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Identifying the Barriers of Sustainable Agriculture Adoption by Wheat Farmers in Takestan, Iran

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Abstract

Conventional agriculture systems of production often lead to environmental degradation, economic problems and even social conflict. The efficacy of agriculture systems conducive to the economic, environmental and social sustainability of farming operations has been demonstrated, yet the adoption of sustainable agricultural practices is not widespread. This study evaluates the barriers of sustainable agriculture by wheat farmers in Takestan using a descriptive–correlation survey methodology. This quantitative study was based on a Researcher made questionnaire designed to elicit the barriers to adoption of sustainable agriculture practices perceived by a sample of 149 wheat farmers in the Takestan (N=268), through a stratified random sampling technique. Instrument validity was confirmed by a panel of experts. The reliability estimated by Cronbach's coefficient (α=0.905). The data has been analyzed using the SPSS (16). The results revealed that the high cost of sustainable agriculture was the most important barriers in its implementation (M=4.74). The findings of multiple regressions explained that farmer's attitudes and practices of sustainable agriculture explained 89 percent of the variance of the barriers of sustainable agriculture. Farmer's attitudes had the most influence on the determination of the barriers of sustainable agriculture (β=0.775).

Keywords:
Barriers, Sustainable agriculture, Wheat farmers, Takestan

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INTRODUCTION

Agriculture is a significant section of the economy in every society. Agriculture affects the environment, human health, and even social affirs. Thus, any attempt to achieve sustainability has to be set as a priority the attainment of a more sustainable agriculture (Cervantes-Godoy and Dewbre, 2010; Horrigan *et al*., 2002). Sustainable agriculture can help farmers to survive in such a system because it works with nature (Norman *et al*., 1997). Sustainable agriculture reduces the cost of purchasing inputs by utilizing farming techniques that incorporate biological cycles and the farmers' knowledge and skills (Lubell *et al*., 2011; Pretty and Hine 2001). It also helps small farms to continue operating through diversification and increased profits from alternative ways of marketing, such as niche markets, value added products, or direct marketing strategies (e.g. Farmers markets and Community-Supported Agriculture (CSA) (Fazio, 2003; Local, 2005; Horrigan *et al.,* 2002).

Despite the great alternative that has been proposed by sustainable agriculture for many farmers, widespread adoption of sustainable agriculture practices has not been carried out. There have been some government efforts to increase adoption, such as the provision of economic incentives and the creation of organizations to provide exclusive support to sustainable agriculture. Nonetheless, the impact of these efforts has been limited significantly. In spite of huge interest in sustainable agriculture practices, a few adoptions have been occurring (Horrigan *et al*., 2002; Pretty and Hine, 2001). This implies that strategies to speed up adoption of sustainable agriculture practices are not being effective.

One potential reason for the lack of effectiveness of these strategies is the reliance on traditional theories about adoption of agricultural innovations. Applying traditional theories that have emerged from research on the adoption of conventional practices may be problematic when trying to influence the adoption of sustainable agriculture innovations. Research on the adoption of Sustainable Agriculture Practices (SAP) lead researchers to think that reliance on the traditional model to understand the adoption of sustainable agriculture practices is not appropriate (Lubell *et al*., 2011). Traditional adoption theories neglect the fact that non-adoption does occur, especially in the case of sustainable agriculture practices (Vanclay and Lawrence, 1994). Moreover, Wandel and Smithers (2000) found that despite getting information and financial incentives to motivate the adoption of conservation tillage, many farmers rejected adoption due to the numerous constraints they encounter. Consequently, some studies suggest that in order to have a more effective impact on promoting widespread adoption of sustainable agriculture practices, concentrating on factors constraining adoption and how these can be overcome can be more fruitful. There have been some advances identifying constraints to adoption of SAP. However, very little is known about specific barriers to adoption in the Takestan region of the Iran. The researcher of this study has decided to make a closer examination of the reasons that are preventing many farmers from adopting sustainable agriculture practices. This decision is based on the results of many studies that find non-adoption of sustainable agriculture practices is a rational decision under certain circumstances.

Barriers to Adoption of Sustainable Agriculture Practices

Most researches on the adoption of sustainable agriculture practices have found several barriers that impede its widespread adoption. Cary *et al*., (2001) point out that there is a range of constraints that discourage adoption of natural resources management programs. They also explain that these constraints can have four different backgrounds: "perspective of individual landholders, the characteristics of desirable management practices, the socioeconomic structure of adopters' communities and the broader institutional settings".

