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ARTICLE

Modeling behavior pattern of Iranian organic paddy farmers

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Abstract This study designed an organic farmer's behavior model based on the Ajzen's theory of planned behavior. The methodology was Mixed Method Research. In the qualitative phase, ten rice producers who received healthy product certification from Standard Organization were interviewed. The results of qualitative research showed that factors affecting the organic farming conversion consisted of facilitating factors and barriers. Facilitating factors include motivations and profits and barriers include challenges and costs. In quantitative phase, 250 rice producers were randomly interviewed. The results of quantitative research showed that attitude and subjective norms of rice producers have a significant positive effect on their intension toward organic farming. Ajzen's model has been improved by adding variables such as knowledge, self-identity and moral obligation . As a result, the model is improved and approximately 92 % of the variance of rice producers' behavior in organic farming is explained by research variables.

Keywords Behavior pattern · Organic farming · Theory of planned behavior · Structural equation modeling · Paddy farmers · Mazandaran

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Introduction

The world population will reach 9 billion by 2050. So, food production must be doubled and the increased demand for basic food products and new food products can lead to excessive pressure on agricultural scarce resources. Therefore, one of the greatest challenges facing governments in the Third Millennium is the food supply and the health of the country's population. Over the last 50–60 years, the focus of agricultural development and research has mainly been on maximizing yields, coupled with the increasing specialization of production and ever larger farm sizes. Although yields have increased substantially, contributing to raising total production, farmers and the environment have had to pay the price for keeping up with this development (Partap 2010a, b). Even though yield is increasing, modern agricultural practices are associated with indiscriminate use of fertilizers and other chemicals over the past four decades, can lead to significant pollution of air, water and soils, putting at risk pristine terrestrial and marine ecosystems downstream, and human health (FAO 2013). This production-driven model led to devastating environmental, social, and health consequences. According to some scientists, industrial agriculture sees the farm as a factory that uses huge quantities of fossil fuels, fertilizers, pesticides, waters, and topsoil and produces not only food stuff and livestock, but huge amount of waste as well (Erdelyi 2008).

In Iran, due to the characteristics of the social and geographical conditions, agriculture is considered as a very important part in economic development (Asadollahpour et al. 2014a, b). The food security of the growing population and increasing demand for quantity, quality, and variety of food are leading to increasing pressure on the

resource base in agriculture. According to the latest official statistics, the annual use of fertilizers and chemical pesticides in Mazandaran province is 1,603,623 and 3574 tons, respectively. Indiscriminate use of pesticides and fertilizers causes several issues such as rampancy of various cancers in Mazandaran province (Ministry of Jihad-e-Agriculture 2014).

Agricultural production has suffered from serious economic challenges such as a steady decline in agricultural prices and rising costs of agricultural inputs, and farmers have been looking for new ways to increase productivity. Organic farming is an important tool to achieve green productivity and reduce the negative effects of conventional farming. With the elimination of synthetic chemical inputs in the production process, air pollution is reduced, reuse of waste production and biodiversity are improved, and productivity of the soil is enhanced (Asadollahpour et al. 2014a, b).

Despite the negative effects of conventional agriculture, economic incentives, and government support, farmers have little interest in the adoption of sustainable agricultural practices and organic farming and insist on the use of conventional agriculture (Rodriguez Baide 2005). Conventional farmers are not aware of many organic farming operations and the information provided by the related institutions on organic farming can be very helpful. On the other hand, economic factors have the greatest effect on farmers to convert to organic farming and also, control of pests, diseases, and insects, uncertainty about the economic return, the complexity and difficulty of the process of conversion to organic farming were identified as the most important obstacles to the application of organic farming operations (Khaledi et al. 2007).

Opinion and attitude of farmers toward organic farming is very important. Comparison of the opinions and attitudes toward organic farming systems by organic rice farmers and non-organic rice farmers in Surin province, northeastern Thailand, showed that there was a correlation of attitudes of both OF and NOF interviewees in the four aspects: organic farming knowledge, environment, marketing, and costs and benefits. Additionally, educational level, farm holding, and extension worker contact affected opinions and attitudes of OF interviewees. Among NOF interviewees, their farming experiences affected their attitude toward organic farming (Chouichom and Yamao 2010).

