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RESEARCH

The Conception-Adoption Model of Organic Rice Innovation: Farmer's Social Economic Aspect (Case Study in Tasikmalaya District, West Java)

Mahra Arari Heryanto, Yayat Sukayat, and Dika Supyandi

Laboratory of Sociology and Agricultural Extension of the Department of Agricultural Social-Economy, Faculty of Agriculture, Universitas Padjadjaran

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*** Correspondence:**
Jl. Raya Bandung-Sumedang Km.21, Jatinangor, 45363

E-mail:
mahra.arari@unpad.ac.id

Abstract

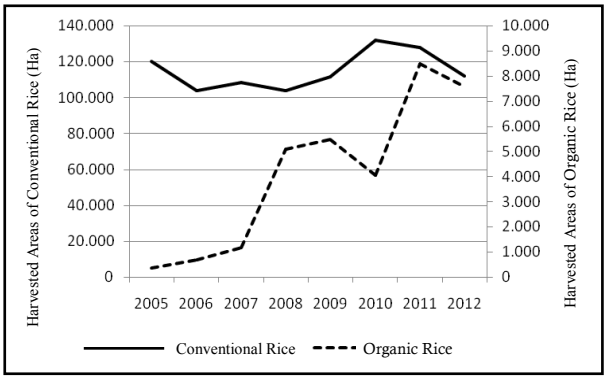
The process of organic rice farming system conception initiated by international market demand for organic rice which is drive businessman to create a partnership with farmer to fullfil the demand. In conception stage, it is running effectively substitue convetional farming with organic farming system. However, conception process which has been running will not continue to adoption stage if this process managed not properly. Social factor (farmer behaviour)is a determinant in farmer decision to adopt organic farming system because of interelations with the economic practically. Technology, environment, attitude and belief interaction in adoption stage more complex than canception stage. This model built qualitatively using system thinking method and social fabric matrix (SFM). Causal loop diagram used to analyze causality of elements interalistionship in conception and adoption stage, thus social fabric matrix used to mapping the element interelation involved in organic farming adoption which is consist of social institution, technology, environment, value and belief, and attitude. This research indicates that adoption stage is critical point that have to be passed in an innovation process. The point is innovation should be managed properly since the conception until adoption that involved social, economy and technology elements.

Keywords: conception-adoption, innovation, organic farming, social fabric matrix, systems thinking

1. Introduction

Organic rice has long been known by Indonesian people as an environmentally-friendly alternative of farming systems. Tasikmalaya District as one of organic rice areas in West Java encounters many challenges, especially from the social and economic aspect of the farmers who develop organic rice since a few years ago.

Since 2005, the developmental behavior of organic rice harvested area showed a significant growth (Figure 1). We can perceive that some of paddy fields previously using conventional technology switched to organic technologies in 2005 -2009 and in 2011). On the contrary, in 2010 the number of conventional paddy fields increased, while the organic rice harvested area declined quite dramatically.



Source: Office of Food Plants Agriculture, Tasikmalaya District

Figure 1. The Development of Harvested Areas of Conventional Rice and Organic Rice in Tasikmalaya District, 2005-2012

Transitional dynamics of technology use from conventional rice to organic rice cannot be separated from social, economic, environmental and technological factors. As an innovation, organic technology is new to the rice farmers who have been highly dependent on the use of chemical pesticides and fertilizers, particularly after the launching of Green Revolution in the 1970s.

Referring to the above phenomenon, the conception process and adoption of an innovation becomes important, even a critical point that must be passed well so that the initiated innovation can run and provide long-term benefits to the community. An innovation will only stop at the invention stage if it does not provide benefits to users (Yuliar, 2009; Heryanto and Supyandi, 2012).

As a developing country, Indonesia requires a lot of innovations, beneficial to move the wheels of economy, especially the food sector that has to continuously catch up the population growth. As the main supporter for food production sector, the sustainability of environmental aspect must be maintained properly so that it will not backfire the agricultural sector, because the environmental supporting capacity drops due to the use of pesticides and chemical fertilizers (Meadows, 2004; Heryanto and Karmana, 2010).

Farming business system then appears as an alternative solution for environmentally-friendly food production. In practice, the model of conception-adoption of organic rice is required as a portrait of the complexity of the going-on processes for gradually changing the chemical-affluent and environmentally-damaging conventional farming system with environmentally and ecosystemically-friendly organic farming. Yet behind it all, there is a cost to be paid both socially, economically, and technologically, causing the process to be difficult to run and full of dynamics.

2. Theoretical/Conceptual Framework

The process of how the conception and adoption of a technology becomes an innovation is the key concept used in this study. Changes in technology will affect people's behavior, both in terms of social institutions, values, attitudes and norms (Hayden, 1986; Setiawan, 2012).

Theoretically, the process of adoption (diffusion) of an innovation is more popular than the theory of how an innovation is conceptualized. Creating a conception of innovation in the agricultural sector is still rare; most players of agricultural sector in Indonesia are still positioned merely as users (adopter) of an innovation.

Diffusion as a process of an innovation is communicated through certain channels to members of the social system, emphasizing on the adoption process. In practice, the players of agricultural sector from upstream to downstream with their variety of differences require innovations suitable with their needs. An invention shall actually be an innovation if it is suitable with the needs of and provide benefits to the agricultural sector players. It means an innovation is diffused in accordance with the needs of its users (Rogers, 1995; Yuliar 2009; Setiawan, 2012).

