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Regional Case Study

Unveiling the Dynamic Between Land Conversion and Food Security of Farmers Households in Bakalan Village, Pasuruan Regency

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Abstract
System Dynamics serves as an approach to unravel behavioral patterns by exploring fundamental structures. In this study, the dynamic system was crafted using STELLA software. The research methodology involved conducting primary surveys with both farmers and conversion farmers' households to gather essential data on their perspectives, practices, and circumstances related to land conversion and food security. Through this data, the System Dynamic model was constructed to depict the interplay among key variables impacting food security, specifically focusing on Food Availability, Affordability, and Needs. The analysis revealed that the Food Affordability indicator consistently played a pivotal role in shaping these trends over the analyzed years. However, a significant discrepancy in food security levels emerged between farming and non-farming households. This divergence primarily stemmed from income inequalities within the agricultural sector, affecting the purchasing power for essential foods like rice across the village. Additionally, a concerning trend of diminishing agricultural land and a subsequent decline in food availability was observed.

Keywords: Farmers; food security; land conversion; system dynamic

1. Introduction
The The transition of agricultural land to non-agricultural use is a multifaceted process influenced by various socioeconomic and environmental factors. As human populations grow and economies expand, the demand for land for residential, industrial, and commercial purposes intensifies. This transition, driven by economic growth and urbanization, presents significant challenges to food security and sustainable land use practices (Seto & Reenberg, 2014; Wang et al., 2020).

The implications of land conversion on food security are profound. Li et al. (2024) note that Indonesia's Agricultural Land Protection Law aims to preserve agricultural land for food production. However, rapid conversions for other purposes threaten agricultural productivity and farmers' livelihoods. This is particularly evident in regions like Pasuruan Regency, where extensive land conversions are driven by economic development and infrastructure projects.

In Pasuruan Regency, particularly in areas such as Bakalan, the conversion of agricultural land has accelerated due to industrial growth and strategic location along economic corridors. The transition from farmland to industrial and residential use has reduced the availability of arable land, impacting local food production capacities (Suharto & Handayani, 2019). This trend is mirrored in other regions across

Indonesia, reflecting broader challenges in balancing economic development with sustainable land use practices (Setiawan et al., 2016).

Food security, defined by the availability, access, and utilization of food, remains a critical concern in Indonesia (Kementan, 2015; Syafani, 2019). The Index of Food Security and Vulnerability in Indonesia (FSVA, 2023) provides insights into regional food security status, highlighting areas like Jawa Timur with varying degrees of food security resilience. However, such indices often overlook micro-level factors affecting food access and nutritional adequacy at the household level. The research gap lies in understanding the nuanced connections between land conversion, particularly agricultural land conversions, and their impacts on local food security dynamics. A study by Nurpita, Wihastuti, and Andjani (2018) suggests significant shifts in household food security post-land conversions, indicating the need for more comprehensive assessments.

Furthermore, the correlation between land conversion and food security extends beyond agricultural productivity to include factors such as crop diversity, water resource management, and resilience to pests and diseases. Research in Subang, Jawa Barat underscores potential disruptions in staple food production due to land conversions, highlighting the interconnectedness of land use, agricultural practices, and food security outcomes. Interestingly, a study by Nurpita et al. (2018) in Temon district presented contrasting results, showing that while land conversion increased food insecurity, statistical analysis did not indicate a significant difference in food security levels before and after land conversion. This suggests that land conversion did not have a substantial impact on household food security for farmers in Temon District, Kulon Progo Regency. The varying results from previous research highlight the complex nature of regional food security. Addressing these challenges requires a multi-dimensional approach that integrates policy interventions, sustainable land management practices, and community engagement. Strategies to safeguard food security in areas experiencing rapid land conversion should prioritize land-use planning, agricultural innovation, and livelihood diversification for rural communities.

This research aims to explore the connection between land conversion and household food security in Bakalan Village, Pasuruan Regency by analyzing food availability. It offers key insights for policy and regional development, aiding in the creation of balanced land use policies, supporting sustainable planning, and enhancing agricultural productivity. By raising awareness about preserving agricultural land and promoting diversified livelihoods, it fosters sustainable management. Additionally, it deepens the understanding of how land conversion impacts food security and serves as a reference for future studies. Addressing these challenges is vital for Indonesia's long-term food security and sustainable development.

