because the farmer dissatisfaction and the feel of disappointment could probably be getting stronger in this stage. The crop failure is an important Risk Control Point (RCP) in post-harvest process to detect the coming of WCR event from the farmer inside. Feder *et al.* (2004) realized that the Integrated Pest Management (IPM) program as the major activity of Farmer Field School (FFM) although, within its heyday in

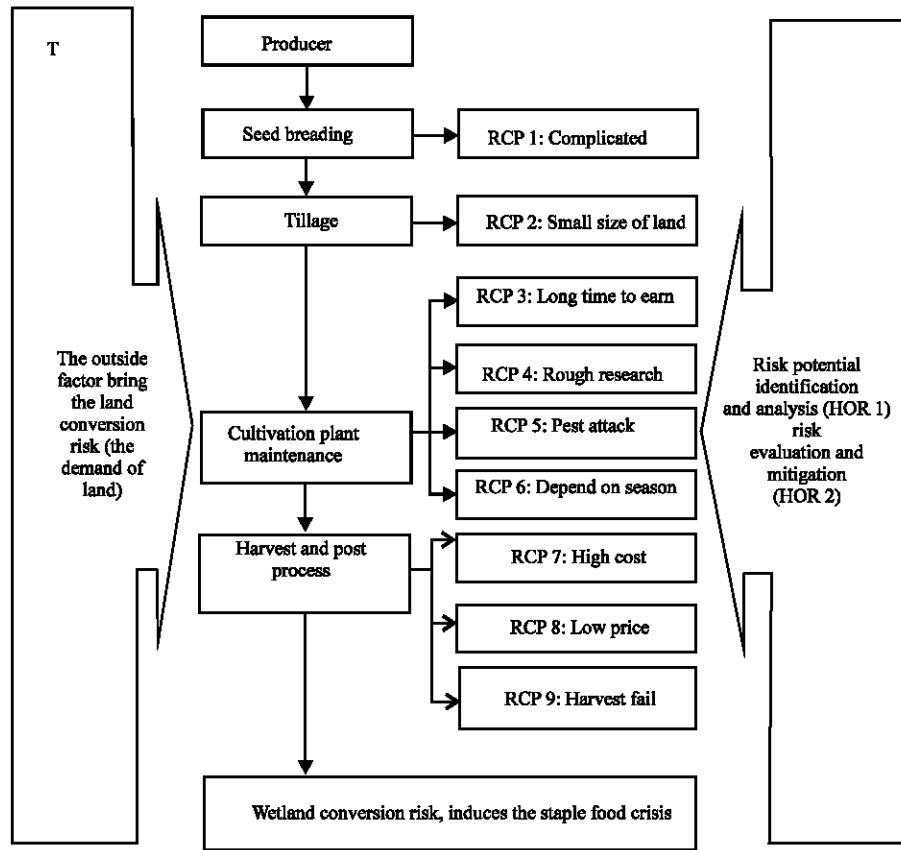


Fig. 1: Wetland conversion risk framework analysis

the 1980's until the early 2000's has gotten less successful to prevent the pest attack and plant disease as the main cause of harvest fail.

The cheap price of paddy product could also be placed as another RCP in post-harvest phase. The revenue imbalance between agricultural worker, especially paddy farm employee and industrial worker (Krisnamurthi, 2006) is majorly because of the cheap price of paddy product and the high cost for the common farmer. The research by Asmara (2011), Barokah (2012) and Handari (2012) in which it pointed out the increasing income of farmer who are daring to sell and convert their farmland have strengthened the assumption that cheap price of paddy product is an important RCP to detect the WCR event from the inside of farmer. Therefore, based on two HCPs as a "stone corner" to watch the surrounding areas, the study tries to identify qualitatively and quantitatively the probable WCR events, the agents of WCR and WCR mitigation.

The items of WCR mitigation in which it includes promoting and changing a behavior tendency should become a strategic planning for Farmer Field School (FFS) agricultural extension model. The recent research

revealed, that FFS approach in which the farmer gets a free dialog, field direct observation and come to self-decision making could effectively disseminate the equal knowledge within heterogeneous farmers as well as the awareness of innovation (Maman *et al.*, 2015). Anandajayasekaram *et al.* (2007) emphasized that the principles of FFS program such as dialog, field observation, knowing the real problems and self-decision making could be picked up and implemented to encourage the farmer's awareness and solve their problems. Based on the suggestion, the WCR mitigation should be integrated completely in FFS model of agricultural extension. Therefore, the strategic planning of WCR mitigation based on FFS approach optimistically will get succeed to optimize awareness of farming innovation and farming sustainability toward staple food availability as the research's ultimate goal.