Conception phase begins with the problematization of certain practical situations sourced from a specific technical configuration. Adoption phase is a follow-up that mobilizes involved social actors and technical objects, so it can produce a new technical configuration (Yuliar, 2009). Innovation-adoption process will run smoothly if it is appropriate to the needs of its users (Heryanto, 2012). Many adoptions of agricultural sector innovations stop in the middle of the process due to the innovation-conception stage that is top-down.

The change in farming business system from previously using chemical fertilizers and pesticides into using natural fertilizers and pesticides is a system innovation. The innovation substance and its realization process is the discussion subject of system innovation. An innovation is comprehensive because it will change the whole system, not just a component of the system alone. In the process, transition management in the system innovation is mandatory and requires time. The principles of transition management include: a) it has objectives, and long-term targets, b) it is intentional, c) it is dominated by interactions, d) it is measurable by medium-term and long-term targets, and e) there is a paradigm shift (Bruijn et al., 2004).

3. Research Method

The method used in the study is qualitative. The study was conducted using mental data, written data and numerical data. Mental data is experienced information of observation results with the most extensive coverage of data between the written data and numerical data (Forrester, 1975).

The process of conception and adoption of organic rice farming system is the innovation substance discussed in this study. The data collection was done by using in-depth observation of each stakeholder involved in the innovation system of organic rice, namely farmers, farmer groups, rice mill, exporters of organic rice and District government of Tasikmalaya.

The data obtained were then analyzed by systems thinking approach and social fabric matrix (SFM). Systems thinking approach is used to study how the process of conception and adoption of organic rice innovation is, while social fabric matrix is used to map the interactions between the elements involved in the process of adoption of organic rice innovation.

The process of system innovation in the structure of the causal diagram is divided into two stages,

namely the innovation-conception phase and innovation-adoption stage. The information from the observation is identified as components or elements that constitute the data to be compiled in a structure of diagram based on cause and effect relationship between elements by using a sequence of system innovation process.

Systems thinking approach has a tool known as system archetype that is useful to recognize the behavioral pattern of the system. Each archetype illustrates a story line with its own theme; particular pattern of behavior can be described and the unique structure of the system can be described with the causal loop diagram/CLD). System archetypes can be used to perceive the future prospect for planning (Braun, 2002).

The positive arrows may mean the cause will add to the effect or will influence the effect in similar direction of change. Similar direction of change means: if the cause increases (or decreases), it will cause the effect also increases (or decreases). While the negative arrow may mean the cause will decrease the effect or the cause influences the effect in the opposite direction of change. Opposite direction of change means: if the cause increases (or decreases), its influence on the effect will be vice versa or the declining (or rising) effect.

Furthermore, the social fabric matrix (SFM) is used to look at the various interactions and linkages between elements in the process of organic rice innovation-adoption. The elements involved are divided into several categories: 1) social institutions, 2) technology, 3) environment, 4) values and norms, and 5) attitudes and behaviors. Linkages and connectedness become regular in the social science that discusses technology. Diffusion of innovation means that technological innovation communicated through certain channels and time to all the elements existing within social systems (Hayden, 1982).

4. Results and Discussions

4.1 The Process of Organic Rice Conception

Organic rice as a high-value economic commodity in Tasikmalaya is one of the innovations initiated by exporters/entrepreneurs whose process involves district government.

Organic rice demand from abroad is a motivating factor for domestic entrepreneurs (exporters) to start an organic rice business. It is recognized that organic rice cannot be produced like ordinary rice whose production uses much chemical fertilizers and pesticides. The exporters commonly