2. Methods

This research employs a descriptive quantitative method, a systematic approach wherein numerical data are collected and analyzed to describe characteristics or phenomena. This method was chosen to provide a comprehensive understanding of the factors influencing food security and land conversion in Bakalan Village. The research commenced by identifying problems related to food security and land conversion in Bakalan Village. Key issues and variables were pinpointed, and hypotheses were formulated. Subsequently, a simulation model was created using STELLA to analyze interactions between factors such as land conversion rates, food production, and affordability. This step confirmed that the simulated results matched real-world observations and data, thereby enhancing the study's credibility.

2.1. Data Collection

The data collection method involved conducting surveys with 50 farmers and conversion farmers' households in Bakalan Village, Pasuruan Regency. These surveys aimed to gather firsthand data on perceptions, practices, and conditions related to land conversion and food security. By directly engaging with the farmers in Bakalan Village, the research sought to capture authentic insights and experiences regarding these critical issues.

2.2. Data Analysis

The analysis for this research utilized System Dynamics, a method for studying how different variables within a system interact and predicting system behavior based on underlying structures. System Dynamics modeling is instrumental in establishing causal relationships crucial for policy-making by considering the effects of policies across various sectors. This approach allows for a nuanced understanding of how changes in one part of the system can impact the whole. The System Dynamics model developed for this study focuses on key factors affecting food security in Bakalan Village. This model is centered around the experiences of farmers and conversion farmers' households to capture the complexities of the system. STELLA software was used to implement the System Dynamics model, chosen for its effectiveness in modeling dynamic systems. STELLA allows users to build and simulate models, conduct sensitivity and what-if analyses, and assess system behavior over time.

By combining survey data with System Dynamics modeling, the study aimed to understand the complex relationship between land conversion and food security in Bakalan Village. Different scenarios were developed to explore potential solutions for improving food security. These scenarios assessed the effectiveness of various policies, land management practices, and agricultural interventions. This helped understand potential outcomes and informed decision-making. This approach provided a comprehensive understanding of food security dynamics, supporting informed decisions and policies for sustainable food systems and community well-being.

3. Result and Discussion

Several studies have explored land conversion. Sarjana (2015) used observation, interviews, and literature reviews to identify factors driving the conversion of agricultural land to non-agricultural uses in Denpasar Selatan. Ly (2023) employed observation and quantitative analysis to examine factors affecting household food security among farmers in Sumba Timur. Oktavariani and Sofyan (2015) used system dynamics modeling with STELLA and probability sampling to investigate energy optimization in the domestic sector in two villages in Bandung Barat.

Despite these studies' specific focuses, there is a significant gap in exploring the interdependencies between these themes. Future research could benefit from interdisciplinary approaches that examine how agricultural land conversion impacts food security and energy consumption across different regions. Integrating various methodologies could provide deeper insights into these dynamics, aiding in comprehensive policy-making and sustainable development. This research aims to analyze the dynamic between land conversion and food security in farmers' households in Bakalan Village, Pasuruan using the system dynamics model STELLA and quantitative methods.

3.1. Land Conversion

In the face of rapid global changes, the conversion of agricultural land has become one of the primary issues affecting the balance between food production, environmental sustainability, and economic development (Ahmad, Mohamed Rashid & Blake, 2022). This land conversion occurs when land previously used for agricultural activities, such as fields, gardens, or plantations, is diverted for other purposes, such as residential development, industry, tourism, or infrastructure (Kristiyono, 2016). These changes can signify economic progress in an area, but they also pose serious challenges, particularly related to food security, environmental sustainability, and social sustainability (Taiwo, Samsudin & Ayodele, 2019).

According to Wicaksono (2022), the conversion of agricultural land often occurs alongside the development of residential and industrial areas to accommodate growing population needs. This shift reduces the availability of agricultural land, converting it to meet the demand for housing and industrial spaces. This trend is particularly evident in densely populated areas where land resources are under greater pressure. Meanwhile, Tsani, Purwaningsih, and Daerobi (2018) emphasize the role of location in land use transitions, especially near urban centers with robust infrastructure. These areas become prime targets for conversion due to their proximity to economic activities and increasing urban populations.

Data from the National Land Agency (BPN) indicates a significant rise in land conversion rates, with urban areas experiencing substantial shifts from agricultural to non-agricultural uses.

