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Analysis of Rice Fields Conversion to Improve Control Strategies: A SWOT Framework

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Abstract. Rice fields are the leading supplier of rice in Indonesia. The conversion of rice fields is a severe problem that needs to be addressed to support food security. This study aims to formulate a strategy to control the conversion of rice fields in Pematangsiantar City. We conducted a comprehensive SWOT analysis, identifying the strengths, weaknesses, opportunities, and threats to control rice field conversion. This analysis was based on focus group discussions and in-depth interviews with 24 key respondents. Based on the evaluation matrix of internal and external factors and the strategy matrix, the strategies to control rice field conversion are aggressive (SO strategy), adaptive (WO strategies), and competitive (ST strategies). The main strategies are regulatory consistency, incentive, and disincentive systems, preparation of LP2B Perda, consistency in issuing non-agricultural sector permits, and institutional capacity building of rice farmers. This research is the latest comprehensive study in formulating control strategies for rice field conversion in Pematangsiantar City. The contribution is a strategy that can be used as an action program to control the conversion of rice fields. Implementing the strategy requires technical and political will from all stakeholders, especially local government, legislators, and farmers.

Keywords: conversion; incentives and disincentives; regulation; rice fields; control strategy; SWOT analysis

INTRODUCTION

Rice is still the primary food in Indonesia. Per capita, rice consumption is still relatively high. Per capita rice consumption reached 94.38 kg/capita/year in 2021 (Sabarella et al., 2022). Providing rice is a priority for agricultural development to maintain food security. Food security is a condition of food fulfillment for the state up to individuals, which is reflected in the availability of sufficient food, both in quantity and quality, safe, diverse, nutritious, equitable, and affordable and does not conflict with the religion, beliefs, and culture of the community, to be able to live healthy, active, and productive lives sustainably (Undang-Undang Nomor 18 Tahun 2012 Tentang Pangan, 2012).

Rice fields are the leading supplier of rice in Indonesia. More than 90% of national rice production is from rice fields (Liana et al., 2022). According to Marwanti et al. (2023), national rice production in 2022 was recorded at 55.67 million tons, an increase of 2.31% from 2021. The increase in rice production has yet to meet national rice needs, with population growth of 1.2% per year and a land use conversion rate of 96 thousand hectares yearly. North Sumatra Province is Indonesia's seventh-largest rice producer (BPS, 2023). The food security strategy is to maintain the area of rice fields and increase productivity. Food security is a strategic aspect considering population growth and declining quality of agricultural land (Pujiati et al., 2020).

However, the conversion of rice fields has increased from year to year. Official data on changes in rice fields could not be obtained, so the area of rice fields was approached with data on the area of rice harvest. Based on data from 2013 to 2023, the conversion rate of rice fields in Pematangsiantar City reached 22.44% per year. The rice harvest area reached 3,615 hectares in 2013, decreasing rapidly to 2,393 hectares in 2023. There is a decrease in the area of rice fields by 122 hectares per year (BPS Pematangsiantar, 2024). The conversion of rice fields is a significant problem and requires attention to the sustainability of agriculture and community life (Suardi et al., 2023). The conversion of agricultural land determines capital and

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political power. The lack of government support and guidance causes land conversion to be less transparent (Rochadi et al., 2022). The pattern of conversion of rice fields is divided into two parts: rice fields turn into dryland agriculture, and rice fields turn into developed land (Mahardika et al., 2021). The potential of rice fields is getting lower due to conversion into housing and non-agricultural activities (Rusyantia et al., 2010).

The driving factors for agricultural land conversion are productivity, farmer income, land value, agricultural land policies, water resources, production costs, and prices of agricultural commodities (Pratomo & Wijayanti, 2023). The causes of land conversion are an increase in family members, community expenditure, and a decrease in young people's interest in the agricultural sector (Adi et al., 2022). Land use change is caused by input costs, irrigation costs, production costs, regional accessibility, rental prices, production values, selling and land prices, the number of farmers, the population, and economic growth (Firmansyah et al., 2021).

