Social Farming Development to Improve Farming Desire and Profit: A System Thinking Approach

by Erma Suryani, Rully Agus Hendrawan, Ulfa Emi R., Ariani Dwi W., Damanhuri, Shuo-yan Chou

Submission date: 28-Apr-2023 03:53AM (UTC-0400)
Submission ID: 2078064567
File name: mprove_Farming_Desire_and_Profit_A_System_Thinking_Approach.pdf (415.44K)
Word count: 3910
Character count: 23360

Social Farming Development to Improve Farming Desire and Profit: A System Thinking Approach

1st Erma Suryani
Department of Information Systems
Institut Teknologi Sepuluh Nopember
Surabaya, Indonesia
erma.suryani@gmail.com

2nd Rully Agus Hendrawan
Department of Information Systems
Institut Teknologi Sepuluh Nopember
Surabaya, Indonesia
ruhendrawan@gmail.com

3rd Ulfa Emi Rahmawati
Department of Information Technology
Politeknik Negeri Jember
Jember, Indonesia
ulfaemi@polije.ac.id

4th Ariani Dwi Wulandari
Department of Information Systems
Institut Teknologi Sepuluh Nopember
Surabaya, Indonesia
arianidwiw@gmail.com

5th Damanhuri
Department of Agronomy
Universitas Brawijaya
Malang, Indonesia
damanhuri385@gmail.com

6th Shuo-Yan Chou
Department of Industrial Management
National Taiwan University of Science and Technology
Taipei, Taiwan
sychou2@gmail.com

2022 International Conference on Computer Engineering, Network, and Intelligent Multimedia (CENIM) | 978-1-6654-7650-8/22/$31.00 ©2022 IEEE | DOI: 10.1109/CENIM56801.2022.10037381

***Abstract*— Increasing the desire to farm to increase income is the main goal of sustainable agriculture. The main challenges include lack of adoption of modern agricultural machinery, difficulty in obtaining capital, and poor social services in farmer households. This study proposes the development of social farming by explaining the concept of multifunctional agriculture using systems thinking which can accommodate non-linear relationships between variables to overcome these problems. The scientific contribution of this research is creating policy formulations to adopt social farming by applying the concept of multifunctional agriculture. From the causal loop diagram developed, it shows that increasing the desire to farm can be done through increasing social awareness and farmers' profit. Farmers' profit can be increased by increasing productivity and minimizing cultivation costs. Further research can be done by developing stock and flow diagrams that refer to the causal loop diagrams.**

Keywords—sustainable agriculture, social farming, system thinking, multifunctional agriculture

I. INTRODUCTION

Currently, the agricultural sector in Indonesia is experiencing various problems, including the narrowing of agricultural land, the lack of use of modern agricultural technology, the emergence of fertilizer problems, the difficulty of finding sources of capital, and the modernization of agricultural marketing [1]. Agricultural land in Indonesia is getting narrower due to the conversion of land functions every year. This is as the result of the lack of Law socialization on the "Protection of Agricultural Land for Sustainable Food." The land expansion can increase the availability of paddy fields while reducing the amount of available rice land [2]. In terms of the use of technology in agriculture, Indonesian people currently do not use much of modern agriculture, such as agricultural machinery, genetic engineering, and information systems.

Furthermore, agricultural problems are also caused by the inadequate distribution of fertilizers and the insufficient involvement of inter-sectoral agencies in ensuring the availability or distribution of fertilizers. Capital is also one of the problems faced by farmers. Farmers' difficulty obtaining capital from banking institutions has hampered the increase in agricultural production, especially food crops [3]. Farmers also face food marketing problems due to inadequate markets, long marketing channels, low bargaining ability, price fluctuations, and the lack of information on agricultural product prices [4].

