

Assessing major drivers of crop shifting from rice to horticultural production: a case of Landonu sub-regency in Southeast Sulawesi

H Saediman¹, Y Indarsyih¹, S Abdullah², S A Fyka¹ and I S Mboe³

¹ Department of Agribusiness, Halu Oleo University, Kampus Hijau Anduonohu, Kendari 93232 Sulawesi Tenggara, Indonesia

² Department of Agricultural Extension, Halu Oleo University, Kampus Hijau Anduonohu, Kendari 93232 Sulawesi Tenggara, Indonesia

³ Independent researcher, Jl Balai Kota 2, Kendari 93117 Sulawesi Tenggara, Indonesia

Corresponding author: saediman@yahoo.com

Abstract. Climate change can have adverse impact on rice as it depends much on precipitation and temperature. In recent years, due partly to climate change, rice farming becomes riskier to failure and less competitive than other crops, so many farmers have left rice farming. This study aimed to determine the major drivers responsible for crop shifting from rice to horticultural production. The study was conducted in Abenggi village of South Konawe Regency in Southeast Sulawesi. Interview and Focus Group Discussions (FGC) were used to collect data and information. Data were analyzed using pairwise comparison method. Study results indicated that the pull factors were more dominant than the push factors. Five most important crop shifting drivers were high farm returns, lower risk of failure, high market demand from horticultural production, and high risk of failure and inadequate water supply from rice farming. Horticulture farming provides more benefits than rice farming in income generation and local economic growth, but abandoning rice fields might compromise food security promotion efforts in the long run. The government and all stakeholders should understand all these drivers to adopt integrated policies and programs in pursuing development objectives of food security promotion, poverty alleviation, and rural development to achieve sustainable development

1. Introduction

Rice is the most important food crop in Indonesia. It has a vital role in maintaining food security as 97% of Indonesia's population consumed it as a staple food [1]. For this reason, the government of Indonesia has implemented various programs and policies to increase rice production and productivity [2]. However, production has been insufficient to meet domestic demand, so Indonesia imports rice from other countries [3]. In 2013, rice production reached 67.4 million tons and imported rice volume was 71,403 tons [4]. In 2016, rice production amounted to 75.5 million tons and imported volume was 997,710 tons [4]. Three major challenges in promoting domestic rice production are growing population, climate change [5], and conversion of paddy fields to non-agricultural uses or non-food crops [6]. Climate change affects rice growth and yield as rice is a water-intensive crop that is much affected by temperature and precipitation changes. The declining yield leads to reduced rice farming competitiveness, which may drive many growers to shift to other crops with higher returns [7].



In Southeast Sulawesi, in recent years, some studies indicate that in certain areas, farmers have shifted from rice farming to other crops [8][9][10]. One area where rice farmers have shifted to horticultural crops is Abenggi village in South Konawe regency. As a transmigration village, the village was once known as a rice-producing village for many years, but farmers have recently shifted to brick making or grown horticultural crops [7][11]. Factors that resulted in the shift consist of push and pull factors [12][13]. Push factors are factors that push farmers to leave rice farming. Pull factors are factors that attract farmers to grow new crops. Higher returns from horticultural crops [10][11] might be one of the pull factors. There is a need to ascertain other drivers of crop shifting and the importance of a particular driver among all other drivers. The objective of this study was to assess the major drivers of crop shifting from rice farming to horticultural crops. Specifically, this study aimed to (1) identify push and pull factors responsible for the crop shift, and (2) analyze the importance of each factor in each group of push and pull factors.

2. Methods

The study was conducted in August-September 2019 in Abenggi village in Southeast Sulawesi. The study is part of a broader study regarding shifting from rice to other crops or livelihoods conducted from 2016, in which the results of other studies had been published [7][10][11][14]. The study village was selected because rice farming in the area does not exist anymore as farmers have shifted to brick production or horticulture production. In this study, we only focused on melon and watermelon. There were 108 farmers in the village, approximately 20 percent each grew melon and watermelon.

Data and information were collected through Focus Group Discussions (FGDs) and observation. FGDs were conducted twice with melon and watermelon farmers. Data and information were analyzed using pairwise comparison of the AHP (Analytical Hierarchy Process) approach. AHP is an analytical tool to assess factors with the highest priority using pairwise comparison [15][16]. Pairwise comparison is conducted to compare two factors through a questionnaire with a scale from one to nine. As shown in Table 1, the value of 1 indicates equal importance, whereas the value of 9 means extreme importance [17].