Land conversion continues to occur due to regional development. Land conversion converts productive agricultural land into built-up land (Iemaaniah et al., 2023). Land use change affects food security nationally (Purwaningsih et al., 2015). Land use change is a threat to food security. The conversion of rice fields significantly affects food availability and the availability of rice fields (Mahardika et al., 2021). This condition will reduce rice production and disrupt food security. Food security has a significant role in meeting the food needs of each individual (Pujiati et al., 2020).

Food security is determined by food availability through variables of land area, production, and productivity (Pusvita et al., 2019). The high rate of agricultural land conversion threatens the sustainable food farmland, referred to as *Lahan Pertanian Pangan Berkelanjutan*/LP2B (Apriyanto et al., 2021). LP2B protection is one of the efforts to control the high conversion rate of agricultural land to non-agricultural land (Satria et al., 2018). The conversion of rice fields cannot be stopped, but it is essential to control. Law Number 41 of 2009 concerning the Protection of Sustainable Food Agricultural Land (LP2B) is expected to control the rate of conversion of rice fields, incredibly technical irrigated rice fields, to support food security (Octavianti & Nurikah, 2021).

Land use change becomes less controlled due to several obstacles. The first obstacle is weak compliance with implementing *Rencana Tata Ruang Wilayah* (RTRW) and *Rencana Detail Tata Ruang* (RDTR). RTRW is a regional spatial plan, while RDTR is a detailed one. RTRW must be optimized as an instrument for planning, utilizing, and controlling space in land use (Arsyad et al., 2022). The dominant factors of agricultural land conversion are housing needs, community ignorance of land functions, unavailable land for settlement development, and lack of socialization of land functions based on RTRW (Arnawa et al., 2022).

The second obstacle to land use change needing to be improved is the absence of LP2B Regional Regulations (*Perda*). Local governments strive to realize food security through regional policies to ensure sustainable agricultural land by controlling land use change (Wijaya et al., 2023). Third, inconsistencies in granting development permits in the secondary and tertiary sectors also contribute to converting rice fields. The fourth obstacle is the need for coordination among internal stakeholders of local governments. Fifth, the role of farmer organizations and village institutions in controlling land use change could be more optimal.

These constraints are simultaneously related to several logical threats from the development of a city. The development of suburban areas encourages land use change (Somantri, 2021). Infrastructure development encourages regional accessibility and increases land prices. The

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increase in population and the number of households require land for settlement development. The increase in population and urbanization reduces the availability of agricultural land, especially converting it into housing and other facilities (Sudipa, 2021). Land use change is affected by population growth, urban development, housing development, tourism development, land price increases, and socio-cultural factors (Somantri, 2021). Development activities and population growth require land for settlement, industry facilities, and infrastructure. Increased land demand leads to competition for land use and accelerates land conversion (Oktavilia et al., 2022).

The development of cities in general will lead to an increase in the secondary and tertiary sectors, and a decline in the primary sector (agriculture) is inevitable. Agricultural land is decreasing, among other things, when constructing industrial estates. Law enforcement related to land use change has yet to be carried out consistently (Hardjoloekito et al., 2022). In addition, the fragmentation of rice field ownership also contributes to the transfer of rice field functions into non-agricultural functions, including housing. Inheritance factors are one of the factors that determine land use change. The heirs got land in a small area, so they changed their functions rather than manage it as agricultural land (Setyoningsih & Silviana, 2022). If the managed agricultural land is fragmented, the opportunity for farmers to work outside the agricultural sector will be even more excellent (Suharyanto et al., 2021).

In addition, the production costs of rice farming and unstable grain prices have contributed to the conversion of rice fields to other uses (non-rice fields and non-agriculture). The strategy to control the conversion of rice fields is related to agricultural policies, infrastructure, distribution of agricultural facilities, stability of grain prices, and increasing knowledge of human resources in the agricultural sector (Pratomo & Wijayanti, 2023).

Strategies to control agricultural land conversion include assistance and incentives for farmers, increasing the capacity of agricultural human resources, and strengthening agricultural sector policies (Firmansyah et al., 2021). Short-term strategies to control the conversion of rice fields to non-agricultural fields are local government policies, production incentives, and marketing facilitation (Faisal et al., 2023). Rice fields and agricultural land are strategic for national food security. Good spatial planning can prevent the conversion of agricultural land to non-agricultural land. Strategies to prevent agricultural land conversion and public participation to increase public knowledge about spatial planning and agricultural licensing (Wahanisa et al., 2021).

