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Review Article

Proposed conceptual framework for studying the organic farmer behaviors

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Abstract

The purpose of this article was to explore influential factors for conserving and encouraging organic farming management. Organic farming can lead to better health for both farmers and consumers because it reduces dangerous chemical contamination in the environment. Currently, the number of organic farms is gradually increasing. An organic farmer behavior (OFB) framework will provide the passion to accelerate wilderness organic farming within the smallholder farmer community, which is a fundamental area in global farmland agriculture. In addition, the OFB concept investigates the following main aspects: (1) attitude of farmers (AoF), (2) subjective norm influence (SNI), (3) perceived behavior control (PBC), (4) comparative behavior usefulness (CBU), (5) farmers' perception of risk (FPR), and (6) support of government policies (SGP). These have been applied to test all the variables manipulating the intentions towards the behavior of organic farmers and could be applied to test most conventional farmers and organic farmers. The conceptual framework has been merged with the Theory of Planned Behavior and with Innovative Diffusion Theory which serves as a basis to conserve and cumulate OFB. As a result, the conceptual framework could be applied to explore and develop land use policies that encourage farmers to diminish conventional farming and to adopt organic farming.

Introduction

Organic farming behavior is a global trend that has encouraged an upshot with respect to land use policies. On the one hand, the world population will be 9.6 billion by 2050 and elderly citizens will account for up to 21 percent of that number (United Nations [UN], 2014), which means that there will be an aging society. Conversely, consumer health-food awareness is increasing the demand for health-food products. Previously, fertilizers and pesticides were widely used in cutting-edge food production in the agricultural sector, both in large farm systems and on smallholder farms. Conventional farming behavior uses chemical-agricultural production processes without considering the consequences and those actions have led to serious toxic waste contamination problems (Chakrabarty, Wang, Meng, & Zhang, 2014). Such farming behavior, which uses agricultural chemicals, converts to an accumulation of more than 2 million tonnes of toxins per year in the ecosystem (Pesticide Action Network [PAN], 2009), as well as unswervingly and circuitously affecting environmental and anthropoid health. In addition, this has created a consciousness of the seriousness of the land use problem (Valencia, 2013).

Food contaminated with toxins from conventional farming will affect the health of consumers and farmers (Costa et al., 2014). Land use policy aimed at reducing pesticides and fertilizers in farming (Owens, Feldman, &

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Kepner, 2010) is urgently needed to encourage organic farmer behavior (OFB) because organic farming is environmentally friendly and advantageous to the well-being of living creatures. Furthermore, the demand for organic products has grown accordingly. In 2013, the revenue from organic products in the global market was USD 72 billion, and since 1999, it has shown an increase of almost 500 percent. Nevertheless, there are only 17.7 million hectares of organic farmland within 170 countries and that accounts for only 0.98 percent of farmland worldwide (Research Institute of Organic Agriculture [FiBL], & International Federation of Organic Agriculture Movements [IFOAM], 2016). This shows that when compared with conventional farmland, there is much less organic farmland. Normally, most farmland is by smallholder farmers (90 percent) in developing countries and up to 70 percent has been held by smallholder farmers worldwide (Lowder, Skoet, & Singh, 2014). For this reason, investigators are interested in the OFB concept, especially the behavior of smallholder farmers, in order to develop the conceptual framework regarding classification of the factors that have an impact on preserving organic behavior and transforming behavior toward organic farming. The expected results from the application of the OFB concept are as follows:

1. Academic benefit: Extending knowledge gained in management theory by utilizing the Theory of Planned Behavior (see Figure 1) and Diffusion of Innovation Theory (see Figure 2).
2. Practical benefit: (1) Extending an operations framework to other crops that could increase organic farming products, such as clean-food materials, food-supplement products and various medicines; and (2) Setting land use policies that outline how to increase organic farming.
3. Long-term profits: Decreasing poisonous contamination of the soil, water, and air, which will benefit human health, the ecosystem, and the environment.

Literature Review

The literature review revealed applications from management theory that had examined farmers' behaviors and some examples are shown in Table 1.

Previously, various management theories had been applied to study the behavioral types of farmers. In particular, Krueger, Reilly, and Carsrud (2000); and Läpple and Kelley (2013) referred to three reasons that the Theory of Planned Behavior (TPB) is suitable for studying OFB. Firstly, suitable adoption of organic farming requires careful planning. Secondly, there must be controls for the potential restraint or adversity that farmers may experience when adopting organic farming. Finally, testing the preceding hypothesis must allow for the fact that the adoption of organic farming methods may be constrained by social or technical factors. As a result, this paper has applied TPB-framework-related investigations to the organic behavior of smallholders, which should be used to test the causal relationship of the smallholders' intentions and the transformation of their behavior toward organic farming.