Table 1. Pairwise comparison scale

Importance	Explanation
1	Two factors equally contribute to the objective
3	One factor is slightly favored over another based on experience and judgment
5	One factor is strongly favored over another based on experience and judgment
7	One factor is strongly favored and its dominance is demonstrated in practice
9	Importance of one factor over another is affirmed on the highest possible order
2,4,6,8	Intermediate values used to represent compromise between the two

The AHP approach used in this study was modified from the SWOT-AHP method [18] that consists of the following four steps: (i) identifying the push and pull factors, (ii) performing pairwise comparison between factors within each group, (iii) performing pairwise comparison between the push and pull groups, and (iv) calculating the global priority value. In step 1, the researcher team consulted previous study results [7][10][11][14] and used the push factors that were identified in Saediman *et al* [7]. In step 2, the researcher team prepared and used AHP questionnaires to make pairwise comparisons between factors within each push and pull group. In step 3, the researcher team performed pairwise comparison of the two factors with the highest local priority value from each group. In step 4, the global priority value was obtained from the multiplication of the group and the local priority values.

3. Results

3.1. Identification of the push and pull factors

Tables 2-3 present the significant drivers of crop shift from rice farming to horticultural production. Factors that compel farmers to leave rice farming (push factors) were higher failure risks (PS1), demand and price uncertainty (PS2), decreased net returns (PS3), water shortage (PS4), labor shortages (PS5), and lack of collective action (PS6). On the other hand, factors that attracted farmers to start horticultural production (pull factors) were lower risk (PL1), short growing period (PL2), higher returns (PL3), farming skills (PL4), high market demand (PL5), and soil and agro-climate suitability (PL6).

3.2. Pairwise comparison between factors

Tables 2-3 show pair-wise comparison results between factors in each group. Under the push factors, “higher failure risk” was the highest-rated factor, and “the lack of collective action” was the lowest-rated factor. Under the pull factors, “higher returns” was the most rated factor, and “lower risks” was the least rated factor.

Table 2. Result of pairwise comparison of the push group

Push Factors	GP	Rank
(PS1) Higher failure risks	0.362	1
(PS2) Demand and price uncertainty	0.173	3
(PS3) Decreased net returns	0.113	4
(PS4) Water shortages	0.245	2
(PS5) Labor shortages	0.065	5
(PS6) Lack of collective action	0.042	6
CR = 0.071		

Source: Geo and Saediman [14]

Table 3. Result of pairwise comparison of the pull group

Pull Factors	GP	Rank
(PL1) Lower risk	0.112	5
(PL2) Short growing period	0.206	2
(PL3) Higher returns	0.293	1
(PL4) Farming skills	0.178	3
(PL5) High market demand	0.151	4
(PL6) Soil and agro-climate suitability	0.059	6
CR = 0.075		

Source: field survey results

Pairwise comparison between the groups of push and pull factors resulted in the priority value of 0.667 for the pull group and 0.333 for the push group. This result implied that pull factors were more responsible for the crop shifting from rice to horticultural farming.

3.3. Global priority values

Table 4 presents the global priority value of each factor. The global priority value reflected the importance of a particular factor relative to all factors on the crop shift. A factor that had the highest priority value was “higher returns” (PL3). Other eleven factors in order of importance were “shorter production cycle” (PS4), “higher risk of failure” (PS1), “higher market demand” (PL5), “inadequate water supply” (PS4), “soil and agro-climatic suitability” (PL6), “demand and price uncertainty” (PS2), “farming skills” (PL4), “declining returns to farming” (PS3), “lower risks” (PL1), “labor shortages” (PS5), and “lack of collective action” (PS6).

Table 4. Global priority value of all factors in the two groups

Push and Pull Factors	Local priority	Global priority	Overall rank
Push Factors (group priority 0.333)			
(PS1) Higher failure risks	0.362	0.120	3
(PS2) Demand and price uncertainty	0.173	0.058	7
(PS3) Decreased net returns	0.113	0.038	9
(PS4) Water shortages	0.245	0.082	5
(PS5) Labor shortages	0.065	0.022	11
(PS6) Lack of collective action	0.042	0.014	12
Pull Factors (group priority 0.667)			
(PL1) Lower risk	0.036	0.024	10
(PL2) Short growing period	0.246	0.164	2
(PL3) Higher returns	0.390	0.260	1
(PL4) Farming skills	0.064	0.043	8
(PL5) High market demand	0.170	0.113	4
(PL6) Soil and agro-climate suitability	0.094	0.063	6

4. Discussion

Higher net returns is rated as the most important factor. Results of the previous studies indicated that net returns in horticultural production is significantly higher than that of rice farming [11]. This finding revealed that the economic returns level was the most important factor for farmers to decide to cultivate horticultural crops. This result confirms the finding in previous studies done in the same subdistrict where net returns was identified as one essential reason for rice farmers to shift to key lime production [8] and brick making [7]. This result is also in line with the findings reported in several studies [12][16][17][18][19] that net returns are essential for farmers to cultivate new crops or enter into non-agricultural activities.