This study proposes the concept of social farming to overcome these problems. Social farming is an emerging approach in rural studies [5]. Social farming is a general term that includes all activities involving agriculture and rural resources to produce food and social services [6]. It combines economic and production dimensions with social dimensions and can then be seen as a process of social innovation [7]. Social farming has received attention from various stakeholders in Europe because it can produce several socio-economic benefits for farming households [8]. The evolution of social farming significantly encourages the affirmation of the concept of multifunctional agriculture. Among the various multifunctional practices, social farming allows farms to broaden the scope of their activities [9]. The notion of multifunctionality in social farming is primarily concerned with the potential combination of agricultural production and the development of welfare services [5]. Given the multifunctional role of agriculture, one of the several social dimensions of agricultural activity is the ability of agriculture to promote labor inclusion for vulnerable people, including individuals with difficulty finding work [10]. Agriculture in the multifunctional paradigm is quite diverse, but all farmers are willing to accept the dual responsibility. To reconsider their main orientation toward primary production and profit maximization, building new cross-sectoral and social alliances, and adopting more socially responsible production and marketing patterns [9]. Understanding participatory behavior, knowledge, food access, and food differences can affect farmers' social inclusion [11]. Social inclusion affects social awareness which means the ability to shift focus for a moment and start thinking about the people around them. Social awareness includes four components, namely: empathy, perspectives from various points of view, respect, and compassion [12]. The main focus of social farming is the ability of social agriculture to combine the production of agricultural products with the provision of services aimed at improving health and social welfare, such as creating jobs for the unemployed or individuals who have significant difficulties in accessing the work environment [13, 14].

The systems thinking approach is a method that can be used to represent the relationship between system variables

[15, 16]. This study introduces systems thinking approach to understand the actual conditions of rice cultivation. The results obtained from this study are causal loop diagrams that contribute to creating policy formulations to adopt social farming by applying the concept of multifunctional agriculture. This paper is structured as follows: Part 1 contains the introduction. Section 2 discusses the literature review. Section 3 contains the methodology. Section 4 presents the results and discussion as a causal loop diagram. Finally, Section 5 describes the conclusions and further research.

II. Literature Review

Increasing food productivity is a strategy to overcome food insecurity because increasing agricultural productivity means greater food supply and lower household food consumption expenditure [17]. The literature review related to paddy productivity and production, paddy harvest area, farmer's profit, social awareness, and system thinking can be explained as follows:

A. Paddy Harvest Area

Paddy harvest area is one of the indicators of sustainable rice farming from the economic side [18]. However, the problem of availability of agricultural land described in the first section is also a source of the problem of narrowing the paddy harvest area. In addition to questioning the availability of sufficient land, solutions to increase the knowledge and ability of farmers to manage agricultural land so that they can apply various modern technologies to improve the quality of crop yields [19].

B. Farmer's Profit

The implementation of the social farming system focuses on providing opportunities to increase economic value. Individual satisfaction will indirectly improve the image of agriculture [6]. Farmers can increase their knowledge on social farming through non-formal education and evaluation for optimal implementation. The development of social farming with multifunctional agriculture aims to increase farming desire and profit.

C. Paddy Productivity and Production

The soil composition is one of the factors that affect rice productivity. Rice is a plant that requires a lot of water, so irrigation management is needed [20]. Rice productivity is limited in the tropics due to low rainfall, nutrient status, and humidity [21]. Rice Husk Biochar (RHB) and commercialized bio-formulation (CSR-BIO) present in the soil, either added or pure, can significantly improve soil nutrient status in the tropics. Under normal conditions, the treatment of nitrogen, phosphate, and potassium fertilizers plus organic manure (NPKM) on the soil significantly increased organic matter content and nutrients in upland and paddy fields [22].

The experience of farmers and the extension will be able to positively impact agricultural development [23] and farmer households [8].