This study is important to identify strengths, weaknesses, opportunities, and threats in controlling rice field land conversion. The evaluation of strengths, weaknesses, opportunities, and threats using SWOT analysis resulted in formulating a better strategy to control the conversion of rice fields in Pematangsiantar. This study has recommendations for control strategies of rice field land conversion. The recommendation is critical to the city government so that rice fields in production centers in three sub-districts can be maintained, at least controlled by the conversion rate. Therefore, this study aims to analyze strengths, weaknesses, opportunities, and threats for formulating a strategy to control rice field land conversion in the city.

METHODS

The research was conducted in Siantar Marimbun Subdistrict, Pematangsiantar City, considering that in 2022, the rice harvest area in this sub-district reached 1,149 ha or 53% of the rice harvest area in Pematangsiantar City. The next consideration is that based on data on the area of rice harvest, there has been a decrease in rice fields by 13.21% from 2016 to 2023, a decrease of 93 hectares per year (BPS Pematangsiantar, 2024). The

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respondents of this study were 24 people. The key respondents consist of the Subdistrict Head (1 person), *Lurah* (6 persons), Agriculture Office (1 person), Housing and Settlement Office (1 person), Public Works and Spatial Planning Office (1 person), DPRD of Pematangsiantar City (1 person), community leaders (3 people), and farmers (10 persons).

Data Analysis Methods

The strategies for controlling the conversion of rice fields are found with a SWOT analysis. The SWOT analysis procedure is as follows (Cabral et al., 2023; Karakök & Beşir, 2023; Heshmati et al., 2022; Rauch, 2007; Stoica et al., 2022):

1. Identify 24 key respondents and conduct focus group discussions (FGDs) to identify components of strengths, weaknesses, opportunities, and threats.
2. The answers of each key respondent were asked separately over the SWOT components. Through interviews, respondents' answers are requested in the five-score system.
3. Determine weights, scores, and final scores based on **Table 1**. Determine the weight of each item: the sum of all respondents' answer scores to each item divided by the sum of all respondents' answer scores to all items, w = si/Qt.
4. Determine the average score of each item: the sum of all respondents' answer scores to each item divided by the number of respondents, s = si/n (Fan et al., 2023).
5. Determine the final score (multiplication of weights and average score, ws).
6. Determine the internal and external factors evaluation matrix of tourism objects.
7. Calculate the final total score based on the internal factor evaluation (IFE) and external factor evaluation (EFE) matrix.
8. Determine the strategy: If the final score of the IFE is greater than the EFE's (IFE > EFE) score, then an aggressive development strategy is recommended. Conversely, if IFE < EFE, a defensive strategy was pursued (Stoica et al., 2022).
9. Establish a strategy matrix based on strengths, weaknesses, opportunities, and threats: offensive strategy or SO strategy (using strengths to maximize opportunities), competitive strategy or ST strategy (using strengths to minimize threats), adaptive strategy or WO strategy (correcting weaknesses by using opportunities), and defensive strategy or WT strategy by avoiding weaknesses and threats (Fan et al., 2023; Sahani, 2021).

Table 1. Score, weight, and final score calculation procedure

Respondent	SWOT factors					Total score
	1	2	3	4	5	
1						Q1
2	Respondents' answers (in scores 1-5) on each item (indicator)					Q2
…						…
n						Qn
Total	s1	s2	s3	s4	s5	ΣQi = Qt
Weight (w)	(s1/Qt)	(s2/Qt)	(s3/Qt)	(s4/Qt)	(s5/Qt)	
Average score (s)	(s1/n)	(s2/n)	(s3/n)	(s4/n)	(s5/n)	
Final score	(ws)	(ws)	(ws)	(ws)	(ws)	

Note: n = number of respondents, si = total answer scores of all respondents to each item, Qi = number of answer scores of each respondent for all items, Qt = total amount of Qi (ΣQi)

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RESULTS AND DISCUSSION

The identification results establish the five primary factors: strengths, weaknesses, opportunities, and threats. Furthermore, a matrix of internal factor evaluation (IFE) and external factor evaluation (EFE) of rice field conversion control is prepared. Based on the IFE matrix for control strategies of rice field conversion (can be seen in **Table 2**), the total final score was 3.2151. Meanwhile, based on the EFE matrix (seen in **Table 3**), the total final score was 3.1929.