The perception of agricultural specialists in Kermanshah Province about factors affecting the adoption of organic farming showed that the extension/education and economic factors determined 31 % of variance on the perception of respondents regarding the adoption of organic farming by farmers (Hosseini and Ajoudani 2013).

Research in potato fields of Ardabil Plain (northwest of Iran) showed that some of sustainable agricultural practices such as soil testing, changing planting and harvesting time, low tillage, maintaining crop residue on the field level, and integrated pest management were moderate to low (Bagheri et al. 2008).

Gender comparison in Iranian organic farming indicated that attitudes among farmers to organic agriculture were slightly variable according to gender, while experts' attitudes to organic agriculture remained constant and were not influenced by gender. The practical model ranked motivating factors as husbandry, financial, health-related quality of life, general, and personal, and challenging factors as financial, legal, educational, and technical (Payandeh and Omidi 2013).

Conversion to organic farming is a complex system change. Its principles challenge aspects of common agricultural practices and its values, and it may imply lower profitability and a high risk. In addition, structural and economic trends in the agricultural industry in general have a clear influence on the diffusion process. The conversion decision of the individual farmer cannot be explained on the basis of traditional personal characteristics of the adopters alone; other factors need to be considered, such as policy support and the development of the markets as well as the attitude toward organic farming in the agricultural community and the institutional development (McCarthy 2007; Padel 2001).

Environmental behavior refers to a socially conscious behavior which is based on social responsibility and involves individual and social aims that a person wants to achieve by behaving in a particular way. Environmentally friendly behavior can be rather complex due to several actions/stages/levels that it comprises (Niaura 2013).

Many researchers, such as Bond (2009), Läpple and Kelley (2010), and Wauters and Mathijs (2010), suggested using social-psychology models that offer farmers' attitudes and beliefs in a conceptual framework to really understand the behavior of farmers. Social-psychology models, with the most widely applied models being the theory of reasoned action (TRA) and the theory of planned behavior (TPB), are used to understand and also to predict why individuals act in the way they do. However, despite the wide application in other areas, the number of studies that have applied social-psychology models to explain the uptake of agricultural technologies is small (Läpple and Kelley 2010).

The TPB is an extension of the TRA (Fig. 1). According to the theory, human behavior is guided by three kinds of considerations: beliefs about the likely consequences of the behavior (behavioral beliefs), beliefs about the normative expectations of others (normative beliefs), and beliefs about the presence of factors that may

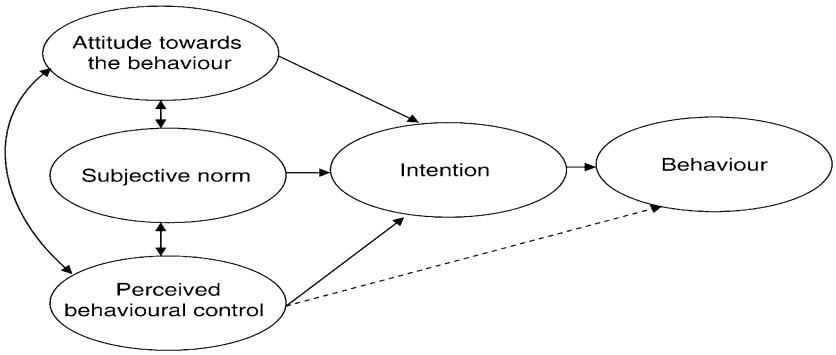

Fig. 1 Theory of planned behavior, source: Ajzen (1991)

facilitate or impede the performance of the behavior (control beliefs). In their respective aggregates, behavioral beliefs produce a favorable or unfavorable attitude toward the behavior; normative beliefs result in perceived social pressure or subjective norm; and control beliefs give rise to perceived behavioral control. In combination, attitude toward the behavior, subjective norm, and perception of behavioral control lead to the formation of a behavioral intention (Ajzen 1991).