Conceptual Framework

This article applied and developed a framework base related to smallholder farming behaviors consisting of six - factors: (1) attitude of farmers (AoF), (2) subjective norm influence (SNI), (3) perceived behavior control (PBC), (4) comparative behaviors' usefulness (CBU), (5) farmers' perception of risk (FPR), and (6) support of government policies (SGP) that affect the farmers' intentions toward OFB. Thus, the framework adoption Theory of Planned Behavior presents the conceptual framework for the conservation and the accumulation of OFB as follows:

1. AoF describes the individual's beliefs about the behavior of a person by estimating that they will be positive or negative. Therefore, people, having encouraging attitudes, will have a greater intention toward this behavior (Ajzen, 1991). For instance, Borges et al. (2016) classified the attitude of farmers as having a statistically significant positive relationship regarding the intention to improve natural grassland at .46. In the same way, Lalani et al. (2016) found that the highest level of significance for farmers' attitudes toward their intention to carry out conservation agriculture was .593. Moreover, numerous results from researchers, such as Deng et al. (2016); Jones et al. (2016); Sok et al. (2016); Van Dijk et al. (2016) confirmed that the attitude of farmers is a

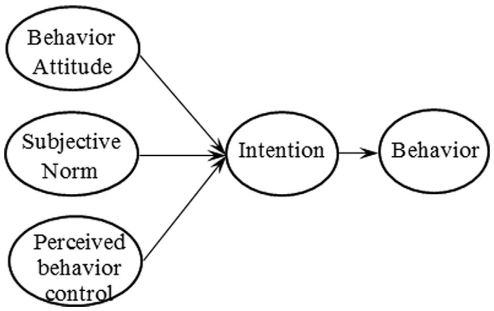

Figure 1 Theory of planned behavior
Source: Ajzen (1991)

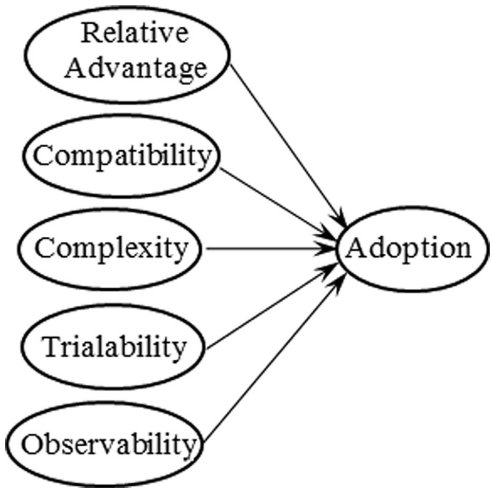

Figure 2 Diffusion of Innovation Theory
Source: Rogers (2003)

significant factor related to the intention of the farmers' behaviors. In addition, research studies have been carried out on organic and conventional farmers. As a result, the attitude of farmers is a factor sufficient to be included in the OFB conceptual framework.

2. SNI is an individual's perception of social pressure to perform in a specific situation (Ajzen, 1991). For example, Deng et al. (2016) related the subjective norm from a neighbor's opinion, government policy, and a family member's consequence to a farmer's behavior regarding payment for ecosystem service and rated these as statistically significant at .418. Moreover, Chin et al. (2016) linked the farmer's intention at a level of significance of .293 to the subjective-norms regarding palm oil supply residues from the following: (1) logistics providers, (2) government agencies, (3) other smallholder farmers, and (4) palm oil companies. Similarly, Dang et al. (2014) calculated a conforming influence group and found that the subjective-norm had not only followed friends, cousins, and neighbors, but had also persuaded the group together. However, the factor subjective-norm perceived learning with the group-norm affected the smallholders' behaviors (Fielding, Terry, Masser, & Hogg, 2008; Van Dijk et al., 2016). Therefore, it was interesting to study the OFB concept given the impact of the farmers' group towards the transformation from conventional behavior to organic behavior.
3. PBC refers to an individual's perception of behavior; their intentions are in alignment with they believe that behavior could achieve (Ajzen, 1991). Westaby (2005) contended that a person's behavior control depends on his/her belief in the difficulty, danger, or challenge level of the behavior. Yazdanpanah et al. (2014) found that raising the farmers' awareness of water conservation was of concern with respect to wasting time, investments, knowledge, and the skills of farmers. For instance, Jones et al. (2016) established the perceived behavior control of organic dairy farmers with the intentions to improve herd health at the effect size of .523. Therefore, the perceived behavior control is feature-suitable for the OFB conceptual framework.