Sarjana (2015) conducted a study about land conversion factors in Denpasar. Agricultural land conversion involves the repurposing of areas traditionally used for farming, which include fields, gardens, or plantations, into zones designated for urban development, industrial activities, tourism, infrastructure, or other forms of non-agricultural use. Such transformations are often seen as markers of economic advancement within a region, signifying improvements in infrastructure, housing, and commercial opportunities. However, this shift is not without its drawbacks. Prasada (2018), in their research of land conversion in Yogyakarta, found that wetland conversion, particularly the conversion of paddy fields, has led to a significant loss of rice production in the region amounting to 18,359.27 tons during the period of 2006-2015. This reduction of agricultural land poses a direct threat to food security by diminishing the area available for crop cultivation, thereby potentially leading to reduced food supply and increased reliance on imports.

In this research, land conversion is analyzed by calculating the rate of conversion of rice fields to built-up land in Bakalan Village to identify the level and speed of land-use change. The following is the calculation of the rate of land conversion in Bakalan Village.

Table 1. Land conversion rate calculation

2020			2021			2022-2023		
Lt-3 (ha)	**Lt (ha)**	**L loss (ha)**	**Lt-2 (ha)**	**Lt (ha)**	**L loss (ha)**	**Lt-1 (ha)**	**Lt (ha)**	**L loss (ha)**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
288.22	267.18	21.04	267.18	253.57	13.61	253.57	253.57	0
% Land conversion rate 2020-2023 = ∑L loss/Lt-3 × 100								12.02%

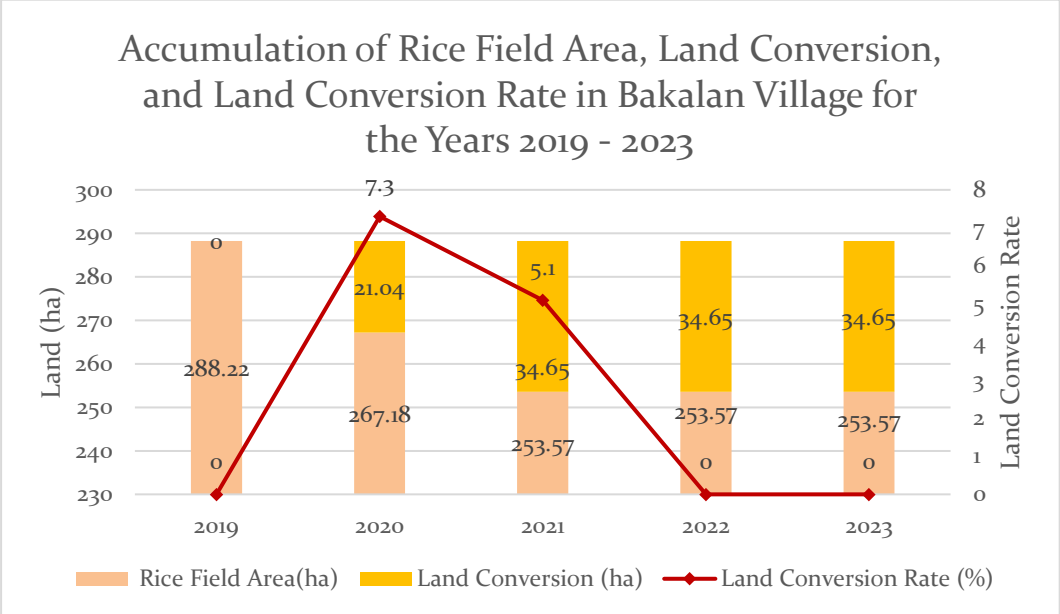

Figure 1. Accumaliton of rice field area, land conversion, and land conversion rate in Bakalan Village

The average loss of L corresponds to the average rate of land-use change, as depicted in Table 1, indicating that agricultural land in Bakalan Village has experienced a conversion rate of 12.02%. Specifically, Bakalan Village saw a reduction of 21.04 hectares in rice field area in 2020 and 13.61 hectares

in 2021. This significant conversion of agricultural land can be attributed to the lack of incentives for farmers to maintain the land they manage, leading to a diminished desire to preserve it.

The implications of such land conversion are substantial, as the high rate of agricultural land conversion relative to land opening suggests a considerable potential loss in food production (Ivanka, Muhammad, Limbong, & Simarmata, 2024). This scenario poses a significant threat to food security (Acintya et al., 2024). Calculations reveal that the average rate of land-use change from 2021 to 2023 is 12.02%. Figure 1 illustrates the decrease in land area, driven by land sales motivated by high land prices at that time. These prices were influenced by plans for the construction of factories and warehouses by PT. Mayora, resulting in substantial offers for land acquisition that were accepted by the farmers.