MATERIALS AND METHODS

The logic of research methodology: The research methodology followed the HOR (House of Risk) logic

developed by Pujawan and Geraldin (2009) to reveal the risk mitigation based on rank of agent of risk that should be prioritized to control and also based on the difficulty to perform the action of mitigation. The agent of risk in this context is a condition, an action or a perception encourages the coming of the risk.

For such logical framework, the research identified qualitatively the WCR potential and the probable agents of risk in post-harvest phase. The next step is determining each agent's contribution quantitatively by HOR phase one analysis to the coming of WCR. The process will present the prioritized agents of risk to mitigate in which it is visualized brightly in Pareto diagram.

Research sample and location: Based on the supply chain approach from pre-cultivation to post-harvest stage, the sample is not based on the representation of the population but to browse depth issues about WCR, the agent of risk and the probable mitigation. Referring to Bryman and Bell (2007), the non-probability sampling could be implemented based on the assumption that the sample is able to explain completely the related issues. The samples of the research are heads as well as prominent members of farmer groups and staffs of local Agricultural Service District (ASD) which the total samples are 60 persons.

Related to the purpose of the study, the research should have to be conducted in the paddy-farming center that has had the experience of massive wetland use change. Therefore, the research took the case of Cianjur farming area, West Java, Indonesia that has such experience of wetland conversion (Apriyana, 2011).

Research stages: The research, methodologically has two main stages, mapping the WCR agent needs a priority to mitigate and deciding the action of WCR mitigation to control the WCR agents. To map the WCR agents in the form of aggregate risk potential, the research adopts the Pujawan and Geraldin (2009) as following:

$$ARP_j = O_j \sum_i S_j R_{ij} \tag{1}$$

Where:

- ARP_j = Aggregate of Risk Potential
- O_j = The Occurrence level of risk agent
- S_j = Severity level of risk event
- R_{ij} = The correlation of Risk agent_i to the risk event_j

Data collection and measurement: Based on the formula, from June to September 2016, the research qualitatively identified WCR event by in-depth interview and FGD. Furthermore, the research measured quantitatively the severity level of WCR event (S_j) in Likert scale. By the

same way, the research measured the occurrence level WCR agents (O_i) and the impact of the risk agent to the emergence of WCR event (R_{ij}) both in Likert scale. On the basis of the technique, the research comes to a mapping of WCR agent and its contribution to the coming of WCR event in the form of Aggregate of Risk Potential (ARP_j).

Data analysis: The next stage as the main aim of the research is to decide the rank priority of action to control the agent of WCR. The first step for that purpose is to count the total effectiveness of each action of mitigation (TE_k) by adopting Pujawan and Geraldine (2009) second stage of the house of risk logic and formula as following:

$$TE_k = \sum_j ARP_j E_{jk} \tag{2}$$

Where:

- TE_k = Total effectiveness of each action of mitigation
- AHRP_j = Aggregate of Risk Potential
- E_{jk} = The impact of mitigation strategy to prevent the agent of risk

The TE_k and D_k is a raw material to get ETD_k (the effectiveness to difficulty ratio) which is designed by following Eq. 3:

$$ETD_k = \frac{TE_k}{D_k} \tag{3}$$

Where:

- ETD_k = Effectiveness to Difficulty Ratio
- TE_k = Total effectiveness of each mitigation strategy
- D_k = Degree of difficulty to perform the action of mitigation

Complying with the equation, the research qualitatively identified the probable mitigation to control the agent of WCR. Based FGD and in-depth interview with the previous sources, the research measured the degree of difficulty to implement the action (D_k) and the impact of the mitigation to control the WCR agent (E_{jk}) in Likert scale and finally comes to prioritized WCR agent mitigation that practically could be applied.

RESULTS AND DISCUSSION

The wetland conversion risk in post-harvest phase: Based on the literature review, in-depth interview and also Focus Group Discussion (FGD) with the Agricultural Services District (ASD) staff and the leaders as well as the prominent members of farmer group, the research got succeed to collect the qualitative data about the behavior and condition of farmer that have a high probability to