The above review confirmed three factors from the Theory of Planned Behavior (Ajzen, 1991). The attitudes of the farmers, the subjective norm influence, and the perceived behavior control were suitable to explain the farmers' behaviors, but were insufficient to describe the OFB concept. The researcher suggests there are more factors that can attract attention in the framework. These include the comparative behaviors' usefulness, the farmers' perception of risk, and the support of government policies. Furthermore, the OFB concept is comprehensive in its relationship to the smallholder farmer issues, which has led to land use policies that have successfully driven farmers to make changes towards organic farming.

4. CBU compares the advantages of a farmer's behavior, adapting to the "Diffusion Innovation Theory" (Rogers, 2003), which is of interest for application to the OFB concept. Accordingly, the theory discusses the factors that affect the adoption of innovation as follows: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability (see Figure 2). In the OFB concept, the relative advantage is suitable for application to compare benefits between organic and conventional farming behaviors. Therefore, the concept of the study covers all the issues that have led to the development of land use policies. Aubert et al. (2012) refers to four relative advantages based on the importance that farmers place on the adoption of precision

Table 1
Applications management theory regarding studied farmers' behaviors

Researcher	Theory/Factors/Result
Borges, Tauer, and Lansink (2016)	Theory of Planned Behavior (TPB); Intention to use improved natural grassland: Attitude (β = .463), Subjective norm (β = .237) and Perceived Behavior Control (β = .218)
Niles, Lubell, and Haden (2013)	The Psychological Distance Theory and hierarchical models; Climate change belief effect on climate change risk (β = .950) and climate change risk effect on government program participant (β = .720)
Dang, Li, Nuberg, and Bruwer (2014)	Protection Motivation Theory (PMT); Farmer's adaptation intention to climate change: Subjective norm (β = .118), Risk perception (β = .155), Belief in climate change (insig.), incentive (insig.), disincentive (β = .100)
Stojcheska, Kotevska, Bogdanov, and Nikolic (2016)	Theory of Planned Behavior (TPB); Attitude effect intention to use RDS (MK, β = .787; RS, β = .406; BA, β = .369), Subjective norms effect intention to use RDS (RS, β = .403; BA, β = .340) and Perceived behavioral control (insig.)
Yazdanpanah, Hayati, Hochrainer-Stigler, and Zamani (2014)	Theory of Planned Behavior (TPB); Farmers' intention and behavior regarding water: Attitude, Subjective norm, Self-Identify and Moral-Norm refers to Normative inclination (β = .980) and Perceived behavior control (insig.), Perceived risk (β = .140)
Lalani, Dorward, Holloway, and Wauters (2016)	Theory of Planned Behavior (TPB); Intention of smallholder farmers' motivations for using conservation agriculture: Farmers' attitude (β = .597), Subjective norm (β = .155) and Perceived behavior control (β = .341)
Chang, Wang, Meng, and Zhang (2016)	Value-Belief-Norm Theory; Farmers' attitudes toward mandatory water-saving policies: Awareness of beneficial consequences (β = .650), Subjective norm (insig.), Perception of policy enforcement (β = .490), New ecological paradigm (insig.), Collectivism (β = .380)
Sok, Hogeveen, Elbers, and Oude Lansink (2016)	Theory of Planned Behavior (TPB); Pressures to design voluntary bluetongue vaccination strategies of farmers: Attitude (β = .610), Injunctive norm (β = .180) Descriptive norm (insig.) and Perceived behavior control (insig.)
Van Dijk, Lokhorst, Berendse, and de Snoo (2016)	Theory of Planned Behavior (TPB); Farmers' intentions to perform unsubsidized agri-environmental measures: Attitude (β = .170), Subjective Norm (β = .110), Perceived behavior control (β = .120), Self-identity (β = .520), Group identification (insig.) and Group norm (insig.)
Deng et al. (2016)	Theory of Planned Behavior (TPB); Behavior of farmers in payment for ecosystem service programs in eco-environmentally fragile areas: Attitude (β = .327), Subjective norm (β = .417), Perceived behavior control (β = .496)
Jones et al. (2016)	Theory of Planned Behavior (TPB); Organic dairy farmers' intentions to improve herd health: Outcome attitude (β = .497), Subjective norm injunction (β = .495), Subjective norm injunction (β = .436) and Perceived behavior control (β = .523)
Läpple and Kelley (2013)	Theory of Planned Behavior (TPB); Understanding the uptake of organic farming: Economic attitude (Receive higher price, β = .360; Increase farm income, β = .380), Belief based subjective norms (Farm advisor, β = .340; Farm walks/information events, β = .340) and Belief based perceived behavioral control (Sufficient time to carry out the work, β = .200)
Chin, Choong, Alwi, and Mohammed (2016)	Theory of Planned Behavior (TPB); Explore oil palm smallholder planters' intention to supply oil palm residues: Attitude (β = .128), Subjective norm (β = .293) and Perceived behavior control (β = .087)
Aubert, Schroeder, and Grimaudo (2012)	Diffusion of Innovation Theory (DIT); Analysis of farmers' adoption decision of precision agriculture technology: Compatibility (β = .356), Relative advantage (β = .176), Perceived trialability (β = .167), Quality of support (β = .155) and Farmer's knowledge (β = .397)