D. Social Awareness

Rural multifunctionality (agriculture and fisheries) is re-captured with the awareness of the relationship between economic, social, and environmental aspects to the sustainable development of the next generation in rural areas [24]. Currently, social capital has the power to deal with crisis conditions by providing food to each other and increasing sources of income [17]. Innovation in the agricultural sector and model-based exploration can support sustainable agriculture [25]. The research applies innovations to agricultural development in the Uruguay region through technology to improve soil quality, operations management, crop density, nutrition, and plant protection that impact increasing crop yields. Social networks that facilitate access to information also benefit farmers in sharing agricultural information with their colleagues [17]. Technology and ownership of resources in rural areas need to collaborate to realize the hope of sustainable life for the next generation.

E. System Thinking

Systems thinking is a method to describe and analyze the causality and interrelations between variables within a system. System Dynamics quantifies the impact of those interactions. Systems thinking is a causality-driven, holistic approach to describing the interactive relationships between components inside a system as well as influences from outside the system [26].

Systems Thinking Diagrams are composed of several components, elements, and influences. An influence also has a direction, indicated by an arrow, and an indicator as to whether the influenced element is changed in the same (S) or opposite (O) direction as the influencing element [27].

III. Methodology

This research uses systems thinking approach. This method was chosen because the system object of this research has a causal relationship involving various complex variables. Systems thinking is part of the system dynamics method that has the explicit ability to overcome non-linear and dynamic problems. It allows an increased understanding of the problems and behaviors [15, 16].

The analysis process begins in a dynamic system environment by collecting various variables on the research object. This study identified several variables that affect social farming and their relationship to increasing farming desire and profit. The variables in the social farming system were obtained from various previous research sources, as explained in the research results section.

A. Variable Analysis

The results of the literature review show that several variables in the social farming system are indicated to increase farming desire and profit. The following are some of the variables of social farming obtained from the literature review results [28, 21, 24, 17, 6, 29]. Each variable identified above has a relationship, which will then be explained in the causal analysis.

TABLE I. LIST OF SOCIAL FARMING SYSTEM VARIABLES

No.	Variable name	No.	Variable name
1	Birth rate	19	Participatory behavior
2	Death rate	20	Compassion of each other
3	Population	21	Perspective from a different point of view
4	Land conversion area	22	Social awareness
5	Paddy harvest area	23	Paddy productivity
6	Land expansion area	24	Cultivation cost
7	Credit	25	Grain price

No.	Variable name	No.	Variable name
8	Farmer's revenue	26	Agriculture tools assistance
9	Farming desire	27	Agriculture machine tools effect
10	Farmer's profit	28	Fertilizer effect
11	Disliking dirty	29	Pest and disease effect
12	Underestimate in terms of farming	30	Seed effect
13	Knowledge	31	Number of farmers effect
14	Food access	32	Paddy production
15	Social inclusion	33	Quality of grain
16	Empathy	34	Storage
17	Respect	35	Processing
18	Food differences	36	Drying

B. *Development of Causal Loop Diagram (CLD)*

At this stage, all identified variables and causal relationships are depicted in the CLD diagram so that the polarities and loops in the social farming system are known. CLD represents the relationship between system variables to provide user understanding of behavior and system problems [27]. The CLD diagram of the social farming system is explained in more detail in the section of results and discussion.

IV. Result And Discussion

This section presents the results of drawing causal loop diagrams from the development of social farming by applying the concept of multifunctional agriculture based on real systems. In the CLD, there are several subsystems, including paddy harvest area, social awareness, farmer's profit, and paddy productivity and production. In the end, a causal loop diagram of social farming to improve farming desire and profit is presented.

A. *Paddy Harvest Area*

Fig. 1 presents the structure of the paddy harvest area subsystem. Paddy harvest area is affected by land conversion area and land expansion area. The land expansion area will expand the paddy harvest area. The wider the paddy harvest area, the higher the land expansion area (R1). The high land expansion area is also influenced by the provision of credit, the amount of farmer's revenue, and farming desire.