Table 2: Wetland conversion risk in post-harvest phase

SCOR area	RCP	Code	Land conversion risk	S _i
Post-Harvest	High Cost (RCP-7)	E-19	Unwilling to farm because the cost burden of rice production is too hard for the farmer	7
Phase		E-20	Better to sell the wetland because the profit of paddy cultivation is small	7
	Crop failure (RCP-8)	E-21	Unwilling to farm because of fear of crop failure	7
		E-22	Better to sell the land due to the frequent of crop failure	5
	Low price (RCP-9)	E-23	Unwilling to farm due to the small profit of rice cultivation	5
		E-24	Better to sell the land and work outside agricultural field due to the probability of earning more	7
		E-25	Better to sell the land and buy in other areas, because of probably of getting a high margin between the selling and the purchase price	7
	E-26	Better to sell the land because the paddy production means price is imbalanced with the acquired profit	3	

Table 3: The agent of land conversion risk and its occurrence in post-harvest phase

SCOR area	RCP	Code	Agent of land conversion risk	O _i
Post-harvest	High cost (RCP-7)	A-19	The Government financial aids for paddy cultivation is still too small	7
Phase		A-20	Selling the land and change the profession gives the probable profit more than farming	7
	Harvest fail (RCP-8)	A-21	The farmer has not felt benefit from the harvest failure incentive	7
		A-22	The absence of routine incentive for farmer	9
		A-23	The absence of pension assurance for farmer	9
	Low price (RCP-9)	A-24	In paddy farming, the majority of profit is gotten by rice trader	9
		A-25	The product of food agriculture is too cheap	7
A-26		The absence of control mechanism to get a balance profit between agricultural and non-agricultural sectors	9	

induce the WCR and the structured interview in Likert scale quantitatively produced severity level of each identified WCR events (Table 2).

In the light of Likert scale, the farmer condition in the post-harvest phase aroused the tendency to sell the wetland and let it converted by other sides to other usage. The statement that the farmer is unwilling to farm because the cost burden of rice production is too hard for the farmer got a high score in which it means that the condition of the farmer affected them to have a tendency to leave the agricultural field and get other job.

The following two statements also have the probable impact to the coming of WCR. The two expressions are the unwillingness of the farmer to farm because of the fears of crop failure and it is better to sell the paddy wetland because the profit of paddy cultivation is small. Related to the previous statement and it also describes the farmer conditions is that for the farmer, it is better to sell the wetland and buyback it in other areas because it will probably to get a high profit margin between the selling and the purchase price due to the high demand of the land and the continuous rise of land price as the consequence. The last statement also gets high score in which it indicates the condition of the farmer that has actually had a high impact to emerge the WCR.

Agent of wetland conversion risk in post-harvest phase:

Browsing of the risk agent in post-harvest process by literature study, FGD and in-depth dialogue acquired at least eight probable agents of WCR (Table 3). Based on the “high cost” as the Risk Control Point (RCP), the research identified two agents, consisted of: the government financial aid for paddy cultivation is still too

small and Selling the wetland and change the farmer’s profession gives the probable profit more than farming. Related to the “high cost,” the next RCP as the stone corner to detect the risk is “harvest fail”. Based on this RCP, the research identified three agents of WCR in which it included: the absence of benefit feeling of the farmer from harvest failure incentive, the absence of routine incentive for farmer and the absence of pension assurance for farmer. The next two agents based on the RCP of “low price” is: the major profit in paddy farming has been gotten by rice trader, the price of agricultural food product is too cheap and the last agent is the absence of control mechanism to get a balance profit between agricultural and non-agricultural sectors.

The score of occurrence level of all agents are varied between seven to nine in which it indicated that all agents has had high probability to bring the event of the WCR. The consequence, all the agents should acquire the high attention in the effort to mitigate the risk. But the agents that get the score of occurrence of nine should get the highest attention. The “nine score” agent included: The absence of routine incentive for the farmer, the absence of pension assurance for the farmer, the imbalance profit between farmer and rice trader but the majority of the profit is acquired by the rice trader and the last is the absence of control mechanism to get a balance profit between agricultural and non-agricultural sectors. In the other phrase the four agents of risks are the major causes lead the farmer to feel dissatisfaction and disappointed in paddy farming cultivation process.

The land conversion risk level in post-harvest phase: In the light of HOR-1 analysis the research pointed out

Table 4: Proposed mitigation strategy in post-harvest phase

SCOR area	RCP	Code	Land conversion risk agent mitigation	D _k
Post-harvest phase	High cost (RCP-7)	M-18	Necessary to improve the aids for the farmer	5
		M-19	State owned land is main provider of staple food	5
		M-20	Optimizing crop failure incentive	5
	Harvest fail (RCP-8)	M-21	Providing the routine assurance and incentive	5
		M-22	Providing pension assurance for the farmer	5
		M-23	Controlling the rice distribution from farmer to consumer	5
	Low price (HCP-9)	M-24	Special market mechanism to control staple food distribution	5
		M-25	Government purchasing of staple food from the farmer at the reasonable price	5