Table 2. Internal factor evaluation (IFE) matrix

Internal factors	Weight	Average Score	Final Score
Strengths			
S_1. Three subdistricts (Marimbun, Marihat, and Martoba) are rice production centers.	0.0986	3.0000	0.2959
S_2. Siantar Marimbun sub-district has a rice field harvest area of more than 50%.	0.1014	3.0833	0.3126
S_3. The rice field area has a technical and semi-technical irrigation system.	0.1027	3.1250	0.3211
S_4. High rice productivity (more than 6 tons/ha)	0.1000	3.0417	0.3042
S_5. Most rice fields have a crop index two times a year	0.0973	2.9583	0.2877
Sum	0.5		1.5214
Weaknesses			
W_1. Weak implementation of RTRW and RDTR	0.0985	3.3333	0.3284
W_2. *Perda* LP2B is not available	0.0961	3.2500	0.3122
W_3. Inconsistencies in secondary and tertiary sector permitting	0.0873	3.2917	0.3202
W_4. Lack of coordination among local government stakeholders	0.1034	3.5000	0.3621
W_5. Farmer organizations and agricultural institutions are in decline	0.1047	3.5417	0.3707
Sum	0.5		1.6937
Total	1		3.2151

Table 3. External factor evaluation (EFE) matrix

External factors	Weight	Average Score	Final Score
Opportunities			
O_1. Regulatory support	0.0922	2.9583	0.2728
O_2. Expansion of the city area	0.0974	3.1250	0.3044
O_3. Incentive and disincentive system	0.1026	3.2917	0.3377
O_4. High rice demand and marketing cooperation between local governments	0.1000	3.2083	0.3208
O_5. Development of agrotourism and culinary in rice fields	0.1078	3.4583	0.3728
Sum	0.5		1.6085
Threats			
T_1. Infrastructure development increases land prices	0.0937	2.9583	0.2771
T_2. Population growth	0.0976	3.0833	0.3010
T_3. Growth of the secondary and tertiary sectors	0.1069	3.3750	0.3607
T_4. Fragmentation of land tenure	0.0950	3.0000	0.2850
T_5. High production costs and grain prices are not guaranteed	0.1069	3.3750	0.3607
Sum	0.5		1.5844
Total	1		3.1929

A comparison of internal and external factor evaluations (IFE > EFE) confirms that the control of rice conversion in Pematangsiantar City is implementing an aggressive strategy. Nevertheless, the internal environment analysis shows that the final score on strength (1.5214) is smaller than weakness (1.6937). Thus, an aggressive strategy must go hand in hand with an adaptive strategy to correct weaknesses by

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taking advantage of opportunities (WO strategy). The strategy is supported by the external environment analysis results, where the opportunity's final score (1.6085) is greater than the final score of the threat (1.5844). Therefore, land use change control is carried out through an aggressive strategy: using strength to take advantage of opportunities. At the same time, adaptive strategies are improving weaknesses.

Rice Field Conversion Control Strategy

Based on the internal and external factors evaluation matrix, a matrix of control strategies for rice field conversion is prepared. Based on the evaluation analysis of internal and external factors, control of rice field conversion is carried out through aggressive strategies (SO strategy), adaptive strategies (WO strategies), and competitive strategies (ST strategies). These strategies can be seen in **Table 4**.