One of the reported reasons for non adoption by Norman *et al*., (1997) is that sustainable agriculture practices are management intensive and require a huge commitment to constant learning. Sovedi *et al*., (2010) state that one reason for farmers being unable to adopt is their inadequate managerial skills.

Lack of farmers' information. The lack of information about sustainable agriculture practices is often regarded as a barrier to adoption (Bell *et al*., 2001; Edson *et al*., 2014; Norman

et al., 1997). Nowak (1991) explains that one of the reasons for farmers being unable to adopt residue management techniques is the lack or scarce information regarding economic or technical issues of these technologies. Lack of knowledge about the implementation and viability of these practices is an important barrier to adoption (Bell *et al.,* 2001; Norman *et al.,* 1997; Presley, 2014).

Economic Factors. Even for sustainable agriculture practices, economic factors are the important determinants of adoption (Pannell, 1998). Economic factors are frequently mentioned as barriers to adoption of sustainable agriculture practices by farmers and also by change agents. Some of the commonly mentioned economic factors holding farmer from adoption are the cost of adopting, the uncertainty of profitability, loss of productivity, labor demand, short term economic necessity, and the economic policies (Presley, 2014).

When environmental problems are not being overcome, current and future productions are at risk, as well as financial and time investments. Thus, farmers need to be sure that the new technology will provide the expected environmental benefits and effect (Vanclay and Lawrence, 1994).

Another factor closely related to risk is the farmers' economic ability. When the farmers' economic situation is not economically solved, they may tend to overexploit natural resources in order to maintain their operation. In such a case, the negative interactions among the components of sustainability, especially environmental and economic, can also be a barrier to adoption. This has been identified mainly in low income countries where poverty and ecological degradation are found to be closely related (Norman *et al.*, 1997; Antle and Diagana, 2003).

Although it has been demonstrated that sustainable practices are as economically viable as conventional practices, profitability of sustainable practices is a concern among farmers and even change agents (Horrigan *et al*., 2002; Roling and Jiggins, 1994). Paulson (1995) found that many agricultural professionals consider sustainable practices as not economically viable. Some of the factors that are frequently considered to affect the profitability of sustainable practices include the crop yield reduction and an increase in costs of inputs or quantity of inputs. Although many agricultural practices have been demonstrated to even increase yields, proof of such, results may not be available to farmers, thus generating uncertainty about their outcomes.

Labor demand is another economic factor that negatively affects profitability and the farmers' decision to adopt. Nowak (1991) cites that increase on labor requirement is one reason that farmer do not adopt residue management systems. Northwest Area Foundation (2004) found that increased labor demands represent a substantial barrier to adoption for many conventional farmers (Horticulture). Conversely, for farmers who have already adopted sustainable practices, labor concerns ceased. Reed (2004) explains that for organic farmers, labor demand represents a constraint to the economic rationality of transition to such production systems.

Policies. In addition to the specific reasons that prevent adoption at the farm level, external factors such as policies may negatively influence farmers' adoption decisions. Adoption of sustainable agriculture practices is commonly affected by influences from higher levels (e.g. National, regional, and watershed). National policies influence the economic environment upon which farmers decide if whether adopting new agricultural practices is feasible or not (Norman *et al*., 1997). Moreover, Pannell (1998) explains that farming systems are the result of "farmers' reaction to government policies and institutions in place".

Farmers' Personal Characteristics. Some personal characteristics are barriers to adoption of sustainable agriculture. The frequently mentioned personal and demographic farmers' characteristics that act as barriers are: reluctant to change, age, and other attitudes.

Farmers' perceptions of environmental problems and media promotion are other barriers to adoption. Farmers are likely to adopt environmental innovations when they perceive a risk of environmental degradation by using traditional practices. However, the extensive literature that gives images of dramatic environmental degradation may have contrary effects. Farmers may feel incapable of solving these problems. In some cases, farmers may not perceive they have such dramatic damage and thus take no action

to solve the problem (Hailemariam *et al*., 2012; Vanclay and Lawrence, 1994).

Incompatibility. Compatibility of sustainable practices with the current agricultural systems in terms of management style, farm size, physical setting, and production goals is often identified as a barrier to adoption. Also, incompatibility with farm and personal objectives is a barrier to adoption. When practices are complex and non divisible, they tend to require substantial changes in farm management (Vanclay and Lawrence, 1994). As Roling and Jiggins (1994) explain "sustainable management requires profound changes in the activities which constitute farm practices," thus tend to be incompatible with current management strategies.