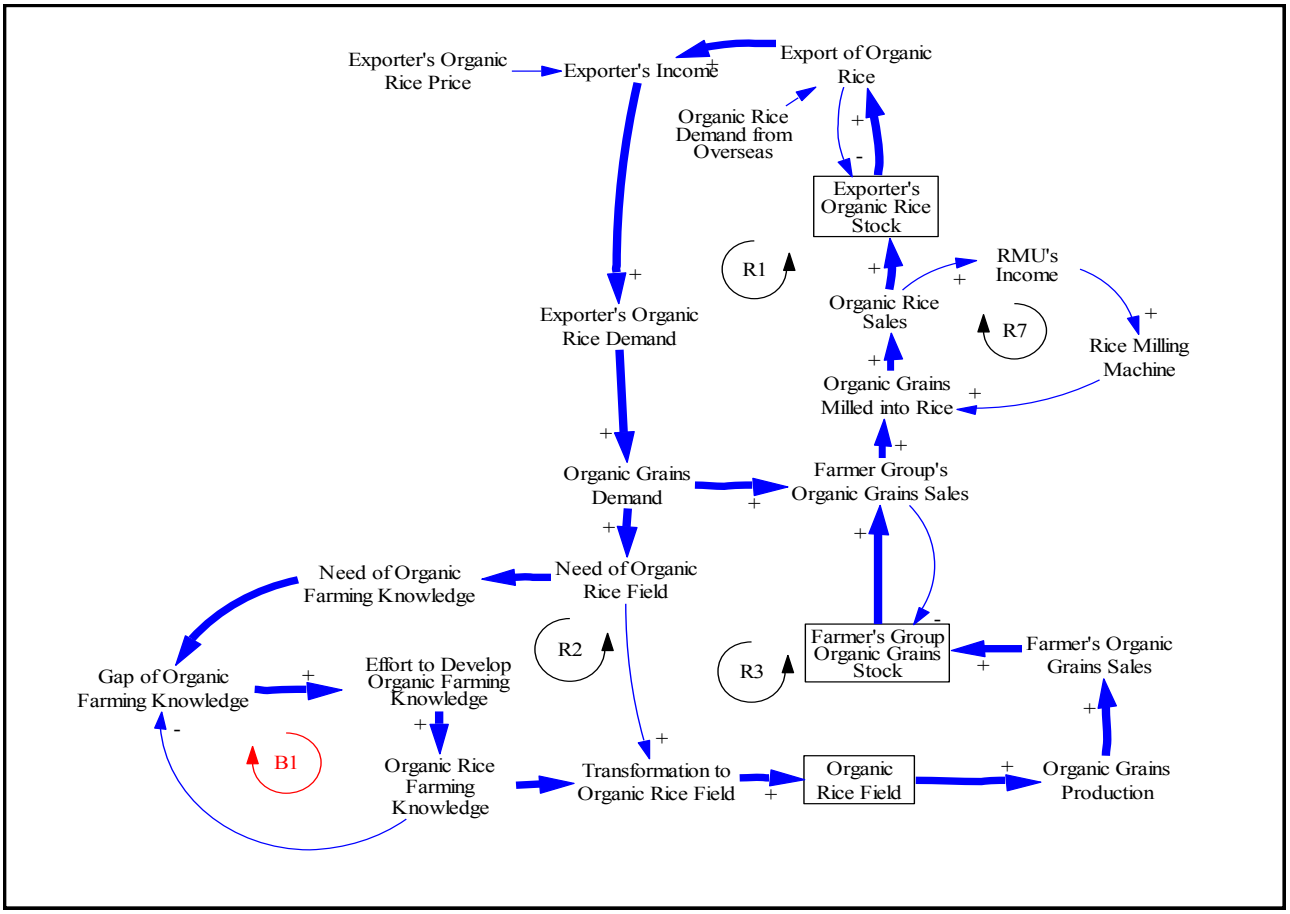


Figure 2. The Structure of Causal Loop Diagram of the Organic Rice Innovation-Conception Process

approach farmer groups to collaborate on the production of certified organic rice. In this phase, economic value is the major trigger, since the price of organic rice in the market is higher than the rice commonly found in the market (Ring R1 in Figure 2).

Rice is the result of agro-processing, previously in the form of grain. Hence, to obtain the certified organic rice, first a certified organic grain is required. Without organic grain, there will not be any organic rice.

The fulfillment of organic grain is then left entirely to the farmer groups who have long cultivated rice as their major commodity. The farmers' knowledge on organic rice farming is an obstacle that must be overcome since farmers are used to using means of production made of chemicals, especially for fertilizers and pesticides. Meanwhile, a product is said to be organic if it does not use either direct or contaminative chemicals at all.

The farming-business knowledge on the organic farming system is a basic capital a farmer must own to implement organic farming system (Ring R2). So far, farmers' knowledge on the organic rice farming is still minimal, thus this gap of knowledge needs to be addressed.

The greater the knowledge gap, the greater the effort required to increase their knowledge. The technology used by farmers reflects the knowledge possessed by farmers. Therefore, the technology used is very important in an innovation (Rogers, 1995). Some efforts are required to identify what technologies are needed in organic rice farming system. One effort that can be taken to improve farmers' knowledge and technology is by developing a demonstrative plot of land (plot-demo). The existence of the plot of land becomes a medium of research for farmer to find out how to cultivate rice with an organic system.

The decision to use innovation will continue if the individual has sufficient knowledge (Rogers, 1995). At the beginning, the organic technology was introduced to farmers (through plot demonstrations), the process is still at the stage of conception because it has not provided benefits to farmers. Organic technology in Tasikmalaya at this stage is still an invention; if it does not give benefit, it will stop merely at invention stage (Yuliar, 2009). At that point, the socio-economic conditions of farmers and the communication channels used will greatly affect the process of conception in order to continue to adoption stage.

After plot-demo was over, only few farmers dared to implement organic farming systems. One time trial was still inadequate to convince many farmers; only a handful of farmers dared to change their agricultural patterns from conventional to organic system. This stage is quite critical in the transition process from conception to adoption.

After harvest, the organic grains as farmers' crop were sold to farmer groups to be processed into rice. The Ministry of Agriculture contributes greatly to the farmer union (Gapoktan) by granting rice milling machine so that the processing can be performed by the union (Ring R7).

In the conception stage, a system was created in which farmers sold grains to farmer groups (Poktan), who then sold the purchased grains to farmer unions (Gapoktan) to be processed into rice using a rice milling machine granted through the program of the Ministry of Agriculture. Further from the unions, exporters bought organic rice that has been packaged (Ring R3 and R7).

4.2 Organic Rice Adoption Process

As described by Rogers (1995), the decision to use innovation will continue if the individual has sufficient knowledge. Adoption phase forms a new socio-technical configuration (Yuliar, 2009), in which the organic farming means of production is the technical object and knowledge is the accumulation, owned by farmers and attached to the social object of rice farmers. Changes in technical objects always cause a change in the social object who receives the technical object changes.