agricultural technology: (1) expanded productivity, (2) reduced input costs, (3) improved information for decision making, and (4) lower environmental impact. Previously, Sattler and Nagel (2010) indicated the relative advantages of three categories: the terms of cost, the terms of time needs, and the terms of risk. Moreover, Warren, Burton, Buchanan, and Birnie (2016) stated that the adoption of biomass energy crops by farmers depended upon revenues and long-term advantages. For this reason, CBU was involved with behavioral intentions that specified this factor as a part of the conceptual framework.

5. FPR is farmers' risk awareness of what may result from the crop behaviors. Dang et al. (2014) calculated the farmer's perceived risk from the effects of climate change on productivity, the farmer's health, the farmer's finances, and on the influence of the farmers' intention to adapt behavior (side effect = .115). Moreover, Yazdanpanah et al. (2014) studied the perception of risk for farmers from a water crisis and analyzed both the direct and indirect risk factors and their impacts on water conservation behaviors. Previously, the farmers' perception of risk and their neighbors' perception with respect to the health effects to farming behaviors were studied (Knowles, 2002), including farmland productivity (Palinkas & Szekely, 2008). As a result, the farmers' perceptions of risk are involved with behavioral intentions that specify this factor as a part of the conceptual framework.
6. SGP is a policy factor arising from the private and governmental sectors to support and shape the farmers' behaviors as an external motivation. Smit, Driessen, and Glasbergen (2009) found that the external motivation from economic conditions drove farmers to change to organic farming because they believed it would be more sustainable than conventional farming. In addition, Bennedsgaard, Thamsborg, Vaarst, and Enevoldsen (2003) determined that economic motivation is an essential factor that makes farmers realize that organic farming would make cattle healthier and lead to higher