The increase in land conversion will reduce the paddy harvest area, but the wider the paddy harvest area, the higher the conversion rate (B1). Land conversion is also influenced by population. The higher the population, the higher the land conversion area. The high population is influenced by the high birth rate, while the death rate influences the decline in the population. The higher the population, the higher the birth rate (R2) and death rate (B2).

B. *Social Awareness*

Fig. 2 presents the general structure of the problem of social awareness. Increased social awareness is influenced by compassion for each other, perspectives from different points of view, respect, empathy, farming desire, and social inclusion. Increased social awareness will also increase farming desire (R3) and social inclusion (R4). Social awareness has a positive influence on access to food. When humans are easy to get food, the level of social inclusion will also increase. Furthermore, social inclusion will again affect social awareness (R5).

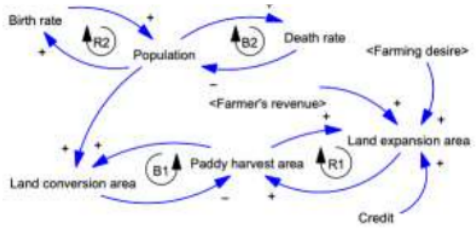

Fig. 1. CLD of paddy harvest area

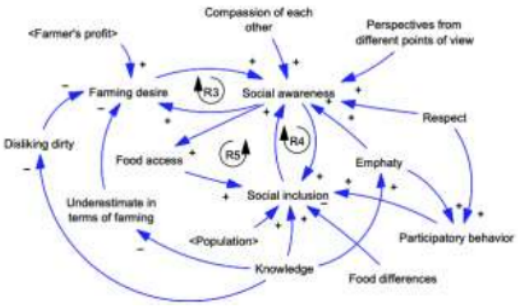

Fig. 2. CLD of social awareness

Besides being influenced by access to food, the increase in social inclusion is also influenced by the level of knowledge, participatory behavior, and population. However, differences in food between humans will reduce the level of social inclusion. Participatory behavior that can increase social inclusion is also influenced by other factors, namely the high level of empathy and respect. Empathy is influenced by the level of knowledge. The higher the knowledge, the greater the sense of empathy. On the other hand, farming desire is increased due to high social awareness and the effect of profits received by farmers.

People who underestimate the work of a farmer and do not like working in dirty fields will trigger a lower level of farming desire, but this can be overcome by increasing public knowledge. The higher knowledge will reduce the mindset that underestimates the work of farmers and views that farmers always work in dirty fields.

C. *Farmer's Profit*

Fig. 3 presents the general structure of the farmer's profit problem. The amount of cultivation cost is influenced by agriculture tools assistance, paddy productivity, and farmer's revenue. The more paddy productivity, the higher the cultivation cost. The existence of agriculture tools assistance also adds to the cultivation cost. The higher the farmer's revenue, the smaller the cultivation cost.

Farmer's profit is the reduction of farmer's revenue with cultivation cost. Farmer's profit 'positively affects farmer's revenue. The amount of farmer's revenue can reduce cultivation costs which reduce farmer's profit (R6). Farmer's revenue is influenced not only by farmer's profit but also by paddy productivity and grain price. The higher the yield of paddy productivity and grain price, the 'more the farmer's revenue.

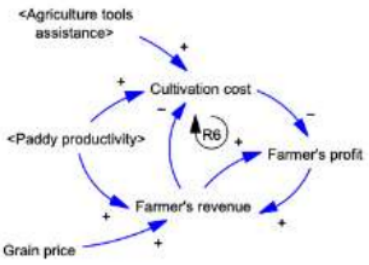

Fig. 3. CLD of farmer's profit

D. Paddy Productivity and Production

Fig. 4 presents the structure of the paddy productivity and production subsystem. Paddy productivity sometimes increases and decreases. The increase in paddy productivity is influenced by the application of fertilizers, quality seeds, the use of agriculture machine tools, the availability of agriculture tools assistance, the amount of farming desire, and many farmers. Meanwhile, the decline in paddy productivity is influenced by pests and plant diseases.