In Figure 2, the land conversion that occurred in Bakalan Village is mapped. In the existing conditions, most of the land resulting from the conversion is used for industrial activities.

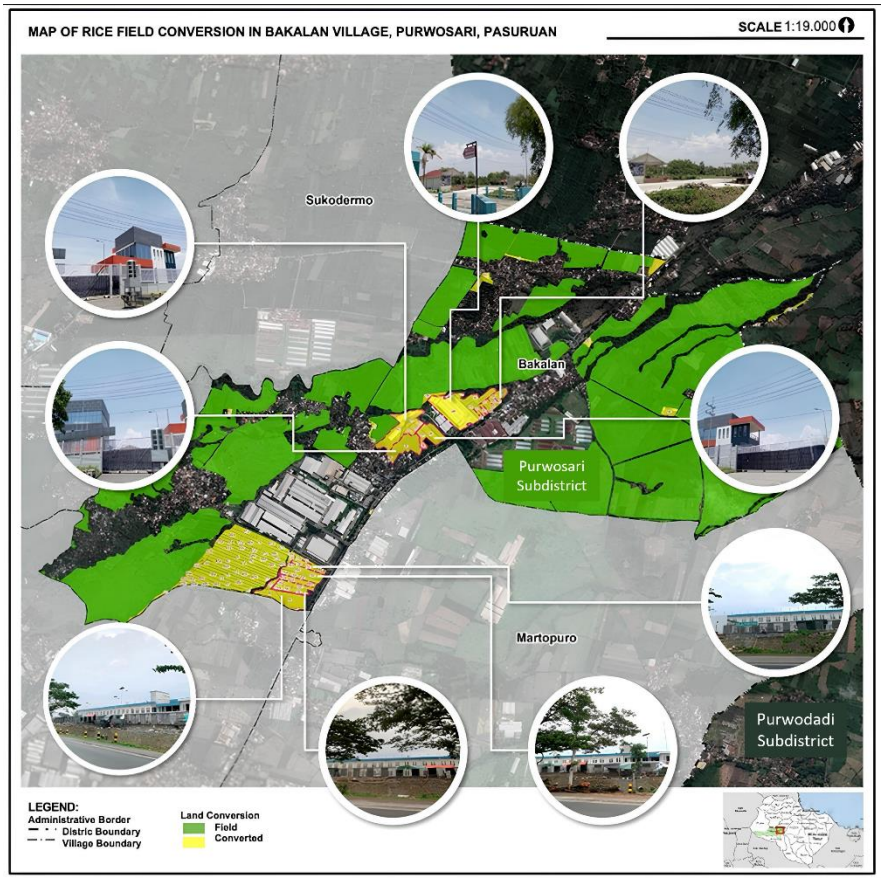

Figure 2. Map of Rice Field Conversion in Bakalan Village, Purwosari Sub-district, Pasuruan Regency

The study conducted by Tsani et al. (2018) identifies several determinants influencing farmers' decisions to convert agricultural land. The findings indicate that the age of farmers and the strategic location of agricultural land negatively impact these decisions, suggesting that older farmers and those with land in strategic locations are less inclined to sell. Conversely, higher levels of education and larger family sizes positively influence land conversion decisions, indicating that more educated farmers with larger families are more likely to convert their agricultural land.

By integrating the insights from these two studies, it becomes evident that the decision-making process for land conversion among farmers is driven by a confluence of economic and demographic factors. This research demonstrates that significant financial incentives, such as those associated with land acquisition for industrial development, can motivate farmers to sell their land. In contrast, the study by Tsani et al. underscores the significance of individual and family characteristics in these decisions.Therefore, policy interventions designed to mitigate the rate of agricultural land conversion

must take into account these multifaceted factors (Prabhakar, 2021). Such interventions should include sustainable economic support for farmers and initiatives to enhance education and raise awareness about the importance of preserving agricultural land (Virianita, Soedewo, Amanah, & Fatchiya, 2019).

It is important to note that high rates of agricultural land conversion can threaten local food security. Policies incentivizing farmers to maintain their agricultural land could be a solution to reduce excessive land conversion rates. Additionally, the involvement of various stakeholders in formulating policies that balance economic development, environmental sustainability, and food security is crucial.