District Government of Tasikmalaya and some private companions have a major role in the efforts to improve the knowledge on organic rice farming through various programs funded by district government and central government, as well as private institutions. The learning media through demonstrative plot of land (plot-demo) were massively provided in several locations of rice production centers (Ring B1 in Figure 3) in hopes of reducing the gap of knowledge on organic farming, in line with the use of organic rice technology.

The more farmers are trained and given the knowledge on organic rice production, the faster the process of adoption or diffusion of organic rice innovation, and the more the amount of organic grain productions (Ring R4 in Figure 3). That is one of the adoption patterns run in the upstream sector (on-farm).

Next, ring R6, R7, and R8 are the adoption process run in the downstream sector at the level of farmer groups (Poktan) (Ring R6) and farmer unions (Gapoktan) (Ring R7 and R8). The process of adoption in the downstream sector is formed gradually, where at the level of farmer groups there are grain-buying and -selling transactions, and at the level of farmer unions, there are grain-buying and rice-selling transactions.

The purchase price of organic grains in the adoption-process phase is determined based on the mechanism of meeting attended by exporters,

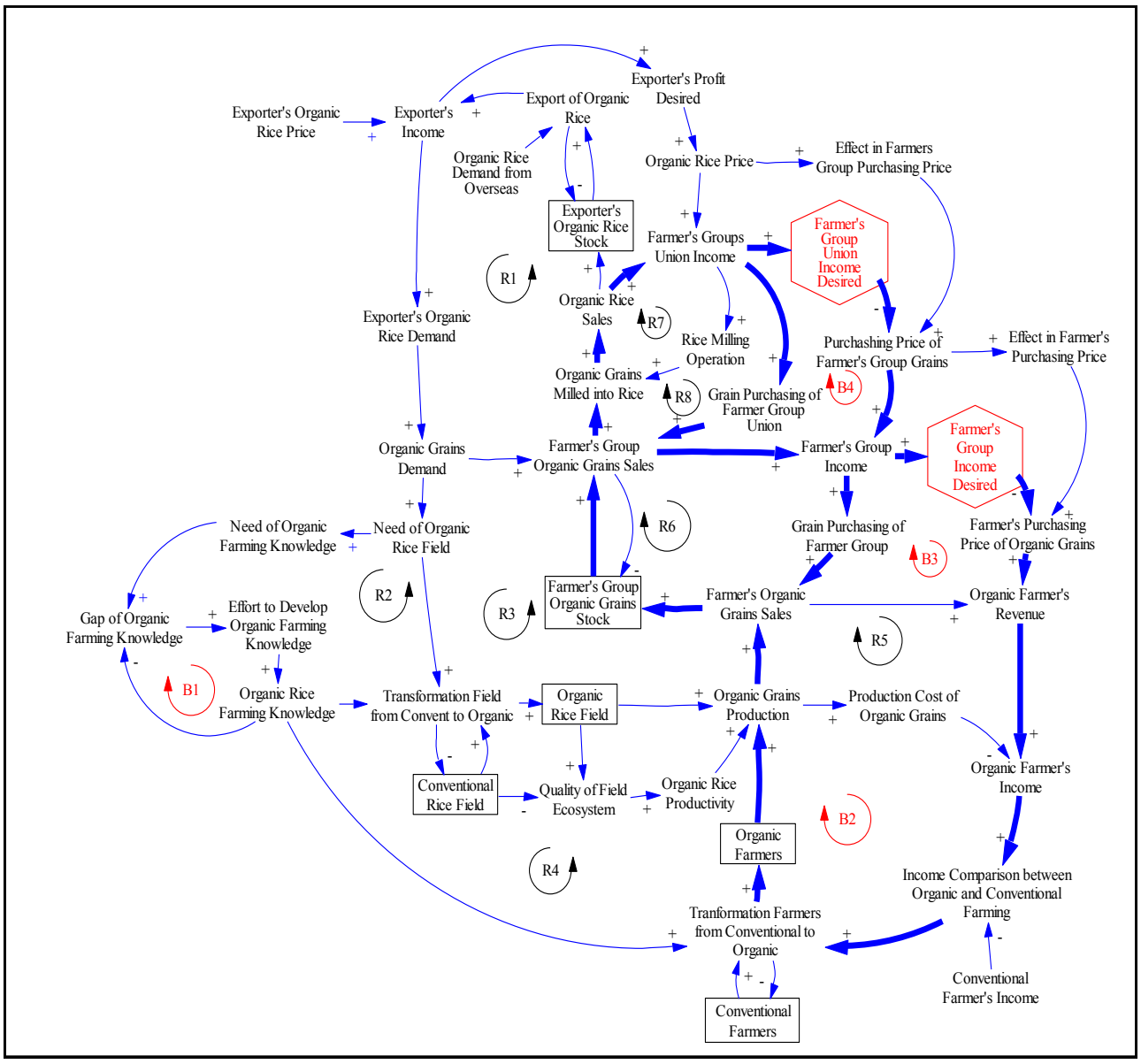


Figure 3. The Structure of Causal Loop Diagram of the Organic Rice Innovation-Adoption Process

Gapoktan and Poktan. At the 2012 meeting it was agreed that the purchase price of grains by Poktan at the farmer level was IDR 5,000 per kilogram and in the level of Gapoktan to exporters of IDR 13,000 per kilogram. This price is above the average price of conventionally cultivated rice (non-organic).