According to many findings, this model is more appropriate in explaining the actual behavior of farmers (Bond 2009; He 2012; Läpple and Kelley 2010; Wauters and Mathijs 2010). In this study, the TPB is used to explain the theoretical basis for the following reasons:

- *Determinant measurement* The determinants of farmers' behavior and intension related to organic farming are many and varied. The sum of all the relevant factors and their interdependencies that determine behavior of organic farming-related behaviors for an individual or group can include individual psychology, economic, social characteristics, and etc. In this model, many of these factors are predicted (He 2012).
- *Predictive power* The TPB is a well-validated decision-making model that provides an appropriate theory framework for understanding and predicting people's behaviors (He 2012).
- *Widely employed* Numerous studies have demonstrated that the TPB has predictive power across a broad range of behaviors. The theory model has been employed in various fields, such as health, physical activity, leisure, technology, etc. (He 2012).
- *Technical reasons* One of the primary reasons that this research employed the TPB was to frame the data analysis and provide a strong theoretical background for the structural modeling. Structural equation modeling (SEM) can go beyond classic segmentations, to produce stronger models to determine causality in the relationships (He 2012).

Although the authors support this model, whether it can predict all the determinants of human behaviors is questioned (Ajzen 1991). Therefore, many researchers propose a revised model to predict the behavior accurately (Bond 2009; He 2012; Läpple and Kelley 2010; McCarthy 2007; Wauters and Mathijs 2010).

The main purpose of this research is to design behavior pattern of organic farming in Mazandaran rice producers. In this regard, the secondary objectives of the study are as follows:

- Identify the attitude of rice producers toward organic farming.
- Identify knowledge of rice producers toward organic farming.
- Identify intension of rice producers toward organic farming.
- Identify subjective norm of rice producers toward organic farming.
- Identify behavior of rice producers toward organic farming.

Materials and methods

The methodology was mixed methods research. Mixed methods research will be defined as a research approach or methodology:

- focusing on research questions that call for real-life contextual understandings, multi-level perspectives, and cultural influences;
- employing rigorous quantitative research assessing magnitude and frequency of constructs and rigorous qualitative research exploring the meaning and understanding of constructs;
- utilizing multiple methods (e.g., intervention trials and in-depth interviews);
- intentionally integrating or combining these methods to draw on the strengths of each; and

- framing the investigation within philosophical and theoretical positions (Yan 2009).

Mixed methods research, then, is more than simply collecting qualitative data from interviews, or collecting multiple forms of qualitative evidence or multiple types of quantitative evidence. It involves the intentional collection of both quantitative and qualitative data and the combination of the strengths of each to answer research questions.

In this research, exploratory design and tool developing model were used. It began by a qualitative exploration followed by a quantitative follow-up. The findings of qualitative phase were the basis for developing the questionnaire in quantitative phase.

Research method used in the qualitative phase was multiple-case study. A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yan 2009).

The population in this phase includes Mazandaran organic rice producers who received certification of healthy product from Standard Organization of Mazandaran province. Purposive sampling and participatory research appraisal techniques were used (Cresswell 2010). By providing the list of subjects, a preliminary visit to the villages of farmers was done. Then, the initial investigation and questioning of residents, council members, rural municipality administrators and expert, the first subject for interview was selected. Selection criteria of subjects were having certification, the amount of information about organic farming, the willingness to cooperate, and power of expression. The data collection process was continued until new information was not obtained from the responses and the so-called "theoretical saturation" was obtained. Ten subjects of organic rice producers in Mazandaran province were interviewed. The main instrument for data collection was open-ended questionnaire (protocol). Questionnaire focused on four major areas including motivations, challenges, benefits, and costs of adoption of organic farming. In-depth interviews approach and direct observation were used. Several months were spent to study the subject in depth, and each interview lasted several hours and sometimes, due to prolong of interview, it was postponed to next days.

Farmers' talks were recorded and all the interviews were filmed and recorded. Responses were listened several times and were classified in codes. Coding and developing category system and creating hierarchical category system were used for data analysis.

In the quantitative research phase, non-experimental research design (Descriptive) was used. The research method was Ex-post facto or causal-comparative approach. The main instrument used for data collection was a questionnaire. Multistage random cluster sampling method was used. The population consisted of rice producers of Mazandaran Province, who applied organic farming practices in their fields. The sample size in this phase was 250 ($n = 250$). The validity obtained by university professors and experts in this field and reliability using Ordinal Theta Coefficients was obtained.