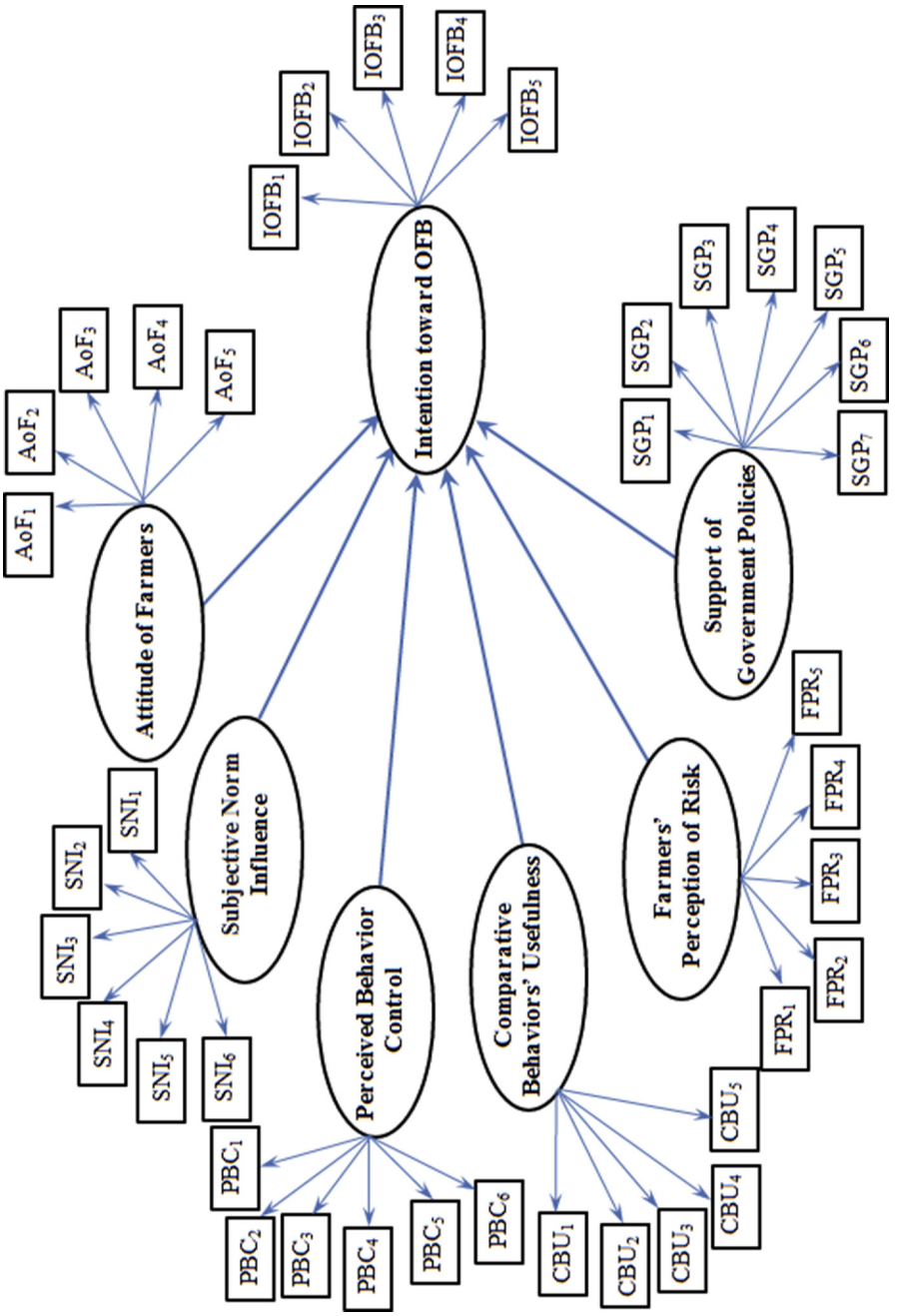

Figure 3 Conceptual framework for studying organic farmer behavior (OFB)

Table 2
Outline of the questionnaires used to collect data in the OFB concept

Latent Variable	Recommendations in creation of questionnaire (Observation Variables)	Adaptation from
Attitude of Farmer, AoF	- AoF_1 Quality of product from organic farming is better than conventional farming.	Deng et al. (2016)
	- AoF_2 Organic farming is good for farmers and the health of family members.	Yazdanpanah et al. (2014)
	- AoF_3 The products from organic farming are good for the consumer's health.	Yazdanpanah et al. (2014)
	- AoF_4 The products from organic farming are good for the environment.	Läpple and Kelley (2013)
	- AoF_5 Organic farming will promote the well-being of families.	
Subjective Norm Influence, SNI	- SNI_1 Other farmer neighbors will change to organic farming.	Chin et al. (2016)
	- SNI_2: Family members need the farmers to transform to organic farming	Chang et al. (2016)
	- SNI_3 Introduction and news releases from media, such as television, radio, or newspapers leads to organic farming.	Chang et al. (2016)
	- SNI_4 Farmer groups on organic farming are better for exchanging information, production, and marketing.	Deng et al. (2016)
	- SNI_5 Farmer groups on organic farming are better for receipts and keeping the organic certificate.	Dang et al. (2014)
	- SNI_6 Farmer groups on organic farming will influence others to join.	Van Dijk et al. (2016)
Perceived Behavioral Control, PBC	- PBC_1 Farmers know the difference between organic farming and conventional farming.	Borges et al. (2016)
	- PBC_2 Farmers know the processes and techniques of organic farming.	Yazdanpanah et al. (2014)
	- PBC_3 Farmers have the self-confidence to carry out organic farming.	Läpple and Kelley (2013)
	- PBC_4 Farmers have the self-confidence to receive an organic certificate.	Van Dijk et al. (2016)
	- PBC_5 Farmers have the self-confidence to control productivity with organic farming.	Borges et al. (2016)
	- PBC_6 Farmers have the money available to make the transformation to organic farming.	Borges et al. (2016)
Comparative Behaviors' Usefulness, CBU	- CBU_1 Products from organic farming are sold at higher prices than conventional farming (products).	Aubert et al. (2012)
	- CBU_2 Machinery and equipment used in organic farming do not differ from conventional farming.	Sattler and Nagel (2010)
	- CBU_3 The labor used to farm organically is not different from conventional farming.	Sattler and Nagel (2010)
	- CBU_4 The cost of organic farming is less than the cost of conventional farming.	Sattler and Nagel (2010)
	- CBU_5 Organic farming has less environmental impact than conventional farming.	Aubert et al. (2012)
Farmers' Perception of Risk, FPR	- FPR_1 Risk of the product's price from conventional farming is likely to decline.	Dang et al. (2014)
	- FPR_2 Risk of exposure to toxins used in the processes from conventional farming.	Dang et al. (2014)
	- FPR_3 Risk of family members being exposed to toxins from the consumption of conventional farm products.	Dang et al. (2014)
	- FPR_4 Risk of conventional farming products that exceed the market requirements.	Dang et al. (2014)
	- FPR_5 Risk of conventional farming costs that are higher as a result of using fertilizers and pesticides.	Dang et al. (2014)
Support of Government Policies, SGP	- SGP_1 Supportive of policies that assist farmers in getting approval for certificates in organic farming.	Chang et al. (2016)
	- SGP_2 Supportive of policies that get knowledge and information about organic farming.	Dang et al. (2014)
	- SGP_3 Supportive of policies to manufacture equipment, such as seeds, organic fertilizers, and tillage tools.	Tate et al. (2012)
	- SGP_4 Supportive of policies that guarantee the product's price from organic farming.	Dang et al. (2014)
	- SGP_5 Supportive of policies that discover new markets for organic farming.	Dang et al. (2014)
	- SGP_6 Supportive of policies that supply water to organic farming.	Tate et al. (2012)
	- SGP_7 Supportive of policies that provide low-interest loans for organic farming.	Dang et al. (2014)
Intention toward OFB	- $IOFB_1$ Farmers intend to farm with similar behavior in the next crop.	Läpple and Kelley (2013)
	- $IOFB_2$ Farmers intend to farm with transformation behavior in the next crop.	Chin et al. (2016) Borges et al. (2016)
	- $IOFB_3$ Farmers are planning to farm with transformation behavior in the next crop.	Yazdanpanah et al. (2014)
	- $IOFB_4$ Farmers intend to participate with activities to promote organic farming.	Chin et al. (2016)
	- $IOFB_5$ Farmers are interested in learning and searching for knowledge about organic farming.	