Therefore, a deep understanding of the dynamics of agricultural land conversion and its impact on local food security is essential for formulating sustainable and inclusive development strategies in Bakalan Village and other regions. Through a comprehensive and collaborative approach involving governments, communities, and the private sector, we can strive for an optimal balance between economic development, environmental sustainability, and long-term food security.

3.2. System Dinamic Model

The system dynamic model illustrates the interaction among variables that influence food security. Food security, as represented by the dynamic system model, is an aggregation of the fulfillment values of its constituent indicators: Food Availability, Food Accessibility, and Food Needs (Rachman, 2010). These indicators are subsequently converted into scores for evaluation:

1) Food Availability is measured by comparing the total local rice production in Bakalan Village with the total rice consumption of households within the village. This comparison reveals whether there is a surplus or deficit in meeting local rice consumption needs.
2) Food Accessibility is assessed by comparing net income allocated for food with the expected food expenditure (Cafer, Mann, Ramachandran, & Kaiser, 2018). This indicator evaluates whether rice is financially accessible to all segments of the population, taking into account prevailing market prices.
3) Food Needs is evaluated by comparing the total rice consumption of households in Bakalan Village with the expected rice consumption figure. This comparison determines whether households are consuming rice at recommended levels to meet their energy and nutritional requirements.

The model operates with annual iterations, incorporating fluctuations in variable values that can affect the food security status of Bakalan Village. By comparing actual rice consumption with expected consumption based on nutritional standards, the Food Needs indicator highlights potential gaps in meeting dietary needs.

Together, these indicators provide a comprehensive assessment of food security, guiding policymakers and stakeholders in implementing targeted interventions to enhance local production, economic access, and nutritional well-being within Bakalan Village.

According to Figure 3, the Food Availability indicator is derived by comparing Bakalan Village's total local rice production with the total rice consumption of households in the village. The Food Accessibility indicator is determined by comparing the net income available for food with the expected expenditure for food. Lastly, the Food Needs indicator is calculated by comparing the total rice consumption of households in Bakalan Village with the expected rice consumption.

The model operates through annual iterations, accounting for fluctuations in variable values that can influence the overall Food Security status in Bakalan Village. This iterative approach helps capture the dynamic nature of food security concerns over time, considering various factors that impact food availability, affordability, and needs within the community. Farmers in Bakalan Village, regardless of whether their land has undergone conversion or not, derive income not only from agricultural activities but also from non-agricultural sectors. This diversified income stream reflects the multifaceted economic engagements of rural households, where members may engage in various forms of employment beyond traditional farming roles.

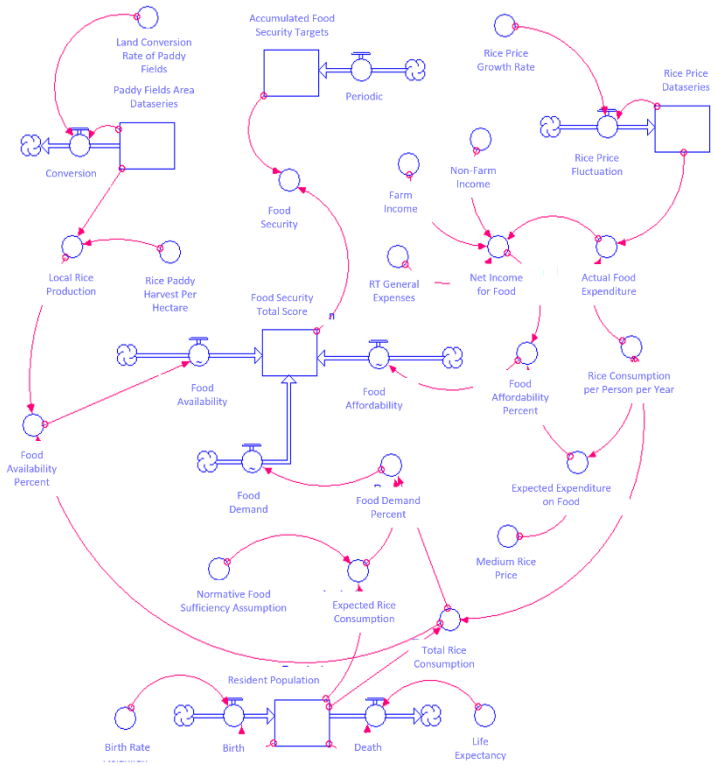

Figure 3. Dynamic system of food securty of farmer and conversion farmer in Bakalan Village