Price is an incentive for farmers to increase crop production based on the ration between the prices received to the cost to produce the crops (Mosher, 1978). If the income differences between organic and conventional rice farming is not significant, only few farmers switch to organic rice farming systems.

The relocation of goods which is transactional in nature then led to other problems as it is related to the determination of the purchase price of grain from the unions/Gapoktan to groups/Poktan and from Poktan to farmers. The mastery of the goods by the actors in the downstream (Poktan and Gapoktan) causes Poktan and Gapoktan to have full power on farmers' grains. At the time of the determination of the purchase price of grain, the income received by Poktan and Gapoktan is determinant to the purchase price of grain at the farmer level.

Although the purchase price of grain has been set and is not volatile, at the time of its determination, the great revenue target desired by Poktan and Gapoktan will suppress the purchase price of grain in Poktan (Ring B4) and spread to the price of grain at the farmer (Ring B3), thus affecting the grain prices received by farmers (Ring B2). The consequences are unexpected yet occurring, due to the transactional system between economic player institutions.

These conditions put farmers in a weak position, since the price received by farmers is merely residual, not based on the mutually beneficial

Tabel 1. Matriks Sosial (*Social Fabric Matrix/SFM*) Adopsi Beras Organik

Receiving Component / Delivering Component		A. Social Institution							B. Technology								C. Environment				D. Beliefs				E. Values			
		Agri Office of Tasikmalaya R	Conventional Farmers	Organic Farmers	Rice Milling Businessman	Farmer Group	Organic Rice Exporter	Private Agricultural Extensi	Fertilizer, Chemical Pesticid	Fertilizer, Natural Pesticide	Plot Demostration	Production of Organic Input	Organic Tech. Services	Organic Rice Exporter	Rice Milling Unit	Organic Grains	Conventioal Rice Field	Organic Rice Field	Natural pest and predator	Quality of Rice Field Ecosys	Farmer's Work Duration	Farmer's Economic Income	Organic Grains Price	Harga beras organik	Farming Rice Habit	Environmental Preservatio	Deliberation	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
1	Agri Office of Tasikmalaya Reg.		1	1		1	1		1	1	1	1	1															Social Institution
2	Conventional Farmers		1		1	1					1	1					1		1	1	1	1	1					
3	Organic Farmers			1		1						1		1		1		1	1	1	1	1	1					
4	Rice Milling Businessman					1	1									1						1	1	1				
5	Farmer Group		1	1	1				1	1	1	1	1	1		1	1	1	1				1	1				
6	Organic Rice Exporter				1			1																1				
7	Private Agricultural Extension		1	1		1					1	1	1					1										
8	Fertilizer, Chemical Pesticide		1														1		1	1	1	1						Technology
9	Fertilizer, Natural Pesticide			1							1	1		1		1		1	1	1	1	1	1	1				
10	Plot Demostration			1		1								1		1		1	1									
11	Production of Organic Input			1										1							1	1						
12	Organic Tech. Services		1	1		1					1			1		1		1										
13	Organic Rice Exporter			1														1	1	1	1							
14	Rice Milling Unit				1		1									1							1	1				
15	Organic Grains			1	1	1									1							1	1					
16	Conventioal Rice Field																		1	1								Envirnment
17	Organic Rice Field													1					1	1								
18	Natural pest and predator													1						1	1							
19	Quality of Rice Field Ecosystem									1		1							1		1							
20	Farmer's Work Duration		1						1	1		1										1						Beliefs
21	Farmer's Economic Income	1	1	1		1																						
22	Organic Grains Price			1	1	1		1																1				
23	Harga beras organik						1															1						
24	Farming Rice Habit								1												1	1						Values
25	Environmental Preservation																				1							
26	Deliberation												1										1	1				

principle. The difference in price by IDR 200 per kilogram of grain produced conventionally and organically is not attractive to farmers. Therefore the rice farmers who have full power to their land prefer to engage in conventional farming system (non-organic).

It would be different if the farmers who cultivate the rice were sharecroppers (tenant farmers). The agricultural land tenure has a major role in the determination of land utilization. Land tenure structure plays a role in determining the wetland utilization (Heryanto, 2012). Moral hazard at the level of farmer groups and unions causes farmers not to receive incentives they should receive, due to insignificant difference of purchase price between organic and conventional grains. The desire to gain institutional income results in the decision to suppress the purchase price.

Therefore, some efforts are required to economically change this condition, so that the process of organic rice innovation-adoption continues. The engineering structures using the principle of archetype system can be done by recognizing the problems caused by the system.

4.3 Interactions between Organic Rice Adoption Actors

Social fabric matrix (SFM) is used to look at various interactions and linkages between elements in the process of organic rice innovation-adoption. The elements involved are divided into several categories: 1) social institutions, 2) technology, 3) environment, 4) norms, and 5) value (Hayden, 1982). Of these various elements, using SFM, we can determine the ones that have the most interactions in the process of organic rice adoption.

The main problem in the process of adoption or diffusion of organic rice innovation, based on systems thinking method is the lack of incentive for actors in the upstream (farmers) to opt for organic rice farming. The thin difference in price between organic and conventional grains (only IDR 200 per kilogram) is not attractive to farmers compared with the efforts deployed to organically grow rice.