A Likert Scale was used to measure six factors—attitudes of the farmers, subjective norm influence, perceived behavior control, comparative behaviors' usefulness, farmers' perception of risk, and support for government policies—and intention toward OFB was divided into five levels: (1) very low, (2) low, (3) moderate, (4) high, and (5) very high.

incomes. On the other hand, the external motivation for farmers was governmental support in providing information, equipment, and product price guarantees (Dang et al., 2014). Blackstock, Ingram, Burton, Brown, and Slee (2010) mentioned knowledge, communication, policy, and related laws as influential factors that had changed farmers' behaviors toward nature conservation. Tate, Mbzibain, and Ali (2012) found that government and local councils supported drivers that had influenced smallholder farmers to adopt enterprises associated with renewable energy. Support from government policies had an especially large impact on smallholder farmers because almost all of them are still underprivileged, have less money, need more knowledge, and have low-technology products. For this reason, inside the OFB concept, the support of government policies should be a tested causal relationship toward the farmers' intentions.

The conceptual OFB seeks to comprehend the differential intentions between conventional and organic farmers toward organic farming. The differences in each of the factors influences the behaviors toward organic farming so organic farmers will know that they still can continue to grow organic plants, while conventional farmers will be convinced by factors that upset the intention to move toward organic behaviors. Afterward, the land use policy can be determined by the sequence gap of differentials for each of the factors. The highest gap will be set as the first priority. The method used to analyze the OFB concept was the structural equation model (SEM), and it was used to estimate the causal relationship as well as to test and answer the questions. Therefore, six factors were tested to determine whether certain variables directly contributed to a farmer's intention to farm organically or conventionally (see Figure 3). However, it was necessary to determine the sample size needed. The sample size must be large enough to enable SEM analysis. Hair, Anderson, Babin, and Anderson (2010) suggested that the sample size should be between 200 and 300 samples, while Kline (2011) suggested that the number should be higher than 200 samples too. In contrast, Kahai and Cooper (2003), and Hair et al. (2010) suggested a sample size based on a number of parameters and recommended using 10 samples for one observed variable. As a result, the OFB concept should use 10 samples for one observed variable (questionnaires in Table 2). However, the item-questionnaires should be tested with qualitative research based on either focus groups or in-depth interviews. There may be some items needing be cut or some items to be added to provide the greatest consistency with the research's context.

Conclusion

The OFB framework proposes the application of the Theory of Planned Behavior by studying six factors that affect the intentions of the smallholder farmers toward organic farming behaviors as follows: (1) attitude of farmers (AoF), (2) subjective norm influence (SNI), (3) perceived behavior control (PBC), (4) comparative behaviors' usefulness (CBU), (5) farmers' perception of risk (FPR), and (6) support of government policies (SGP). Therefore, the testing and confirmation of two sampling groups—the organic farmers and the conventional farmers—utilizing similar questionnaires, may have predictable results as follows: 1) Outcomes from organic farmers should reveal different variables that influence intention toward organic farmer behavior (OFB). Then, the influential factors with the highest significance should first be applied as a priority to create policies that can promote sustainable OFB. 2) Outcomes from conventional farmers should acknowledge different variables that influence the intention toward OFB. Later, the highest influential factors should be utilized to develop policies to promote behavioral changes towards organic farming. 3) Outcomes from both groups should be compared at differential levels and the gaps between the consequences factors can be used to promote policy building. Therefore, the variables for each of the gaps can help to create practical policies to motivate farmers toward more organic farming behavior.