Classical approach using Amos_{19} was used to analyze the data because the contribution of each unknown parameter (m) is more than four ($m = 12.5$) (Payandeh and Omidi 2013). The m is given by

$$m = n \,/\, \text{NPAR},$$

where "n" is the sample size, equal to 250 ($n = 250$) and "NPAR" is the number of distinct parameters (q) being estimated, or is the number of unknown parameters, equal to 20.

Results and discussion

Personal characteristics

The results showed that of the 250 respondents, 61 (24.4 %) were women and 189 (75.6 %) were male, and 44 (17.6 %) had certification of healthy product and the others (206 equal to 82.4 %) did not have any certificate but applied organic farming practices in their fields. The average age and the average education level of respondents were 50 and 10 years, respectively. Also, the average of farm size was 2.1 ha and the average yield per hectare was 4795 kg. Average of farming experience was 28 years and mean number of attendance in training courses was six and the average of agricultural income was USD 8620 in year.

Findings of qualitative phase

The results show that factors affecting the conversion to organic farming are two main categories: Facilitators and barriers. The facilitating factors include motivations and profits. Health and safety motivations, environmental motivations, educational motivations, ideological and philosophical motivations, and economic motivations were important motivating factors mentioned by the rice producers. The benefits identified by the interviewed farmers were categorized into three themes, namely economic, environmental, health and safety. The second category is the barriers to conversion to organic farming that consist of challenges and costs. The challenges include knowledge, lack of government supports, fear of the future and

production, and costs are included financial and "spend more time and energy.

Classical analysis of the behavior of organic farmers

Theoretical model

Theoretical model was developed using literature review, field surveys, review of models proposed by various researchers, and also using Ajzen's theory of planned behavior as basis for this model (Fig. 1).

In this model, the behavior of organic farming meant applying organic agricultural practices by rice producers such as the use of farm inputs as much as possible, no use of artificial fertilizers and pesticides, crop rotation, integrated pest management, green manures, weed control, natural pest and disease control, genetic diversity and so on. Intention toward organic farming is a central factor in the model and means farmer's intention to perform behavior of organic farming. Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert in order to perform the behavior. As a general rule, the stronger the intention to engage in a behavior, the more likely should be its performance. It should be clear, however, that a behavioral intention can find expression in behavior only if the behavior in question is under volitional control, i.e., if the person can decide at will to perform or not perform the behavior. Attitude toward the behavior is a farmer's overall evaluation of the behavior and refers to the degree to which a farmer has a favorable or unfavorable evaluation or appraisal of the behavior in question. Subjective norms are a farmer's own estimate of the social pressure to perform or not perform the target behavior and refer to the perceived social pressure to perform or not to perform the behavior that may be from family, friends, local leaders, experts, agents, etc. Perceived behavioral control or possibility is the extent to which a farmer feels able to enact the behavior. In other words, possibility refers to the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles. It has two aspects: how much a farmer has control over the behavior (controllability), and how confident a farmer feels about being able to perform or not perform the behavior (self-efficacy).

The addition of variables knowledge, self-identity, and moral obligation increased the predictive power of the model. Self-identity refers to salient and enduring aspects of farmer's self-perception (e.g., "I think of myself as a 'organic farmer; according to identity theory people apply socially meaningful categories to describe themselves when answering the question "Who am I?" in terms of, for example, socio-demographic characteristics (e.g., gender), social roles (e.g., mother, father), social types (e.g., smoker, exerciser, healthy eater, blood donor), and even personality traits (e.g., honest, optimist) (Rise and Sheeran 2010).

Significance test

As shown in Table 1, the following paths are significant and the other paths are not significant (Table 1).