Such reaction given by farmers is the result of the institutional system of actors in the downstream, because in this position, farmers only act as price takers. Although there are meetings (deliberation) to determine the purchase price of grain from the

Gapoktan and Poktan (26.22) and (26.23) in Table 1), the decision is not based on transparent economic calculation at each level of actor.

Meanwhile, in terms of victims incurred by farmers, the organic system requires longer time to prepare for the means of production (fertilizers and pesticides), different with the conventional system where fertilizers and pesticides have been instantly available, made by chemical plants (11.20 in Table 1). As a consequence of organic rice adoption process, the labor costs swells (11.21). Although economically farmers do not spend any cost for the purchase of fertilizers and pesticides, the swelling labor costs are perceived by farmers to be greater in impact on the total cost of farming.

The farmers' learning media in the form of demonstrative plot of land (plot-demo) are accumulatively quite effective in building farmers' knowledge about organic farming system, so that farmers have the capacity to undertake organic rice farming. Knowledge in this case is defined as the capacity to act (Ritzer and Smart, 2001). In some cases, the increasing capacity of farmers' knowledge on organic farming is sufficient to bring the conception phase to the adoption phase; yet as economic actor, the price factor is not less important as an effective incentive to encourage farmers to adopt organic farming system (22.3).

Farmer groups (Poktan) and farmer unions have a major role as the power determining the price of grain (22.4) (5.22). As actors who buy the products of farmers (transactional), Poktan should be able to provide incentives to their members. In practice Poktan is still subject to Gapoktan and exporters as downstream actors who own markets. Ideally, the decision of the purchase price of grains at farmers level accounts for the costs incurred by farmers, including the ratio of grain price between conventional to organic rice farming, so that the adoption/diffusion process can take place.

Interactions between elements in the organic rice innovation-adoption process, particularly between elements of social institutions, technology and norms are the key of adoption-process sustainability (Figure 4). In line with Yuliar (2009), we need a new socio-technical configuration capable to adapt to the organic rice innovations introduced to farmers through government and private agricultural extensions through farmers groups.

In general, the process of innovation-adoption of organic rice commodity, based on the development of organic rice harvested area (Figure 1) can run quite well viewed from the increasing growth of harvested area. The decline in organic rice harvested area in 2010 and in 2012 was a result of behavior as a result of the interactions between social institutions, technology, environment, norms, and values during the period of 2005 to 2012.

Social institution in the case of organic rice innovation-adoption has a central role as a determinant actor for technological and other decisions related to the values and norms. Economic actors in the organic rice innovation-adoption phase have the power to decide the technology that will be used (3.10) (3.11) (5.9) and the economic value of output produced (4.21) (4.22).

The economic value resulting from the use of technical artifacts (technology) will eventually received by the actors involved.

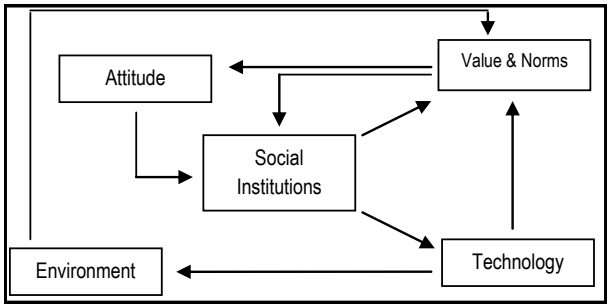


Figure 4. Interactions between Elements of Organic Rice Innovation-Adoption

If economically the organic rice technology is only slightly profitable than the use of conventional rice technology, the attitude of farmers in deciding the technology used will remain on the side of the previous one, already accustomed, applied by farmers: the conventional (non-organic) rice technology.

Environment (land) becomes better preserved in quality since the use of chemical fertilizers and pesticides are no longer performed. Good environmental quality will result in higher grain production so as to provide benefits in the form of economic value for farmers.

4.4 Improvement of Organic Rice Innovation-Adoption Process

As a qualitative construction, social fabric matrix (SFM) cannot investigate the pattern of behavior of the system over time. SFM is good to investigate the actors involved in the system factually. The static output formula of SFM has a great opportunity to be developed, one of them through the system dynamics that similarly have holistic paradigm (Gill, 1995). The resulting matrix of SFM is a very useful material to identify problems, one of them through the feedback between the elements involved.

Feedback loop is a basic principle in the system dynamics. Every action and change is basically a set of networks of feedback. Feedback loop is the structure that can make change happen (Forrester, 2009).

In the process of adoption-conception, based on the causal loop structure analysis and actors approach using SFM, it is known that the phase of adoption becomes the source of problem why the behavior of organic rice field area is not entirely as expected (Figure 1). A change is required to improve the system of innovation-adoption.

The approach to improve the system can use system-archetype: to remove the structure causing chaos in the system is to reduce it (Braun, 2002). Referring to the analysis of structures and actors discussed above, one of the sources of chaos in the system is unintended yet occurring result in each transactional linkage i.e. transactions between farmers institutions: Poktan and Gapoktan. Transactional patterns that occur at the level of the farmer groups and unions cause the disincentive for farmers from switching from conventional to organic rice farming because the difference between the selling price of conventional and organic grains is notably thin.