Shorter production cycle of horticultural crops is the second-rated factor in the pull category. Compared to rice, melon and watermelon are short duration crops that reach maturity in 2-3 months. Farmers prefer this shorter period to maturity and harvest as they can obtain cash faster. Quick cash earning is preferred as farmers usually borrow money from traders or intermediaries to buy inputs, do land preparation, provide wages to workers, or just to cover daily living costs. In addition, after the harvest, they can do other income-generating activities while waiting for the next cropping season. Therefore, farmers consider a cropping period as an important aspect of selecting the crop to grow.

High market demand is the third-rated factor in the pull category. Melon and watermelon are recent commercially growing crops in the province, both melon and watermelon were observed to have high demand in the urban and peri-urban markets. Along with an increase in the number of middle-income households, knowledge of melon and watermelon as a source of vitamins and micronutrients, and awareness regarding the importance of fruit for health, there is a growing demand for melon and watermelon. As a result, both melon and watermelon enjoy high market prices and hence they become high-value cash crops.

Agroclimatic condition and farming skills are two factors also taken into account. Farmers perceived the soil types in the area as being suitable for growing horticultural crops. Likewise, climatic condition is also regarded as suitable despite the effect of climate change. Concerning farming practices, farmers noted that growing melon and watermelon require more care, but the farming skills are something they can learn and master. After all, farming practices on horticultural production are now widely accessible on various social media platforms, so farmers can learn directly from them.

Lower risk is also considered as one factor taken into account. Farmers noted that actually growing melon and watermelon have high risks, especially weather conditions, water availability, and input availability. However, in the farmers' minds, risks in growing melon and watermelon are relatively manageable. For example, they avoided planting melon and watermelon during heavy rainy season and

used water pump to move water from its source to the field. Overall, melon and watermelon are regarded as less risky crops compared to rice.

5. Conclusion

There were a number of factors that push farmers to quit rice growing (push factors) and attract farmers to involve in horticultural production (pull factors). Push factors, in order of priority, were higher failure risks, water shortages, price and market uncertainty, declining net returns, labor shortage, and lack of collective action. The pull factors, in order of priority, are higher returns, shorter growing period, high market demand, soil and agro-climate suitability, farming skills, and lower risks. The pull factors were more dominant than push factors, meaning that the pull factors were more responsible for the crop shift than the push factors. Horticultural production offers more benefits in terms of income generation and rural economic development, but abandoning rice fields might not be in line with the efforts to foster food security. Therefore, it is necessary for the local government and all stakeholders to adopt the right policies and programs that take into account comprehensively the development objectives of food security, poverty alleviation, and rural economic development.