Land Tenure. Land tenure issues are often found to be an important barrier to adoption of sustainable practices in developing countries, and in developed countries such as the United States. Antle and Diagana (2003) explain how insecure property rights would make very unclear and thus difficult to establish contracts for carbon sequestration with farmers from developing countries. Moreover, farmers with insecure property rights may degrade soil unintentionally. Insecure property rights have existed in Honduras for a long period of time, causing a conflict that affects many resource poor farmers. This has been demonstrated to have a deterrent effect on the adoption of sustainable practices. Plots that were owned by farmers were four times more likely to employ minimum tillage and conservation tillage (Arellanes and Lee, 2003). Physical and social infrastructures may present other barriers to adoption. Physical infrastructure such as marketing infrastructures may constrain the adoption of an innovation. Social infrastructure is very important because farmers often refer their peers for information. Therefore, most farmers wait until there is sufficient interest in the innovation by their peers before adoption occurs.

Social Infrastructure. One dimension of social infrastructure is the farming subculture or farming style. Meeting the expectations of subcultural norms is a fundamental part of social behavior. In farming subcultures there are norms about acceptable agricultural practices. The subculture concept leads us to understand that "ideas that are different to the currently held in the subculture are likely to be rejected… [thus] subcultures are a powerful force in resisting change" (Shaian *et al*., 2012). For example, new environmental practices are often not part of the subculture. Therefore, adoption of new environmental practices is less likely to occur.

Vanclay and Lawrence (1993) recognized that adoption decisions regarding sustainable agriculture are based on precise factors such as risk, cost, and benefits. These types of decision are often based on more imprecise factors such as "what is considered to be socially and culturally acceptable by members of [potential adopters'] social group" (Vanclay and Lawrence, 1993). According to a change agent "two drivers determine whether a farmer will adopt a new technology: if he thinks it's profitable and if his peers accept it" (Bearenklau, 2005).

Physical Infrastructure. It is well known that infrastructure issues play an important role in farming decisions (Ogunnowo and Oderinde, 2012). Khanna *et al*. (1999) find that drip irrigation did not reach widespread adoption until a support infrastructure was established. Extension specialists, dealers, support staff, and farmers understood its implementation and functioning. Infrastructural problems have been identified in developing countries as a barrier to adoption. After analyzing a large sample from 52 countries in Latin America, Africa, and Asia, Pretty and Hine (2001) suggested that for a more widespread adoption of sustainable practices, countries must invest in the options markets, transportation, and communications.

Papzan and Shiri (2012) study have shown that a deficiency or lack of infrastructure (such as restrictions on access to the relevant market, the lack of adequate stocks, and lack of appropriate inputs for organic products, etc.) on the adoption of sustainable agricultural practices affects.

The main purpose of this research was to identify the barriers of sustainable agriculture adoption by wheat farmers in Takestan. The objectives were as follows:

1. To prioritize to the barriers of sustainable agriculture from the farmers' perspectives.
2. To correlate between the barriers of sustainable agriculture and research Variables.
3. To identify the barriers to sustainable agriculture from the farmers' perspectives.

MATERIALS AND METHODS

A descriptive – correlation research survey methodology and a correlational design are used in this study.

Takestan County has five rural districts. The target population of this study includes all wheat farmers in these five districts that work in wheat farms from Takestan during the 2012-2013 (N=268).

Proportional stratified sampling is employed to ensure equal representation from each district in the target population. A sample size of 149 is needed to represent this population (Krejcie- and Morgan, 1970).

A questionnaire was developed to gather necessary data for this study. This instrumentation was utilized by researchers to identify the barriers of sustainable agriculture. The instrument consists of 36 statements rated on a five-point Likert-type scale with 1=strongly disagree, 3=neutral, and 5=strongly agree and by 36 statments were measured the technical knowledge farmers. Finally, questionnaire had seven parts (technical knowledge of farmers, economic factors, and sustainable agriculture methods, the barriers of sustainable agriculture, Channels for gaining information, farmer attitudes and technical factors).

Both content and face validities were gained through a panel of experts. Reliability is gained by selecting 30 farmers. Choronbach alpha was obtained about 0.905 in all that was reliable. These instruments were sent to 149 farmers in Takestan county.

The data collection efforts began in the winter of 2013 for the study, instruments demographic questionnaires and cover letters were forwarded to the samples in selected districts.