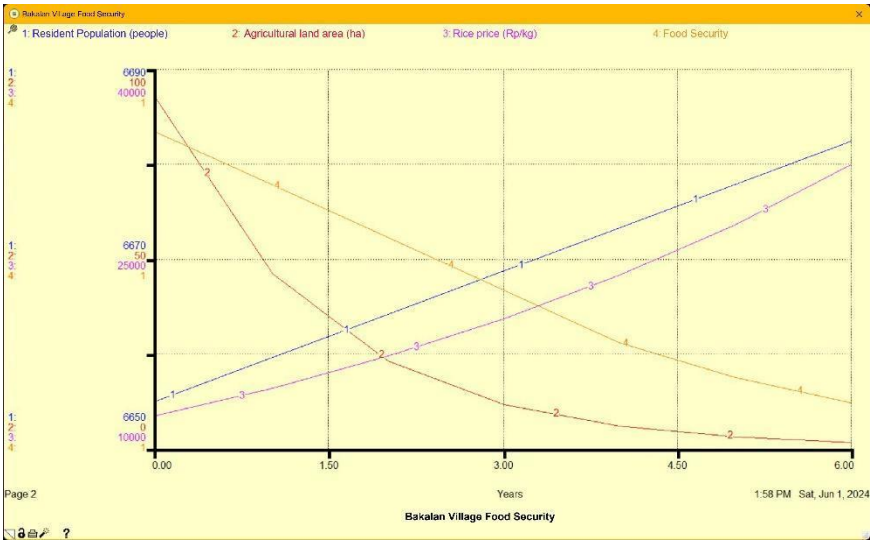

Figure 4. Bakalan Village food security graphic

The graph in Figure 4 illustrates the dynamics associated with food security as outlined by the system dynamics model, with iterations spanning up to the fifth year. Line 1 represents a continuous increase in the population, maintaining a relatively constant slope over time. Conversely, Line 2 shows a downward trend in the area of agricultural land each year, forming a decreasing exponential curve. The varying slopes of the lines result from the differing percentage rates of growth or reduction for each component. For instance, while the total population increases by only 5 individuals annually (0.07%), the reduction in agricultural land area amounts to 12%. Consequently, the line representing the decrease in agricultural land area exhibits a steeper slope compared to the population line.