Agriculture tools assistance will not only increase paddy productivity but will also positively affect the provision of better agriculture tools assistance (R7). The availability of agriculture tools assistance will increase the effect and volume of use of agriculture machine tools (R8). The existence of agriculture tools assistance is also influenced by the level of social awareness. Farming desire has a positive effect on paddy productivity and the number of farmers and paddy production.

The number of farmers is not only influenced by farming desire but also positively influenced by farmer's profit because the greater the farmer's profit, the greater the number of farmers. The amount of paddy production, which is influenced by farming desire and agriculture machine tools, is a multiplication of paddy productivity with paddy harvest area and quality of grain. The quality of grain is the quality of grain that is influenced by 3 aspects: drying, processing, and storage.

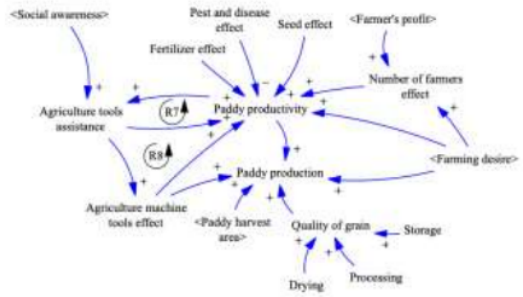

Fig. 4. CLD of paddy productivity and production

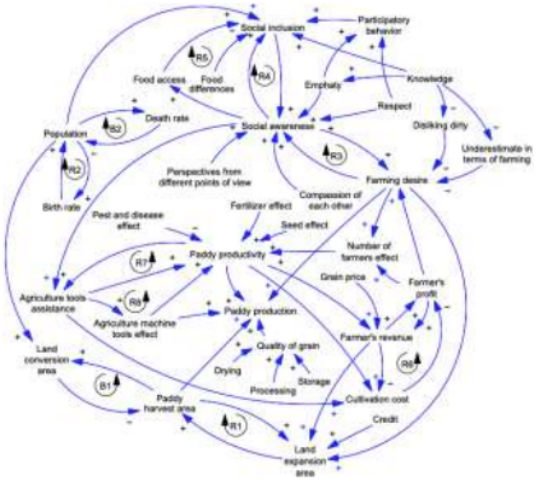

Fig. 5. CLD of paddy cultivation system

Fig. 5 shows the relationship between the structure of the paddy harvest area subsystems, social awareness, farmer's profit, and paddy productivity and production in increasing the desire to farm for high incomes. The scenario can be done by adopting social farming by applying the concept of multifunctional agriculture.

V. Conclusion And Further Research

Social farming is an approach that includes all activities that use rural and agricultural resources to produce food and social services. Social farming focuses on the concept of multifunctional agriculture. This multifunctional farming system is influenced by several variables that are interrelated linearly and nonlinearly with interactive feedback loops. These variables include the process of social innovation, socio-economic improvement of farmer households, development of welfare services, improvement of farmer health services, encouraging labor inclusion of vulnerable people, including individuals with difficulty finding work, increasing production, maximizing profits, building cross-sectoral alliances, adopting more socially responsible production and marketing patterns, providing credit, procuring agriculture tools assistance, and increasing social awareness.

The findings of this study are the scenario of the adoption of social farming by applying the concept of multifunctional agriculture described in the causal loop diagram. A causal loop diagram is system thinking, describing the relationship between system variables. In this study, the causal loop diagram describes the relationship between variables that affect the impact of social farming on farming desire and farmer's profit. Farming desire is influenced by four significant variables': farmer's profit, social awareness, disliking dirty, and underestimation in farming. At the same time, significant variables that affect farmer's profit are farmer's revenue and cultivation cost.

The government and other stakeholders can use system thinking described in the conceptual model (causal loop diagram) to make decisions and formulate policy strategies to adopt social farming by applying the concept of multifunctional agriculture. Further research can be done by

developing stock and flow diagrams that refer to the causal loop diagrams generated from this research.