The desire to increase income through making use of institution is an initial point of the establishment of transactional relation between actors. The desire to earn more is a moral hazard which, if not properly managed, will fuse with the decision of pricing decisions at the level of actors who are in the upper reaches. In the end, the determination of the purchase price of grain at the farmer level, resulting in thin difference between the conventional grain and organic rice (only USD 200 per kg), causing a disincentive for farmers.

One alternative solution offered is to eliminate the desire to earn income by Poktan and Gapoktan. As institutions embodying farmers, the function of gaining institutional profit (Ring B4 and B3) must be eliminated. The grains, the crops of farmers, must be as far as possible not sold to farmer groups (Poktan) and farmer unions (Gapoktan) to avoid institutional relationships that are transactional. We needs a mechanism to prevent transactions between farmers and Poktan, Poktan and Gapoktan. Poktan and Gapoktan in this case must be directed to function as the provider of logistics services ranging from grains to rice. Grain purchase transactions are made directly between buyers (exporters) with farmers after taking into account the costs of logistics.

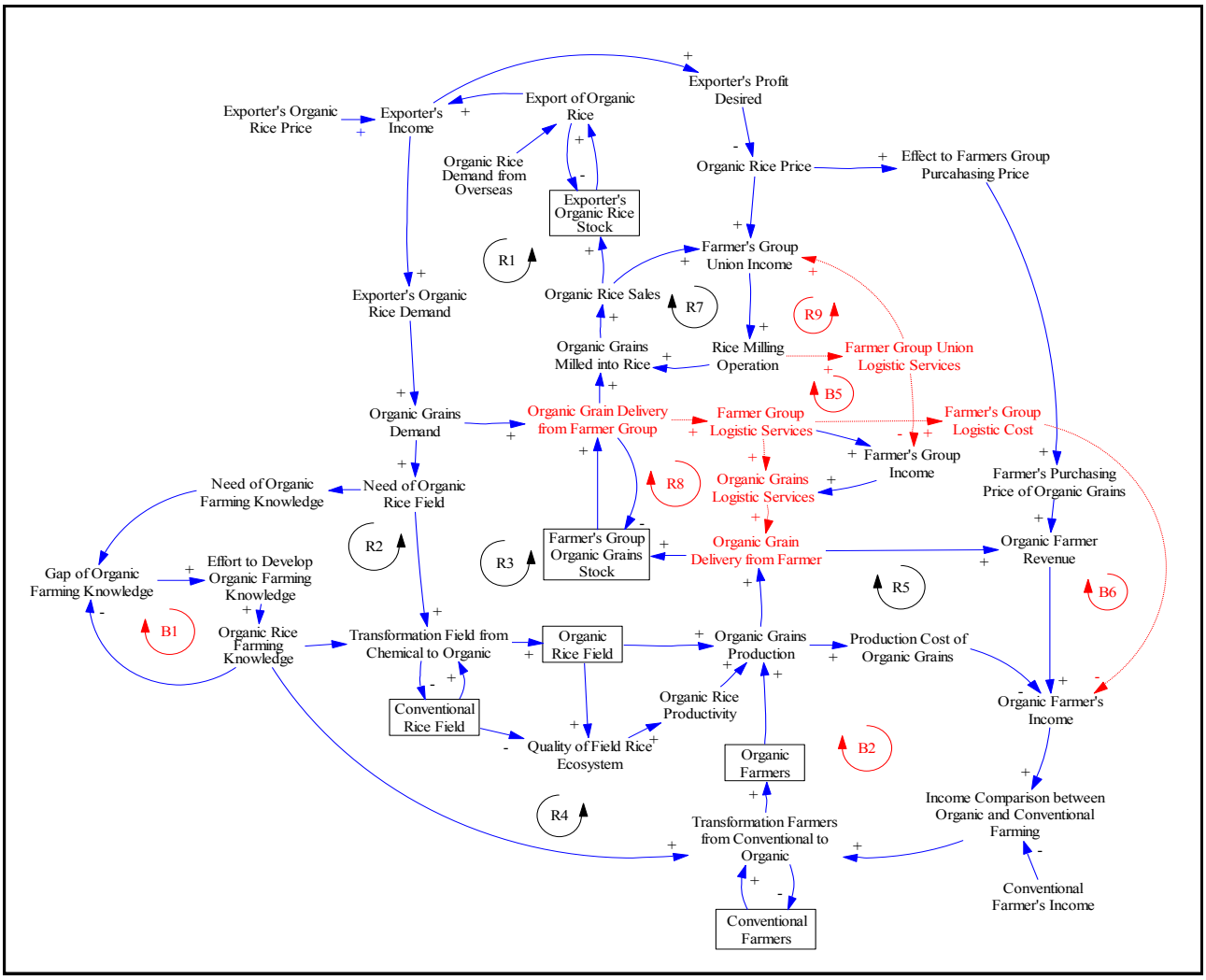


Figure 5. Causal Loop Structure Engineering of the Organic Rice Innovation-Adoption Process

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The cost incurred in the process from grains into rice is calculated as the cost of logistics, including the income margin for the farmer groups and unions as an added value for the logistics players in it (Ring B5 and B6 in Figure 4). The income earned by farmer groups and unions should be rolled back for the development of the institutions and its members, such as for the technological treatment and human resource development. Price transactions previously occurred between farmers and Poktan, and Poktan and Gapoktan become invalid.