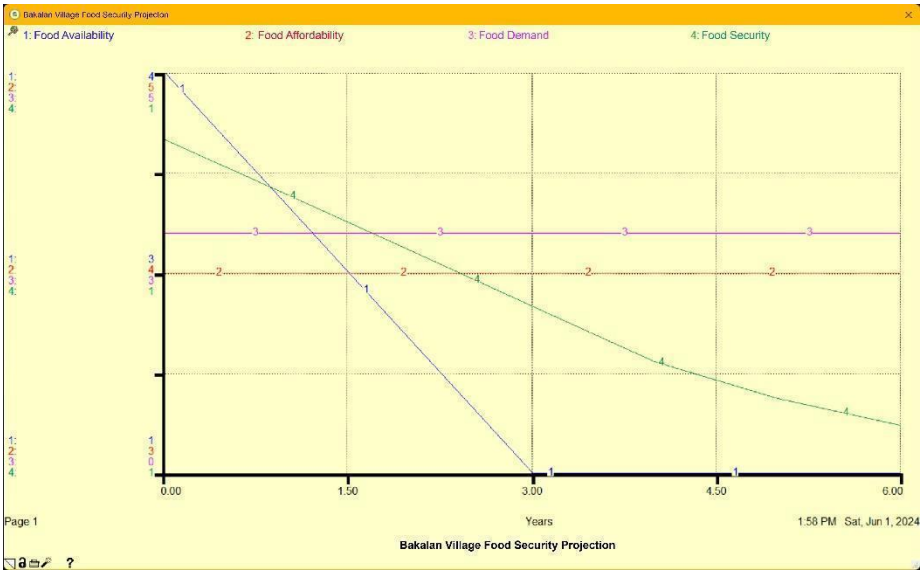

Figure 5. Bakalan Viilage food securty projection next five years

Figure 5 presents an analysis of Bakalan Village's food security projection over the next five years, focusing on food availability, a key indicator of food security. The graph shows a decline in food availability from a value of 4 to 1, attributed to the conversion of agricultural land to non-agricultural uses. The -45° slope of the food availability line indicates a consistent decrease, reflecting the 12% annual rate of land conversion. This reduction in agricultural land leads to decreased food production and availability.This projected decline in food availability has significant implications for Bakalan Village's food security. Reduced agricultural land could lead to challenges in meeting local food needs, increased dependence on external food sources, higher food prices, and broader food insecurity issues affecting community well-being. Policymakers, local authorities, and stakeholders must understand these dynamics to balance economic development with sustainable land use practices, ensuring long-term food security and community resilience. The indicators' values are derived from fulfillment percentages, categorized into four values: 1 for 0-25%, 2 for 26-50%, 3 for 51-75%, and 4 for >75%. These values are averaged to classify food security. Initially, Bakalan Village exhibits relatively good food security, but transitions to food insecurity in subsequent years, mainly due to consistent Food Affordability indicators. Despite good food affordability for both farmers and conversion farmers, food security is lower due to income disparities between agricultural and non-agricultural sectors.

Initially, Bakalan Village demonstrates relatively robust food security with higher fulfillment percentages across key indicators. However, over subsequent years, this shifts from food security to food insecurity, primarily due to the consistent Food Affordability indicator. Despite maintaining good food affordability for both traditional and conversion farmers, overall food security declines due to income disparities between the agricultural and non-agricultural sectors. While food may be affordable for some, income distribution limits access to food for others, affecting overall food security.

From year 2, there is a noticeable decline in food availability, dropping to 6.69% by year 5, linked to ongoing agricultural land conversion. This reduces the land available for food production, impacting food availability for the community. Additionally, Food Needs indicators remain below satisfactory levels at 71.38%, failing to meet the 80% energy sufficiency requirements, highlighting potential nutritional deficiencies within the population.

Efforts to bolster food security must focus on availability and demand. Controlling agricultural land conversion and intensifying land use can help mitigate shortages. Intensified cropping patterns allow villages to maintain food security more efficiently. Jones and Taylor (2015) highlight the importance of

agricultural intensification to address global food security challenges. Options include importing rice or increasing local yields. However, Pingali (2012) notes that reliance on food imports carries geopolitical and economic risks, such as international price fluctuations, which can threaten local food stability.

For Bakalan Village, while rice imports may be a short-term solution, increasing local production through agricultural intensification and land conversion control are essential for stable and sustainable food security. To meet norms, a 32.8 kg/person/year increase in rice consumption is needed. Fortunately, no significant interventions are required for food affordability, as Bakalan Village households have strong financial capabilities to procure rice.

4. Conclusions

Enhancing food security necessitates targeted actions aimed at enhancing food availability and meeting nutritional requirements. Implementing regulatory frameworks to effectively manage agricultural land conversion is imperative in safeguarding vital resources. Furthermore, adopting strategies such as agricultural intensification or supplementing local production with rice imports can contribute significantly to ensuring a stable and sufficient food supply. Addressing the specific food needs of Bakalan Village households, particularly in terms of increasing rice consumption, emerges as a pivotal aspect of these efforts. By focusing on these measures, the overarching goal of achieving optimal food security for the community can be realized.

Improving food security in Bakalan Village requires targeted efforts addressing both availability and nutritional needs while leveraging existing strengths in food affordability. Implementing measures to control the conversion of agricultural land can help maintain a stable food production base. Regulations, incentives for sustainable land use, and zoning policies that prioritize agricultural activities can be explored to mitigate land shortages for farming. In addition, encouraging farmers to adopt practices that intensify land use, such as crop rotation, multiple cropping, and integrated farming systems, can enhance agricultural productivity without expanding land area. This approach optimizes existing land resources for increased yields.

Interestingly, interventions aimed at enhancing food affordability may not be as pressing within the context of Bakalan Village given the relatively robust financial capability of the average household. However, this aspect should be continually monitored and reassessed to ensure that any emerging affordability challenges are promptly addressed in a timely manner.

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References

Cafer, A., Mann, G., Ramachandran, S. & Kaiser, M., 2018. National food affordability: A county-level analysis. Preventing Chronic Disease, 15, p.E115.

Jones, L. & Taylor, P., 2015. Agricultural intensification and food security: A global perspective. Journal of Agricultural Sustainability, 12(3), pp. 45-58.

Khoirunnisa, 2020. Potensi Kelurahan Bakalan Tahun 2020. Pasuruan: Badan Pusat Statistik.

Ly, V.T., Retang, E.U.K. & Wadu, J., 2023. Analisis faktor-faktor yang mempengaruhi ketahanan pangan rumah tangga petani di Kelurahan Mauliru Kecamatan Kambera Kabupaten Sumba Timur. Sustainable Agricultural Technology Innovation (SATI), 1(1), pp. 236–244. Available at: https://ojs.unkriswina.ac.id/index.php/semnas-FST/article/view/358.