Table 4. Strategy matrix for controlling the conversion of rice fields

	Strengths: S_1. S_2. S_3. S_4. S_5	Weaknesses: W_1. W_2. W_3. W_4. W_5
	SO strategies (Agressive)	WO strategies (Adaptive)
Opportunities: O_1. O_2. O_3. O_4. O_5	Strengthen the implementation of regulations to control the conversion of rice fields in three production center districts. Implementing an incentive and disincentive system in the rice farming system. Increase strategic partnerships between local governments in rice marketing. Increase collaboration between stakeholders in developing agrotourism and culinary in rice fields area. Develop a plan for the long-term expansion of the city area.	Improve land use compliance based on RTRW and RDTR. Designing the preparation of multi-stakeholder-based LP2B Regional Regulations (*Perda*). Increase consistency in the issuance of permits for secondary and tertiary sector activities (housing, industry, trade, and infrastructure). Improve data accuracy, permit coordination, and standard land determination for LP2B. Increase the capacity and role of farmer organizations and agricultural institutions in controlling the conversion of rice fields.
	ST strategies (Competitive)	WT strategies (Defensive)
Threats: T_1. T_2. T_3. T_4. T_5	Improve coordination to prevent the diversion of technical irrigated rice fields in infrastructure development. Improve coordination to prevent the transfer of technical irrigated rice fields in settlement development. Improve coordination to prevent the transfer of technical irrigated rice fields in the development of industry and trade. Increase collaboration in the procurement of production inputs.	Infrastructure development by RTRW. Settlement development by RTRW. The development of housing, industrial, and trade areas is based on RTRW. Maintain the mechanism for procurement of production facilities for rice farming and marketing of grain and rice.

Aggressive Strategies (SO Strategy)

Strengthen the Implementation of Regulations

The rice harvest area in three subdistricts (Siantar Marimbun, Siantar Marihat, and Siantar Martoba) reached 2,044 hectares (95%) of the total rice harvest area in Pematangsiantar City (2,155 hectares). In particular, Siantar Marimbun District has a rice harvest area of 1,149 hectares (53%). One of the essential strategies to control land use change in these three subdistricts is to enforce mandated regulations directly related to agricultural land and rice fields. Applying spatial instruments, such as zoning rules and permits for land use change, is essential to reducing high conversion rates (Pradana & Pamungkas, 2013).

The implementation of the regulation has yet to be effective in controlling the conversion of rice fields. The regulations in question include Law Number 41 of 2009 concerning the Protection of Sustainable

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Food Agricultural Land (LP2B), Government Regulation Number 12 of 2012 concerning the Provision of Sustainable Food Agriculture Incentives, Presidential Regulation Number 59 of 2019 concerning the Control of Rice Field Land Conversion, and Pematangsiantar City Regional Regulation Number 7 of 2011 concerning the Regional Spatial Plan of Pematangsiantar City 2010-2030.

In this regard, implementing a control policy for rice field land conversion has not been effective (Sriartha & Windia, 2015). The effectiveness of implementing land conversion control instruments has yet to run optimally (Iqbal & Sumaryanto, 2007). Setyoningsih and Silviana (2022) concluded that insufficient law enforcement factors and inadequate human resource quality are some of the causes of land use conversion. Meanwhile, according to Karenina et al. (2016), the strategy to control agricultural land conversion is carried out through consistent implementation of RTRW. In addition, another effort is to increase public participation and knowledge about spatial planning and agricultural licensing (Wahanisa et al., 2021).

Increasing law enforcement efforts aims to cause a deterrent effect on those who violate regulations regarding land use change (Fauzan et al., 2022). Criminal and civil sanctions in the LP2B Protection Law are expected to minimize land use change (Adha et al., 2023). Research by Hardjoloekito et al. (2022) in Ngawi District, among others, simulates that law enforcement related to land use conversion needs to be carried out adequately. Strategies to improve food security include establishing local government policies regarding regulations on land use change (Pusvita et al., 2019).

Implementing an Incentive and Disincentive System

The production costs of rice farming and unstable grain prices also encourage the conversion of rice fields to other uses (non-rice fields and non-agriculture). In this case, the strategies carried out are incentive systems, marketing facilitation, agricultural facilities, infrastructure, increasing human resources, and strengthening agricultural sector policies (Faisal et al., 2023; Firmansyah et al., 2021; Pratomo & Wijayanti, 2023). Based on the Minister of Agriculture Number 79 Regulation of 2013, incentives are rewards to farmers who maintain and do not convert sustainable food agricultural land. Research results in Tasikmalaya Regency concluded that farmers responded strongly to the incentive policy and agreed with the disincentive policy (Naura et al., 2020).

Law No. 41 of 2009 mandates that LP2B control be carried out through incentives, disincentives, licensing mechanisms, protection, and counseling. Incentives are given to farmers in the form of land and building tax relief, agricultural infrastructure development, financing research and development of seeds and superior varieties, ease of access to information and technology, provision of agricultural production facilities and infrastructure, guarantee of issuance of certificates in the field of food agricultural land through sporadic and systematic land registration; and awards for high-achieving farmers.