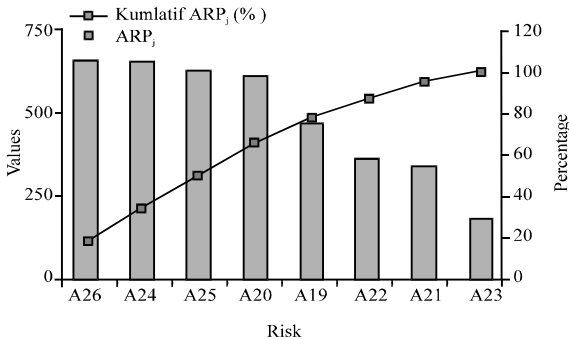


Fig. 2: The aggregate risk potential in post-harvest

5 agents of wetland conversion risk which accumulated 78% to the coming of WCR and it should be a priority to mitigate (Fig. 2). Actually, the research got succeed to accumulate eight potential agents that probably induced the coming of WCR but in detail the research proved 5 agents as the main factors toward selling and converting the paddy wetland usage. The absence of control mechanism to get a balance profit between agricultural and non-agricultural sectors (A26) is the main agent in which it contributed 17% to the coming of WCR. Related to the condition, the research also found and also as the main agent which contributed 17% to the coming of risk that in paddy farming, the majority of profit is gotten by rice trader (A24). In addition, the research also pointed out the other three agents in which each of them contributed 16% to the emergence of WCR. First, the food agricultural product is too cheap (A25). Second, selling the wetland and change the farmer's profession gives the probable profit more than farming (A20). The last main agent is the government financial aid for paddy cultivating is too small (A19). The research finding is valuable to control the tendency of WCR and to optimize staple food availability.

The land conversion risk mitigation in post-harvest phase: Based on FGD and in-depth interview, the research identified eight mitigations that probably performed to control the WCR in post-harvest phase (Table 4). The degree of difficulty to perform the action is relatively equal, according to the experience of the agricultural

extension services staffs and the leader of farmer group in the local context. The next step of the research is to select and choose the action that should be the priority of the actions.

The agent of WCR that should get attention to control is presented in the left side of Fig. 3. In the light of HOR-1 as presented in Pareto diagram (Fig. 2), the research pointed out five agent of risk. The core of farmer problems are the small and the less of their profit from the paddy farming in which it is imbalance between the profit got from rice farming and other business outside the paddy-cultivation. For more clear and detail, the agents are: Financial aids for paddy cultivation are too small, Selling land and change profession gives more profit, The majority of profit is gotten by rice trader, The product of food agriculture is too cheap and The lack of control to get a balance profit between agricultural and non-agricultural sectors. By controlling the five agent of risks, it will get succeed to mitigate more than 70% of WCR that would probably happen. Therefore, the five agents are the priority to mitigate to prevent the WCR.

In the light of HOR-2 Model analyses with considering ARP for each selected risk agent; the impact of proposed mitigation to prevent the risk agent measured in Likert scale, degree of difficulty to perform the action and finally come to Effectiveness to Difficulty ratio (ETD_k). The ETD_k gives brightly the information about the rank of priority of mitigation strategy. The first of three priorities of mitigation have close connection each other to solve the issue of dissatisfaction of paddy farming profit of the farmer. The detail mitigations are: The first is necessary to control the rice distribution from farmer to consumer. The consequence appears in the second priority in which it needs to improve the aids for the farmer. In addition to financial assistance, the research request to the government to purchase staple food from the farmer in the reasonable price.

The second of three priorities of mitigation are most likely designed to support the recommended previous mitigation strategy. To control the WCR, it is necessary to make a special market mechanism to control staple food