REFERENCES

[1] N. M. Reswari, "Permasalahan yang terjadi di sektor sosial ekonomi pertanian Indonesia," MISEKTA, 13 Agustus 2021. [Online]. Available: https://misekta.id/news/permasalahan-yang-terjadi-pada-sektor-sosial-ekonomi-pertanian-indonesia. [Accessed 05 April 2022].

[2] E. Suryani, R. A. Hendrawan, Damanhuri, U. E. Rahmawati and S.-Y. Chou, "Scenario development to create a sustainable price of rice: A system thinking approach," *Procedia Computer Science,* vol. 197, pp. 599-606, 2022.

[3] Ant/Fir, "Kementerian Desa, Pembangunan Daerah Tertinggan dan Transmigrasi Republik Indonesia," Kementerian Desa, Pembangunan Daerah Tertinggan dan Transmigrasi Republik Indonesia, 17 Juli 2007. [Online]. Available: https://kemendesa.go.id/berita/view/detil/406/sulit-modal-peningkatan-produksi-pertanian-terhambat. [Accessed 05 April 2022].

[4] Tani, "paktanidigital," Pak Tani Digital, 14 09 2021. [Online]. Available: https://paktanidigital.com/artikel/beberapa-kendala-pemasaran-produk-agribisnis/#.YlVnFchBzb0. [Accessed 05 04 2022].

[5] S. Elsen and L. Fazzi, "Extending the concept of social farming: Rural development and the fight against organized crime in disadvantaged areas of southern Italy," *Journal of Rural Studies,* vol. 84, pp. 100-107, 2021.

[6] M. Garcia-Liorente, C. M. Rossignoli, F. D. Lacovo and R. Moruzzo, "Social farming in the promotion of social-ecological sustainability in rural and periurban areas," *Sustainability,* vol. 8, pp. 1-15, 2016.

[7] S. Elsen, Eco-social transformation and comunity-based economy, London: Routledge, 2019.

[8] I. Bassi, F. Nassivera and L. Piani, "Social farming: a proposal to explore the effects of structural and relational variables on social farm results," *Agricultural and Food Economics,* pp. 1-13, 2016.

[9] J. D. Van Der Ploeg and D. Roep, "Multifunctionality and rural development: the actual situation in Europe," in *Multifunctional Agriculture: A New Paradigm for European Agriculture and Rural Development*, Aldershot, Ashgate Publishers, 2003, pp. 37-53.

[10] B. Torquati, C. Paffarini, T. Tempesta and D. Vecchiato, "Evaluating consumer perceptions of social farming through choice modelling," *Sustainable Production and Consumption,* pp. 1-9, 2019a.

[11] E. Fourat, C. Closson, L. Holzemer and M. Hudon, "Social inclusion in an alternative food network: Values, practices and tensions," *Journal of Rural Studies,* vol. 76, pp. 49-57, 2020.

[12] E. Straw, "Social awareness: What is it & why is it important?," 2022. [Online]. Available: https://www.successstartswithin.com/blog/social-awareness. [Accessed 10 Februari 2022].

[13] C. Milligan, A. Gatrell and A. Bingley, "'Cultivating health': therapeutic landscapes and older people in northern England," *Social Science & Medicine,* vol. 58, no. 9, pp. 1781-1793, 2004.

[14] C. Leck, D. Upton and N. Evans, "Growing well-beings: The positive experience of care farms," *British Journal of Health Psychology,* vol. 20, p. 745–762, 2015.

[15] C. W. Churchman, The systems approach, New York: Dell Publishing Co., Inc., 1968.

[16] J. D. Sterman, Business dynamics: System thinking and modeling for a complex world, McGraw-Hill/Irwin: Jeffrey J. Shelstad, 2000.