The new transactional relationships will be established at the time Gapoktan deals with exporters. The thought is based on the function of groups that act as a risk damper of the market-derived prices. Market price risks originating from exporters is mitigated and controlled by Gapoktan as the institution having the information on the volume of organic rice demand and price. Gapoktan as a bastion is not supposed to pass on the risk to Poktan, even to farmers, because the more upstream, the more actors involved.

Healthy transactional relationship will go well if a ruling relationship between actors is formed to reduce the risk of inter-actors (production, supply chain, and cluster) (Perdana and Kusnandar, 2012). Farmers in this case can have reduced risks through the instruments of market and price assurance, farmer groups, farmer unions and exporter, the certainty of organic grains/rice supply (Ring R1, R3 and R7 in Figure 5).

Farmers are actors in the most basic position in the structure of organic rice supply chain. Actors in the upstream are frequently the recipient of the residual risk distributed by actors in the downstream. The instruments used to reduce risks experienced by actors in principle is a paradigm shift of actors themselves, from previously transactional relation into one that is service in nature. Poktan and Gapoktan as institutions that serve to protect farmers get bigger role when their exercised activities are based on services, not based on transactional profit that subsequently affects the price at the farmer level.

The principle of openness between actors (exporters, Gapoktan, Poktan and farmers) becomes very important. According to Perdana and Kusnandar (2012), as a cluster, these actors must be able to mutually reduce risks. Openness between actors is required so each actor mutually recognize the risk encountered by both exporters, Gapoktan, Poktan and farmers. One element of openness in the organic rice adoption process is the pricing mechanism; the meetings held to determine the price should aim to reduce the risk of actors, namely the certainty of market and price for farmers and the certainty of grain supply for Poktan and Gapoktan, and certainty of rice supply for the exporters.

5. Conclusions and Policy Implications

The role of social institutions in the process of conception-adoption of an innovation is notably great. Technical elements (technology) and economy as the instruments used in the process of conception-adoption should be able to provide maximum benefits for the actors involved in order to be able to continue the conception phase to the adoption phase.

Interaction and inter-institutional relations are reflected from the norms and values shared by the actors in social institutions. The norms and values held by social institutions are determinant to the success of conception-adoption process, as a set of rules of the new socio-technical configuration. The rules made with the spirit of mutually reducing risks in the process of conception-adoption will make the actors convenient to carry out their institutional role (farmers, Poktan, Gapoktan and exporters), so that the conception-adoption process can run well.

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References

Braun, W. 2002. The System Archetypes. *http://www.albany.edu/faculty/gpr/PAD724/724WebArticles/sys_archetypes.pdf*

Bruijn, H., Haiko van der Voort, Dicke, W., de Jong, M., Veeneman, W. 2004. *Creating System Innovation*. A.A. Balkema Publisher.

Forrester, J.W. 1975. *Some Basic Concepts in System Dynamics.* Sloan School of Management, Massachusetts Institute of Technology.

Gill, R. 1995. "An Integrated Social Fabric Matrix/System Dynamics Approach to Policy Analysis". *System Dynamic Review Vol.II.*

Hayden, F.G. 1982. "Social Fabric Matrix: From Perspective to Analytical Tool". *Journal of Economic Issues, Vol.16 No.3 (Sep.1982),* pp.637-662

_____ . 1986. "Defining and Articulating Social Change through the Social Fabric Matrix and System Digraph". *Journal of Economic Issues, Vol.20 No.2 (Jun.1986),* pp.383-392

Heryanto, M.A., Supyandi, D. 2012. "Model Peran Lembaga Riset Dalam Sistem Inovasi Frugal Sektor Pertanian: Pendekatan Analisis Berpikir Sistem". *Journal of S&T Policy and R&D Management. Vol.10 No.2.* Pusat Penelitian Perkembangan Ilmu Pengetahuan dan Teknologi-LIPI.

Heryanto, M.A., Karmana, M.H. 2010. "Pembangunan Pertanian Berkelanjutan". *Seminar on Sustainable Agricultural Development.* Universitas Siliwangi: Tasikmalaya.

Meadows, D., Meadows, D., Randers, J.. 2004. *Limit to Growth. The 30 Year Update.* Chelsea Green Publishing Company.

Mosher, AT. 1978. *Menggerakan dan Membangun Pertanian. Syarat-Syarat Pokok Pembangunan dan Modernisasi.* CV. Yasaguna: Jakarta.

Perdana, T., dan Kusnandar. 2012. "The Triple Helix Model for Fruits and Vegetables Supply Chain Management Development Involving Small Farmers in Order to Fulfill the Global Market Demand: a Case Study in 'Value Chain Center (VCC) Universitas Padjadjaran'." *Procedia Social and Behavioral Sciences 52 (2012) 80-89*

Ritzer, G. dan Smart, B. 2001. *Handbook Teori Sosial. Handbook of Social Theory,* translated by Derta Sri Widowatie. Penerbit Nusamedia: Bandung.

Rogers, E. 1995. *Diffusion of Innovation. Fourth Edition*. The Free Press: New York.

Setiawan, I. 2012. *Dinamika Pemberdayaan Petani: Sebuah Refleksi dan Generalisasi Kasus di Jawa Barat*. Widya Padjadjaran: Bandung

Yuliar, S. 2009. *Tata Kelola Teknologi. Perspektif Teori Jaringan Aktor.* Penerbit ITB: Bandung.