Furthermore, Presidential Regulation Number 59 of 2019 concerning Control of Rice Field Conversion aims to (1) accelerate the determination of maps of protected rice fields in order to meet and maintain the availability of rice fields to support national food needs, (2) control the conversion of rice fields, (3) empower farmers not to convert rice fields, and (4) provide data and information on rice fields for the determination of sustainable food agricultural land.

Increase Strategic Partnerships in Rice Marketing

The production value and selling price of rice include being a driver of rice field conversion (Firmansyah et al., 2021). Therefore, alternative strategies for rice

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marketing are partnership patterns with e-commerce marketing institutions, farmer partnerships with cooperatives, and direct partnerships with large companies (Mursalat, 2021). In terms of rice marketing, the performance of the urban rice market can be improved by the development of rice packaging in the agro-industry within the framework of urban rice downstream (Yusri et al., 2021)

Increase Collaboration in the Development of Agrotourism and Culinary in Rice Fields

The development of rice field agrotourism has increased in the last ten years. The expanse of rice fields is a tourist attraction and is supported by culinary through the development of cafes in rice fields. This potential is considered strategically developed as an effort to control the conversion of rice fields. Agrotourism based on rice fields can contribute to household income in rural areas (Handayani et al., 2019). The number of visits to rice field agrotourism is determined by facilities, location, and tourist attractions (Rifansyah & Sihombing, 2022).

Develop a Plan for the Long-term Expansion of the City Area

Simalungun Regency surrounds Pematangsiantar City. Opportunities for urban expansion are possible through complex mechanisms. The expansion of the city of Pematangsiantar was carried out in 1986 when the area became 70.230 km². Then, in 1994, a joint agreement was issued on the Adjustment of Administrative Area Boundaries between Pematangsiantar City and Simalungun Regency. The result of the agreement is the area of Pematangsiantar City to an area of 79.9706 km². Long-term plans for an increase in urban areas will benefit the agricultural sector. Potential areas are rice fields and plantation land in Simalungun Regency.

Adaptive Strategy (WO Strategy)

Improve Land Use Consistency Based on RTRW and RDTR

The results of research in Sleman Regency can be used as study material in this strategy (Asmara & Purbokusumo, 2022). Policy consistency in fulfilling LP2B (rice fields) land area can be seen from its planning and protection in LP2B and RTRW Regional Regulations 2021-2041. The consistency of fulfilling the rice fields area in the two regional regulations is also reflected in the Yogyakarta RTRW Regional Regulation. The commitment of the Sleman Regency Government is also reflected in the implementation of rice field land protection. The conversion of rice fields can be prevented and can be held for less than 100 ha/year. The area of rice fields maintained above 22,000 hectares in 2021. However, at the supervision and control stage, the Sleman Regency Government has not consistently enforced criminal sanctions of confinement and fines for perpetrators of agricultural land conversion.

Designing the Preparation of Multi-stakeholder-based LP2B Regional Regulations (Perda)

The effectiveness of controlling agricultural land conversion is part of public policy (Sriartha & Windia, 2015). Local governments must support the preparation of regional regulations to control the conversion of rice fields and improve law enforcement (Primasari et al., 2021). One of the efforts to control the conversion of agricultural land is to make technical regulations regarding the protection of food agricultural land (Cahyaningrum, 2019).

Increase Consistency in the Issuance of Permits for Secondary and Tertiary Sector

RTRW is the basis for granting location permits and is the key instrument to prevent the conversion of technically irrigated rice fields. However, many RTRWs plan to convert technically irrigated rice fields to

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non-agricultural (Iqbal & Sumaryanto, 2007). The study in Kendal found that the RTRW essentially converted agricultural land into industry from 2014-2018. Industrial location permits (91.18%), and agricultural becomes industrial (62%) by RTRW (Adiyaksa & Djojomartono, 2020). Permitting constraints related to the change of agricultural land to residential are policy coordination, policy implementation, and planning inconsistencies (Setiawan & Hanim, 2017).