Recommendations

1. For academic and application practice, the OFB framework with data collection and analysis of smallholder farmers could be applied to other fruit and vegetable crops, such as potatoes, cucumbers, lettuce, apples, and cherries. This could contribute to a conceptual framework that could lead to the successful creation of land use policies that encourage farmers to conserve and move toward organic farming.
2. For future research, the framework could be used to compare the two groups of farmers (organic farmers and conventional farmers) by utilizing the same questionnaire. For example, if the attitudes of the two groups of farmers were compared, the expected results could reveal differences in attitudes regarding the behaviors of both groups. These could be analyzed and compared to further understand attitudes toward organic farming behavior.
3. For government agencies, by applying the OFB concept, farmers could be encouraged to avoid using fertilizers and pesticides in the agricultural process to accomplish the following: 1) create a balance in the ecosystem and the global environment, 2) recover soil integrity, 3) restore cleanliness to the rivers, and 4) improve the quality of the air we breathe.

Conflict of interest

No conflict of interest.

References

Ajzen, I. (1991). The theory of planned behavior. *Organization Behavior Human Decision Process, 50*(2), 179–211.

Aubert, B. A., Schroeder, A., & Grimaudo, J. (2012). IT as enabler of sustainable farming: An empirical analysis of farmers' adoption decision of precision agriculture technology. *Decision Support Systems, 54*, 510–520.

Bennedsgaard, T. W., Thamsborg, S. M., Vaarst, M., & Enevoldsen, C. (2003). Eleven years of organic dairy production in Denmark: Herd health and production related to time of conversion and compared to conventional production. *Livestock Production Science, 80*, 121–131.

Blackstock, K. L., Ingram, J., Burton, R., Brown, K. M., & Slee, B. (2010). Understanding and influencing behavior change by farmers to improve water quality. *Science of the Total Environment, 408*, 5631–5638.

Borges, J. A. R., Tauer, L. W., & Lansink, A. G. J. M. (2016). Using the theory of planned behavior to identify key beliefs underlying Brazilian cattle farmers' intention to use improved natural grassland: A MIMIC modelling approach. *Land Use Policy, 55*, 193–203.

Chakrabarty, T., Akter, S., Saifullah, A. S. M., Sheikh, M. dS., & Bhowmick, A. C. (2014). Use of fertilizer and pesticide for crop production in agrarian area of Tangail District, Bangladesh. *Environment and Ecology Research, 2*(6), 253–261.

Chang, G., Wang, L., Meng, L., & Zhang, W. (2016). Farmers' attitudes toward mandatory water-saving policies: A case study in two basins in northwest China. *Journal of Environmental Management, 181*, 455–464.

Chin, H.-C., Choong, W.-W., Alwi, S. R. W., & Mohammed, A. H. (2016). Using theory of planned behaviour to explore oil palm smallholder planters' intention to supply oil palm residues. *Journal of Cleaner Production, 126*, 428–439.

Costa, C., Garcia-Lestion, J., Costa, S., Coelho, P., Silva, S., Pingqarilho, M., et al. (2014). Is organic farming safer to farmers' health? A comparison between organic and traditional farming. *Toxicology Letters, 230*, 166–176.

Dang, H. L., Li, E., Nuberg, I., & Bruwer, J. (2014). Understanding farmers' adaptation intention to climate change: A structural equation modeling study in the Mekong Delta, Vietnam. *Environmental Science & Policy, 41*, 11–22.

Deng, J., Sun, P., Zhao, F., Han, X., Yang, G., & Feng, Y. (2016). Analysis of the ecological conservation behavior of farmers in payment for ecosystem service programs in eco-environmentally fragile areas using social psychology models. *Science of the Total Environment, 550*, 382–390.

Fielding, K. S., Terry, D. J., Masser, B. M., & Hogg, M. A. (2008). Integrating social identity theory and the theory of planned behaviour to explain decisions to engage in sustainable agricultural practices. *British Journal Social Psychology, 47*, 23–48.

Hair, J. F., Anderson, B. W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis with readings* (4th ed.). Englewood Cliffs, NJ: Prentice-Hall.

Jones, P. J., Sok, J., Tranter, R. B., Blanco-Penedo, I., Fall, N., Fourichon, C., et al. (2016). Assessing, and understanding, European organic dairy farmers' intentions to improve herd health. *Preventive Veterinary Medicine, 133*, 84–96.

Kahai, S. S., & Cooper, R. B. (2003). Exploring the core concepts of media richness theory: The impact of cue multiplicity and feedback immediacy on decision quality. *Journal of Management Information Systems, 20*(1), 263–299.