Table 1 Regression weight and significance test of paths

Paths	Estimate	S.E.	C.R.	*P* value
Personal and professional characteristics → attitude	−0.011	0.01	1.1	0.267
Personal and professional characteristics → intention	0.003	0.015	0.2	0.822
Agronomic and economic characteristics → attitude	0	0.01	0	0.835
Agronomic and economic characteristics → intention	0.001	0.002	0.5	0.629
Knowledge → attitudes	0.14	0.012	6.27	0.001***
Attitude → intention	0.49	0.095	4.27	0.001***
Subjective norms → intention	0.46	0.064	7.13	0.001***
Possibility → behavior	0.904	0.057	16.47	0.001***
Self-identity → attitude	0.434	0.069	6.27	0.001***
Moral obligation → subjective norms	0.833	0.067	12.46	0.001***
Intention → behavior	0.71	0.108	6.6	0.001***
Possibility → intention	0.106	0.109	0.973	0.331
Moral obligation → intention	−0.175	0.154	−1.133	0.257
Self-identity → intention	0.115	0.182	0.631	0.528

* *P* 0.05

** *P* 0.01

*** *P* 0.001

Knowledge → Attitudes.
Attitude → Intention.
Subjective norms → Intention.
Possibility → Behavior.
Self-identity → Attitude.
Moral obligation → Subjective norms.
Intention → Behavior.

According to the analysis of results, it can be deduced that

- knowledge of rice producers has a significant positive effect on their attitude toward organic farming. The result verifies findings of Shabnam (2013) and Zsuzsa (2012).
- attitude of rice producers has a significant positive effect on their intention toward organic farming. Our findings are consistent with the findings of Mary McCarthy (2007), Laepple and Donnellan (2008), Bond (2009) and Läpple and Kelley (2010).
- subjective norms of rice producers have a significant positive effect on their intention toward organic farming. Findings of McCarthy (2007), Laepple and Donnellan (2008), and Läpple and Kelley (2010) are in accordance with results of this study.
- self-identity of rice producers has a significant positive effect on their attitude toward organic farming. The result of this study verifies the findings of McCarthy (2007) and Rise and Sheeran (2010).
- moral obligations of rice producers have a significant positive effect on their subjective norms. Our findings are consistent with the findings of McCarthy (2007).
- possibility has a significant positive effect on their behavior toward organic farming. The result of this study verifies the findings of Wauters and Mathijs (2010).
- intention of rice producers has a significant positive effect on their behavior toward organic farming. The findings of McCarthy (2007) and Läpple and Kelley (2010) are in accordance with the results of this study.

In this study, the effect of possibility on intention is not significant. Results of Voon et al. (2011) confirm the findings of this research.

As shown in Table 2, the variable of possibility with the amount of 0.639 has the most effect on the dependent variable (behavior of organic farming).

The standardized coefficient estimates are as follows:

In Table 3, Squared Multiple Correlation paths are shown. The squared multiple correlation of a variable is the proportion of its variance that is accounted for by its predictors. For example, in this research, knowledge, attitude, subjective norms, self-identity, moral obligation, possibility, and intention account for about 92 % of the variance of behavior of organic farming. Therefore the final model is appropriate. Also about 80, 51, and 45 % of variance of attitude, knowledge, and intention are explained by variables of the model, respectively.

Table 2 Standardized regression weights of significant paths

Paths	Estimate
Knowledge → attitudes	0.703
Attitude → intention	0.346
Subjective norms → intention	0.432
Possibility → behavior	0.639
Self-identity → attitude	0.33
Moral obligation → subjective norms	0.746
Intention → behavior	0.625

Table 3 Squared multiple correlations of dependent variables

Variable	Squared multiple correlations
Knowledge	0.538
Attitude	0.803
Intention	0.452
Behavior	0.916

Structural analysis and measures of fit

Model evaluation is one of the most unsettled and difficult issues connected with structural modeling. The following fit measures are used in this research (Table 4):

- **RMSEA** is root mean square error of approximation that equals to 0.033 (less than 0.05) and indicates a close fit of the model in relation to the degrees of freedom.
- **CMIN/DF** is the minimum discrepancy that is given by $\hat{C}$ (Chi square distribution for correctly specified models under appropriate distributional assumptions) divided by its degrees of freedom that equal to 1.13 (less than 2) that indicates an acceptable fit.