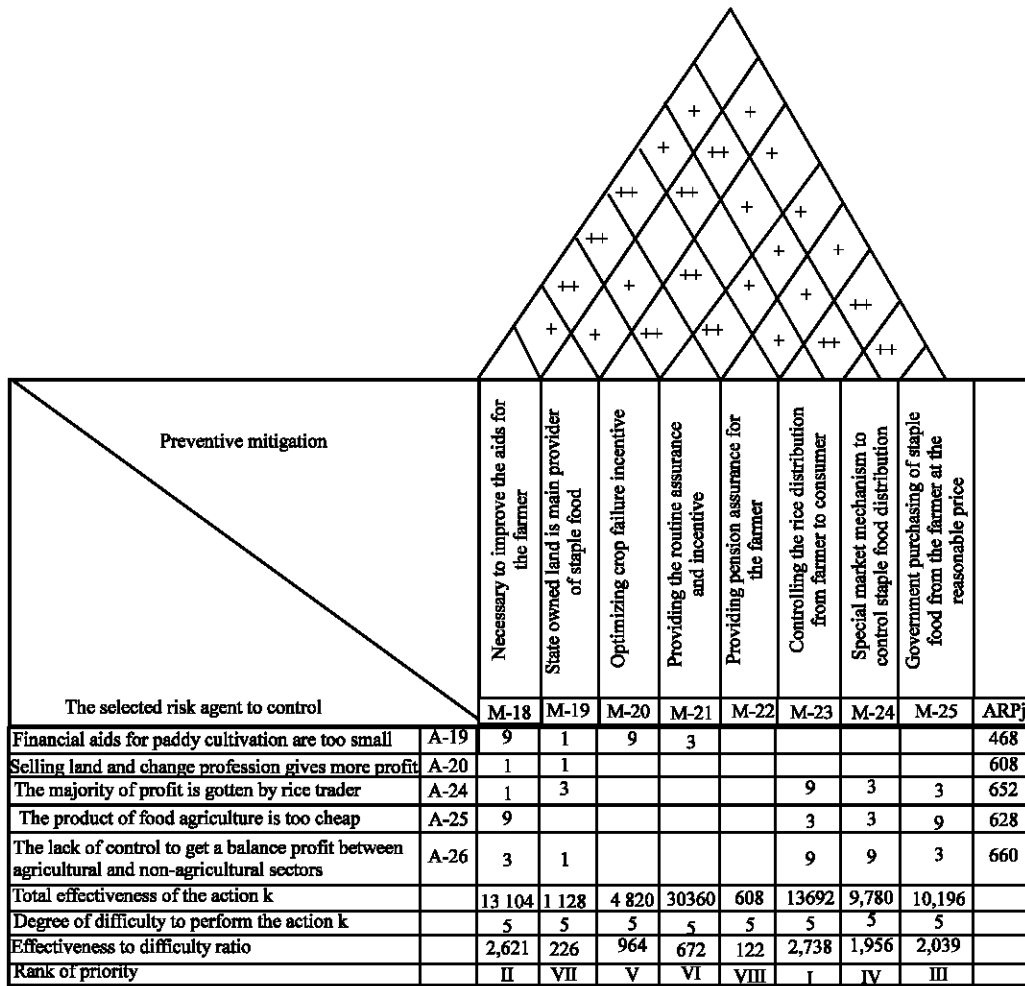


Fig. 3: The HOR-2 to plan the priority of mitigations

distribution and the rice price is not let competitively to the market mechanism. For the farmer, to make them more prosperously and seriously work in paddy farming, it needs to optimize the crop failure incentive and to provide the routine assurance and incentive.

But unfortunately, the routine incentive and the market control, it is not guarantee to get succeed encouraging the farming interest and maintaining the continuous land use change. Based on the assumption, the research proposed another important mitigation in which it is also included one of the priorities that is the state owned land should be the main provider of staple food supply. Preferably, food self-sufficiency is not a burden of the farmer but it is charged to the government budget, included land procurements, land management and product distribution. In other words, providing the staple food is not let to the farmer but entirely controlled by the government.

CONCLUSION

The risk events that had high impact toward land conversion risk is: unwilling to farm because the cost burden of rice production is too hard, better selling the land because the profit of paddy cultivation is small, better to sell the land and work outside agricultural field because of the probability of more earning, better to sell the land and buy in other areas because it will probably to get a high margin between the selling and the purchase price. The main agents of the risk that should be prioritized to mitigate is: the lack of control to get a balance profit between agricultural and non-agricultural sectors; the majority of profit is gotten by rice trader; the product of food agriculture is too cheap, selling land and change the profession gives more profit than farming and less of the government financial aids for paddy cultivation. While the prioritized mitigation strategy is: the need to control rice distribution from the farmer to end

consumer, the necessary to improve the aids for the farmer, the government has to purchase staple food from the farmer at the reasonable price; the distribution of staple food is not let to the market mechanism and the government should have to manage the state owned land as main provider of staple food for the people.

IMPLEMENTATIONS

The research suggests to change the government policy toward staple food procurement from the private orientation to the government orientation in which the government should be the center of food procurement and distribution and it include the subsidy type from the mean production subsidy to staple food price subsidy. The research also suggests to change the agricultural extension model from dissemination of innovation by various methods to encourage the farmer's awareness about the importance of mitigation toward food availability. It can be implemented in FFS Model of agricultural extension.

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