Kline, L. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York, NY: The Guilford Press.

Knowles, D. J. B. A. (2002). *Risk perception leading to risk taking behavior amongst farmers in England and Wales*. Retrieved from http://www.hse.gov.uk/research/crr-pdf/2002/crr02404.

Krueger, N. F., Reilly, M. D., & Carsrud, A. L. (2000). Competing models of entrepreneurial intentions. *Journal of Business Venturing, 15*(5–6), 411–432.

Lalani, B., Dorward, P., Holloway, G., & Wauters, E. (2016). Smallholder farmers' motivations for using conservation agriculture and the roles of yield, labor and soil fertility in decision making. *Agricultural Systems, 146*, 80–90.

Läpple, D., & Kelley, H. (2013). Understanding the uptake of organic farming: Accounting for heterogeneities among Irish farmers. *Ecology Economics, 88*, 11–19.

Lowder, S. K., Skoet, J., & Singh, S. (2014). What do we really know about the number and distribution of farms and family farms in the world? Background paper for the State of Food and Agriculture 2014. *ESA working paper No. 14-02, Food and Agriculture Organization of the United Nations*. Retrieved from http://fao.org/economic/esa.

Niles, M. T., Lubell, M., & Haden, V. R. (2013). Perceptions and responses to climate policy risks among California farmers. *Global Environmental Change, 23*, 1752–1760.

Owens, K., Feldman, J., & Kepner, J. (2010). Wide range of diseases linked to pesticides. *Pesticides and You A Quarterly Publication of Beyond Pesticides, 30*(2), 13–21. Retrieved from http://beyondpesiticides.org/health/pid-database.

Palinkas, P., & Szekely, C. S. (2008). *Farmers' risk perception and risk management practices in international comparison*. H-2103 Gödöllö, Hungary: Faculty of Economics and Social Sciences, SzentIstván University. Retrieved from http://ageconsearch.umn.edu/bitstream./47554/2/30palinkas-szekely.

Pesticide Action Network. (2009). *PAN pesticides database*. Retrieved from http://pesticideinfo.org/.

Research Institute of Organic Agriculture [FiBL], & International Federation of Organic Agriculture Movements [IFOAM]. (2016). The world of organic agriculture statistics & emerging trends. Retrieved from https://shop.fibl.org/fileadmin/documents/shop/1698-organic-world-2016.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York, NY: The Free Press.

Sattler, C., & Nagel, U. J. (2010). Factors affecting farmers' acceptance of conservation measures- A case study from north-eastern Germany. *Land Use Policy, 27*, 70–77.

Smit, A. A. H., Driessen, P. P. J., & Glasbergen, P. (2009). Conversion to organic dairy production in The Netherlands: Opportunities and constraints. *Rural Social, 74*, 383–411.

Sok, J., Hogeveen, H., Elbers, A. R. W., & Oude Lansink, A. G. J. M. (2016). Using farmers' attitude and social pressures to design voluntary Bluetongue vaccination strategies. *Preventive Veterinary Medicine, 133*, 114–119.

Stojcheska, A. M., Kotevska, A., Bogdanov, N., & Nikolic, A. (2016). How do farmers respond to rural development policy challenges? Evidence from Macedonia, Serbia and Bosnia and Herzegovina. *Land Use Policy, 59*, 71–83.

Tate, G., Mbzibain, A., & Ali, S. (2012). A comparison of the drivers influencing farmers' adoption of enterprises associated with renewable energy. *Energy Policy, 49*, 400–409.

United Nations. (2014). Population ageing and sustainable management. *Population Division Department of Economic and Social Affairs, 4*, 1–4. Retrieved from http://un.org/esa/population.

Valencia, R. C. (2013). *The future of the chemical industry by 2050* (1st ed.). Weinheim, Germany: Wiley-VCH.

Van Dijk, W. F. A., Lokhorst, A. M., Berendse, F., & de Snoo, G. R. (2016). Factors underlying farmers' intentions to perform unsubsidised agri-environmental measures. *Land Use Policy, 59*, 207–216.

Warren, C. R., Burton, R., Buchanan, O., & Birnie, R. V. (2016). Limited adoption of short rotation coppice: The role of farmers' sociocultural identity in influencing practice. *Journal of Rural Studies, 45*, 175–183.

Westaby, J. D. (2005). Behavioral reasoning theory: Identifying new linkages underlying intentions and behavior. *Organizational Behavior and Human Decision Processes, 98*, 97–120.

Yazdanpanah, M., Hayati, D., Hochrainer-Stigler, S., & Zamani, G. H. (2014). Understanding farmers' intention and behavior regarding water conservation in the Middle-East and North Africa: A case study in Iran. *Journal of Environmental Management, 135*, 63–72.