$$\frac{\chi^2}{df} = 1.13 < 2$$

- The goodness-of-fit index (**GFI**) and the adjusted goodness-of-fit index (**AGFI**) take into account the degrees of freedom available for testing the model. In this research, they equal to 0.832 and 0.823 (close to 0.95), respectively, that indicate an acceptable fit.
- **P** is the probability of getting as large a discrepancy as occurred with the present sample (under appropriate distributional assumptions and assuming a correctly specified model). That is, **P** is a "*p* value" for testing the hypothesis that the model fits perfectly in the

Table 4 Fit measures for model evaluation

Fit measures	RMSEA	CMIN/DF	GFI	AGFI	NFI	CFI	RMR	p
Amount	0.033	1.13	0.832	0.823	0.832	0.978	0.054	0.076

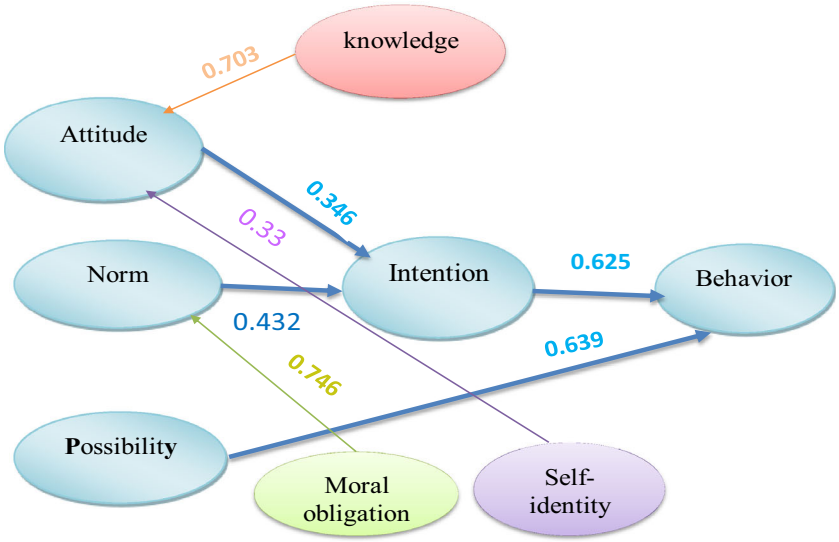

Fig. 2 The model of latent variables

population. As shown in the Table 4, *p* value equals to 0.076 (greater than 0.05) and indicates a perfect fit of the model.

– Other goodness-of-fit measures are shown in the Table 4.

Regression models are shown below:

(1) Behavior = 0.71 × intention + 0.904 × Possibility − 0.02.
(2) Intention = 0.49 × attitude + 0.46 × Norm + 0.11.
(3) Attitude = 0.14 × knowledge + 0.4 × self-efficacy + 0.02.
(4) Norm = 0.833 × moral obligation + 0.1

In Fig. 2, latent variables influencing behavior and also intention are shown. The effect of possibility, self-efficacy, and moral obligation on intention are not significant. The effects of personal–professional characteristics and agronomic–economic characteristics on attitude are not significant too.

The final model of behavior of organic rice producers in Mazandaran District is shown in Fig. 3.

Conclusion

Modern agricultural practices, along with widespread use of chemical synthetic materials lead to negative impacts on air, soils, and water, in turn, a negative impact on agricultural production and human well-being. Alternatively, organic farming is an important tool for achieving Green Productivity in agriculture and mitigates the negative impacts of conventional input-intensive agriculture by excluding the use of agrochemical inputs from the production system, minimizing environmental pollution, promoting reuse, and recycling of organic farm waste and crop residues, improving biodiversity, and enhancing soil productivity. The decision to convert from conventional to organic production is a complex system change and stems from interest in organic farming. This interest may be sparked by personal motivations or other outside influences. If these motivations and influences are strong enough, then the farmer will decide to convert to organic production.

The results show that knowledge of rice producers has a significant positive effect on their attitude toward organic farming; also attitude and subjective norms of rice producers have a significant positive effect on their intension toward organic farming. Possibility (Perceived behavioral control) and intention have a significant positive effect on the behavior of organic farming. The results show that behavioral model of rice producers for the conversion to organic farming is largely consistent with the modified Azen's theory of planned behavior. The proposed research model has been improved by adding three variables such as knowledge, self-identity, and moral obligations. As a result, the model is improved. Based on the findings, effect of the possibility on the intention is not significant.