Increase the Capacity and Role of Farmer Organizations and Agricultural Institutions

Controlling agricultural land conversion involves the active participation of all stakeholders in planning, implementing, supervising, and assessing regulations through socialization and advocacy (Iqbal & Sumaryanto, 2007). Local governments must involve all stakeholders in planning, implementing, and supervising the control of rice field conversion (Primasari et al., 2021). The effectiveness of the Subak control policy of rice field conversion can be improved by reorienting agricultural policy priorities and institutional participation of local communities (Sriartha & Windia, 2015). Farm income plays a significant role in farmers' preferences for conversion. For this reason, it is essential to strengthen institutions and the role of farmers to support the sustainability of agricultural businesses (Pradana & Pamungkas, 2013).

Competitive Strategy (ST Strategy)

The results of this study offer four competitive strategies, namely, using strength to minimize threats. The strategy is to improve coordination to prevent the conversion of technical irrigated rice fields in (1) infrastructure development, (2) housing development, (3) industrial and trade development, and (4) increase collaboration in the procurement of production inputs. The conversion of agricultural land is a consequence of regional and urban development, especially for housing, industry, and infrastructure.

A strategy that can also be applied is to compile a model of sustainable rice fields based on variables of rice productivity, suitability of agricultural land, harvest intensity, and projected directions of urban development (Nafi & Basuki, 2019). Regarding the productivity of paddy fields, research by Wahyuni et al. (2011) concluded that varieties and sowing density influence rice production. In this case, because the implementation of regulatory instruments is less effective, economic instruments are needed to support the control of rice field conversion. The priorities of budget strategy for rice field protection are socialization budgets, regional regulation-making budgets, budget sharing with the central/provincial government, streamlining the role of the private sector, supervision budgets, land banking budgets, and providing incentives and disincentives to farmers (Hidayati et al., 2017).

CONCLUSION

Based on the internal factor evaluation (IFE) matrix for the control strategy of rice field land conversion, the total final score is 3.2151. This score indicates the overall strength of the internal factors influencing the control strategy. Meanwhile, based on the external factor evaluation (EFE) matrix, a total final score of 3.1929 was obtained, reflecting the strength of the external factors. A comparison of internal and external factor evaluation (IFE > EFE) confirms that rice field conversion control in Pematangsiantar City implements an aggressive strategy (SO strategy). Nevertheless, the internal environment analysis shows that the final score on strength (1.5214) is smaller than weakness (1.6937). Therefore, an aggressive strategy must be implemented with an adaptive strategy to improve weaknesses by taking advantage of opportunities (WO strategy). The external environment analysis results, where the opportunity's final score (1.6085) is greater than the final score of the

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threat (1.5844) support the strategy. Aggressive strategy (SO) becomes the primary strategy for controlling rice field conversion. Concurrently, adaptive strategies are carried out to correct weakness factors. In addition, competitive strategy (ST strategy) minimizes the threat factor.

The aggressive strategy consists of (1) strengthening the implementation of regulations to control the conversion of rice fields in three production center sub-districts, (2) implementing an incentive and disincentive system in the rice farming system, (3) increasing strategic partnerships between local governments in rice marketing, (4) increasing collaboration between stakeholders in the development of agrotourism and culinary in rice fields, and (5) drafting urban area expansion plans in the long term. Adaptive strategies include: (1) increasing consistency in land use based on RTRW and RDTR, (2) designing the preparation of multi-stakeholder-based LP2B Regional Regulations, (3) increasing consistency in the issuance of permits for secondary and tertiary sector activities (housing, industry, trade, and infrastructure), (4) improving data accuracy, coordinating permits, and determining standard land for LP2B, and (5) increasing the capacity and role of farmer organizations and agricultural institutions in control of rice field conversion. The competitive strategy is implemented through improved coordination to prevent the conversion of technical irrigated rice fields for infrastructure development, housing, and industrial and trade development. This strategy can also be done by increasing collaboration in procuring production inputs.

This research is the latest study that is more comprehensive in formulating strategies to control the conversion of rice fields in Pematangsiantar City. The contribution given is a strategy that can be used as an action program to control the conversion of rice fields. Implementing the strategy requires technical and political will from all stakeholders, especially local government, legislators, and farmers. This study has a limitation, namely the location of only one sub-district with limited respondents. Future studies are needed to analyze the development of rice field conversion and formulate an overall strategy for controlling agricultural land conversion for whole city areas.

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