Ministry of Agriculture, 2015. Panduan perhitungan pola pangan harapan (PPH). Jakarta: Food Security Agency.

National Food Agency, 2022. Indeks ketahanan pangan tahun 2022. Jakarta: National Food Agency.

Nurpita, A., Wihastuti, K. & Andjani, I.Y., 2018. Dampak alih fungsi lahan terhadap ketahanan pangan rumah tangga tani di Kecamatan Temon Kabupaten Kulon. Jurnal Gama Societa, 1(1), pp. 103-110.

Oktavariani, D. & Sofyan, A., 2015. Sistem dinamik optimalisasi penggunaan energi sektor domestik di dua desa Kabupaten Bandung Barat. Jurnal Teknik Lingkungan, 21(1), pp. 66–76.

Pingali, P., 2012. Green revolution: Impacts, limits, and the path ahead. Proceedings of the National Academy of Sciences, 109(31), pp. 12302-12308.

Prasada, I.M.Y. & Rosa, T.A., 2018. Dampak alih fungsi lahan sawah terhadap ketahanan pangan di Daerah Istimewa Yogyakarta. Jurnal Ekonomi Pertanian, 14(3), pp. 210-224.

Purwaningsih, Y., Hartono, S., Masyhuri & Mulyo, J.H., 2010. Pola pengeluaran rumah tangga menurut tingkat ketahanan pangan di Provinsi Jawa Tengah. Jurnal Ekonomi Pembangunan, 11(2), pp. 236-253.

Ivanka, R., Muhammad, F.A., Limbong, A.D. & Simarmata, T., 2024. Assessing the current state and future trends of land use conversion: Implications for food security in Indonesia. International Journal of Life Science and Agriculture Research, 3(4), pp. 284–290.

Sarjana, I.M., Dewi, L. & Ayu, I., 2015. Faktor-faktor pendorong alih fungsi lahan sawah menjadi lahan non-pertanian (Kasus: Subak Kerdung, Kecamatan Denpasar Selatan). Jurnal Manajemen Agribisnis.

Setiawan, B., Noor, I. & Rachman, A., 2016. The dynamics of agricultural land conversion in Indonesia. Agriculture and Human Values, 33(3), pp. 507-519.

Seto, K.C. & Reenberg, A., 2014. Rethinking global land use in an urban era. Cambridge: MIT Press.

Sudaryanto, T., 2011. Agricultural land conversion: Review and policy recommendations. Journal of Rural Development, 30(1), pp. 13-22.

Suharto, R. & Handayani, T., 2019. Industrial growth and land use change in Pasuruan Regency. Journal of Sustainable Development, 8(2), pp. 65-78.

Syafani, T.S., Sayekti, W.D. & Zakaria, W.A., 2019. Food coping strategy rumah tangga sasaran penerima manfaat beras sejahtera di Kabupaten Pringsewu. Indonesian Journal of Socio Economics, 1(1), pp. 61-71.

Tsani, A.F., Purwaningsih, Y. & Daerobi, A., 2018. Farmer's decision in converting the function of agricultural lands. Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan, 19(1), pp. 1-11.

Tscharntke, T., Clough, Y., Wanger, T.C., Jackson, L., Motzke, I., Perfecto, I., Vandermeer, J. & Whitbread, A., 2012. Global food security, biodiversity conservation and the future of agricultural intensification. Biological Conservation, 151(1), pp. 53-59.

Virianita, R., Soedewo, T., Amanah, S. & Fatchiya, A., 2019. Persepsi petani terhadap dukungan pemerintah dalam penerapan sistem pertanian berkelanjutan. Jurnal Ilmu Pertanian Indonesia, 24(2), pp. 168-177.

Wang, W., Yang, H., Li, J. & Zhang, D., 2020. Urbanization, land use transition, and environmental impact in China. Resources, Conservation and Recycling, 156, p.104679.

Wicaksono, A.D., Meidiana, C., Prayitno, G., Hasyim, A.W., Subagiyo, A., Dinanti, D. & Roziqin, F., 2022. Ruang berketahanan pangan: Menjawab tantangan produksi pangan berkelanjutan dengan optimasi ruang darat dan laut menuju Indonesia berkedaulatan. Malang: UB Press.