[17] A. D. Kehinde, R. Adeyemo and A. A. Ogundeji, "Does social capital improve farm productivity and foo security? Evidence from cocoa-based farming household in Southwestern Nigeria," *Heliyon,* vol. 7, 2021.

[18] I. Mucharam, E. Rustiadi, A. Fauzi and Harianto, "Assessment of rice farming sustainability: Evidence from Indonesia provincial data," *International Journal of Sustainable Development and Planning,* vol. 15, no. 8, pp. 1323-1332, 2020.

[19] S.-u.-. Haq and B. Ismet, "Developing sustainable agriculture indicators framework for tea farms in Rize province Turkey," *International Conference on Food and Agricultural Economics,* pp. 223-230, 2017.

[20] A. Darzi-Naftchali, H. Ritzema, F. Karandish, A. Mokhtassi-Bidgoli and M. Ghasemi-Nasr, "Alternate wetting and drying for different subsurface drainage system to improve paddy yield and water productivity in Iran," *Agricultural Water Management,* vol. 193, pp. 221-231, 2017.

[21] J. S. Singh, V. C. Pandey and D. Singh, "Coal fly ash and farmyard manure amendments in dry-land paddy agriculture field: Effect on N-dynamics and paddy productivity," *Applied Soil Ecology,* vol. 47, pp. 133-140, 2011.

[22] L. Kai-lou, L. Ya-zhen, Z. Li-jun, C. Yan, H. Qing-hai, H. Xi-chu and L. Da-ming, "Comparison of crop productivity and soil microbial activity among different fertilization patterns in red upland and paddy soils," *Acta Ecologica Sinica,* pp. 1872-2032, 2017.

[23] M. N. Hoque, S. M. Saha, S. Imran, A. Hannan, M. M. H. Seen, S. S. Thamid and F. Tuz-zohra, "Farmers' agrochemicals usage and willingness to adopt organic inputs: Watermelon farming in Bangladesh," *Environmental Challenges,* vol. 7, 2022.

[24] A. U. Szumelda, "Agriculture and everyday realities on small farms – An entrepreneurial challenge to farmers between the desire for autonomy and a secure existence. Two examples from east and south-east Poland," *Journal of Rural Studies,* vol. 67, pp. 57-68, 2019.

[25] C. P., W. Rossing and S. Dogliotti, "Closing sustainability gaps on family farms: Combining on-farm co-innovation an dmodel-based explorations," *Agricultural Systems,* vol. 188, no. 103017, pp. 1-12, 2021.

[26] System Dynamic Society, "System dynamic society," 2022. [Online]. Available: https://systemdynamics.org/what-is-system-dynamics/. [Accessed 17 10 2022].

[27] U. E. Rahmawati, E. Suryani and R. Riski, "System thinking approach to increase eco-friendly maize production to support food security," *IPTEK Journal of Proceedings Series,* no. 6, pp. 17-23, 2020.

Social Farming Development to Improve Farming Desire and Profit: A System Thinking Approach

ORIGINALITY REPORT

14%	11%	10%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	"Front Matter", 2022 International Conference on Computer Engineering, Network, and Intelligent Multimedia (CENIM), 2022 Publication	2%
2	Susanne Elsen, Luca Fazzi. "Extending the concept of social farming: Rural development and the fight against organized crime in disadvantaged areas of southern Italy", Journal of Rural Studies, 2021 Publication	2%
3	systemdynamics.org Internet Source	2%
4	iptek.its.ac.id Internet Source	2%
5	link.springer.com Internet Source	2%
6	Submitted to Universitas Islam Indonesia Student Paper	2%
7	www.coursehero.com	

	Internet Source	1%
8	www.mdpi.com Internet Source	1%
9	coek.info Internet Source	1%
10	sciendo.com Internet Source	1%
11	vufind.katalog.k.utb.cz Internet Source	1%

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		

Social Farming Development to Improve Farming Desire and Profit: A System Thinking Approach

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5