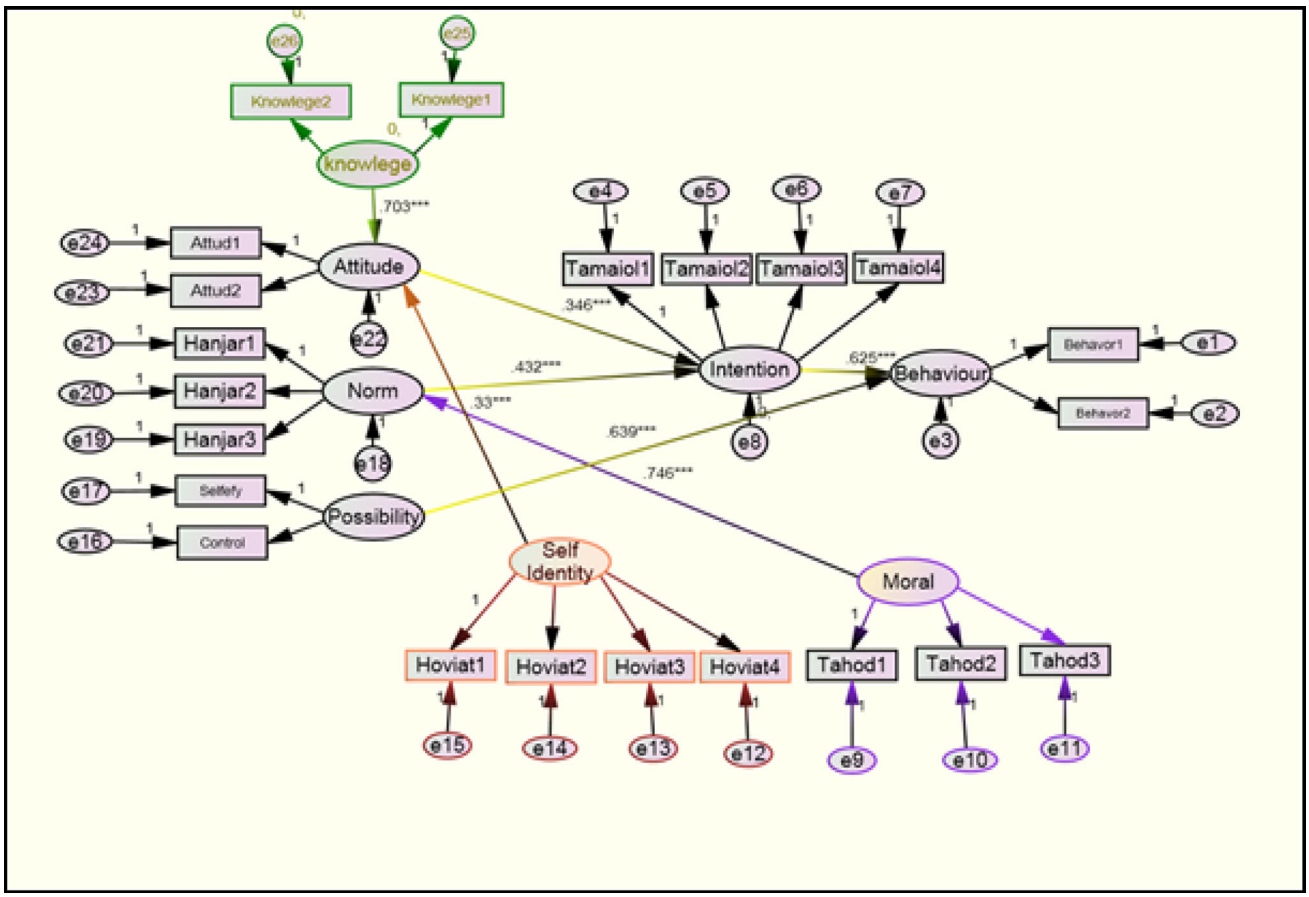

Fig. 3 Final model of behavior of organic agriculture

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