References

- [1] BPS 2018 *Perkembangan beberapa indikator utama sosial-ekonomi Indonesia November 2017* (Jakarta: BPS)
- [2] Saediman H, Limi M A, Rosmawaty, Arimbawa P, Indarsyih Y 2016 Cassava consumption and food security status among cassava growing households in southeast Sulawesi, *Pakistan J. Nutr.* **15** 1008–1016
- Saediman H, Aisa S, Zani M, Limi M A, Yusria W O 2019 Food Security Status of Households in a Cassava-Growing Village in Southeast Sulawesi, Indonesia *J. Agric. Ext.* **23** 199–209
- [3] Widyanti A, Sunaryo I, Kumalasari A D 2014 Reducing the Dependency on Rice as Staple Food in Indonesia - A Behavior Intervention Approach, *J. Int. Soc. Southeast Asian Agric. Sci.* **20** 93–103.
- [4] Kementerian Pertanian Republik Indonesia 2017 *Statistik Pertanian 2017* (Jakarta: Kementerian Pertanian Republik Indonesia)
- [5] Saediman H, Lasmin L O, Limi M A, Rianse U, Geo L 2020 Rice Farmers' Perception of Climate Variability in South Konawe District of Southeast Sulawesi, *Int. J. Sci. Technol. Res.* **9** 3128–32.
- [6] Harini R, Yunus H, Kasto, Hartono S, Harini R 2012 Agricultural land conversion: determinants and impact for food sufficiency in Sleman Regency, *Indones. J. Geogr.* **44** 120 – 33.
- Nurliani and Rosada I 2016 Rice-field conversion and its impact on food availability *Agric. Sci. Procedia* **9** 40–46.
- [7] Saediman H, Mustika, Nalefo L, Tufaila M, Zani M 2019 Cost and Return Analysis of Rice Farming and Brick Making in South Konawe District of Southeast Sulawesi *Int. J. Sci. Technol. Res.* **8** 835–38.
- [8] Fausayana I, Miniarti Y, Rosmawaty R 2019 Perbedaan Pendapatan Peralihan Lahan Usahatani Padi Sawah Menjadi Usahatani Jeruk Nipis Di Desa Watabenua Kecamatan Landono Kabupaten Konawe Selatan, *J. Ilm. Membangun Desa Dan Pertan.* **4** 117–21.
- [9] Surni S, Saediman H, Wulandari F, Zani M, Yunus L, Taridala S A A 2020, Profitability and constraints of small-scale tomato production in Baubau municipality of Southeast Sulawesi, *WSEAS Trans. Environ. Dev.* **16** 219–25.
- Saputra I N, Rahmah N, Meisanti 2019 Strategi nafkah petani oleh adanya konversi lahan sawah ke lahan kelapa sawit (studi kasus Desa Padangguni Utama Kecamatan Abuki Kabupaten Konawe), *J. Ilm. Membangun Desa Dan Pertan.* **4** 35–40.
- [10] Saediman H, Alwi L O, Rianse I S, Taridala S A A, Salahuddin S, Indarsyih Y, R W Astuti 2020 Comparative Profitability of Melon and Watermelon Production in South Konawe District of Southeast Sulawesi, *WSEAS Trans. Bus. Econ.* **17** 933-39.

- Isnian S N, Nalefo L, Mutmainnah M, Rosmawaty R, Mardin M 2018 Fungsi Kelembagaan Subak Pada Perkebunan Lada di Kecamatan Mowila Kabupaten Konawe Selatan (Studi Kasus pada Kelembagaan Subak Satu pada Tanaman Lada Hasil Konversi dari Padi Sawah di Kecamatan Mowila Kabupaten Konawe Selatan), *Bul. Penelit. Sosek.* **20** 72–81.
- [11] Saediman H, Astuti R W, Alwi L O, Zani M, Mboe I S 2020 Cost and Returns Analysis of Small-Scale Rice and Horticultural Farming in South Konawe District of Southeast Sulawesi, Paper Presented in 3rd Int. Conf. Adv. Sci. Innov. 20 June 2020, Medan.
- [12] Davis J 2006 Rural non-farm livelihoods in transition economies: emerging issues and policies, *Electron. J. Agric. Dev. Econ.* **3** 180–224.
- [13] Kainth G S 2010 Push and Pull Factors of Migration: A Case Study of Brick Kiln Migrant Workers in Punjab, available at <https://mpra.ub.uni-muenchen.de/30036/>.
- [14] Geo L and Saediman H 2019 Rice farming to brick production: What are major drivers of livelihood shift?, *Biosci. Res.* **16** 3640–47.
- [15] Saediman H 2015 Prioritizing commodities in southeast sulawesi province of Indonesia using AHP based borda count method, *Asian Soc. Sci.* **11** 171-79
- [16] Kurttila M, Pesonen M, Kangas J, Kajanus M 2000 Utilizing the Analytic Hierarchy Process AHP in SWOT Analysis: A Hybrid Method and Its Application to a Forest-Certification Case, *For. Policy Econ.* **1** 41–52.
- [17] Saaty T 2008 Decision making with the analytical hierarchy process, *Int. J. Serv. Sci.* **1** 83-98
- [18] Kahraman C, Demirel N C, Demirel T 2007 Prioritization of e-Government strategies using a SWOT-AHP analysis: the case of Turkey, *Eur. J. Inf. Syst.* **16** 284–98.
- [19] Yusuf S F G, Lategan F S, Ayinde I A 2013 Profitability and Adoption of Watermelon Technologies by Farmers in Moro Local Government of Kwara State, Nigeria, *J. Agric. Sci.* **5** 91–99.
- Daulay A R, Eka Intan K P, Barus B, Pramudya N B 2016 Rice Land Conversion into Plantation Crop and Challenges on Sustainable Land Use System in the East Tanjung Jabung Regency, *Procedia - Soc. Behav. Sci.* **227** 174–80.

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.