The collected data are analyzed using SPSS (16). Descriptive statistics (frequencies, mean scores, and standard deviation) as well as correlation and multivariate analyses are used to analyze the research data.

RESULTS AND DISCUSSION

Results/Findings

Respondents were asked to include age, gender, degree, experience in agriculture.

The Table 1 shows that average age of the respondents is 50 years. All of the respondents are male. Sixteen respondents (11.2%) have a college degree (bachelor, master's degree, or PhD while 127 respondents (88.8%) have a qualification below degree.

The minimum number of years of working on the farm was thirteen years while the maximum was 61 years. The mean number of years that farmers have worked in the farms was 41 years.

The following table shows the mean, Std.deviation, minimum and maximum of the farmers, economic variables.

As the Table 2 shows, The average area of irrigated land were 8.07 Hectare and the average area of dry land were 20.61 Hectare.

Table 1: Distribution of respondent demographic characteristics (n=143)

Variable		Frequency	Percentage
Level of education			
	Illiterate	15	10.5
	Below diploma	87	60.8
	Diploma	25	17.5
	College degree	16	11.2
Gender			
	Male	143	100
	Female	0	0
Age (year)			
	36-48	72	50.3
	48-60	36	25.2
	60-72	35	24.5
Experience in agriculture (year)			
	30>	26	18.2
	30<	117	81.8

Table 2: Economic characteristics of wheat farmers (n=143)

Variables	Mean	SD	Min	Max
The area of irrigated land (Hectare)	8.07	5.88	3	39
The area of dry land (Hectare)	20.61	22.42	0	72
Irrigated Wheat acreage (Hectare)	4.39	4.11	1	25
Dry Wheat acreage (Hectare)	2.67	2.16	0	7
Rented land (Hectare)	0.72	1.40	0	6
Production of irrigated wheat (Kg)	4475.8	1243.4	2500	7900
Production of dry wheat (Kg)	925.8	644.8	0	2000
Income (Rails *10000)	47615	75729	5000	140000

Table 3: Prioritize to the barriers of sustainable agriculture from farmers' perspectives

Items	Mean	SD	Rank
High costs	4.74	0.45	1
Government policies	4.73	0.50	2
Weak economy of farmers	4.65	0.51	3
Low profitability	4.62	0.56	4
Low technical knowledge	3.35	1.29	5
Lack of knowledge and expertise	3.25	1.28	6
Failure to provide banking facilities for organic products	3.01	1.36	9
Lack of experience implementing sustainable agriculture practices	2.95	1.30	8
The lack of organic farming support services	2.90	1.20	7
The complexity of a sustainable agriculture system	2.20	1.15	10

To assess the barriers of sustainable agriculture, farmers were asked to indicate their viewpoints on the barriers of sustainable agriculture for 10 items. Means, standard deviations and coefficient of variation of the 10 items are shown in Table 3.

Farmers reported the lack of organic farming support services had a mean 2.9 indicating less than moderate levels (M=2. 9, SD=1.2). Furthermore, seven of the 10 items had a mean value of over 3.00 indicating more than moderate. Another three items had a mean score between 2.00 and 3.00 indicating less than moderate. It can be concluded from table 3 that the main barrier is the high cost of adoption of sustainable agriculture (M= 4.74). The least important barrier is the complexity of a sustainable agriculture system (M=1.15).

To examine the correlation between farmers' viewpoints on the barriers of sustainable agriculture and research variables Spearman and Pearson coefficients were also employed for measurement of the relationships between farmers' viewpoints on the barriers of sustainable agriculture and research variables. Table 4 reveals that there was no significant statistical relationship between farmers' viewpoints on the barriers of sustainable agriculture and their demographic characteristics such as age (r_s=0.15, p=0.06), years of doing agriculture (r_s=0.10, p=0.22), income (r_s=0.15, p=0.08), technical knowledge of farmers (r_s=0.02, p=0.77) and Channels for information by farmers (r_s=0.15, p=0.06).

Table 4 also demonstrates that there is a significant negative relationship between farmers' viewpoints on the barriers of sustainable agriculture and their level of education (r_s=0.21, p=0.014), farmers' attitudes of sustainable agriculture (r_s=0.94, p=0. 000) and sustainable agriculture practices (r_s=0.90, p=0.000).

The findings of multiple regressions explain that farmer's attitudes and practices of sustainable agriculture determined 89 percent of the variance of the barriers of sustainable agriculture. Farmer's attitudes have the most influence on the determination of a causal model of the barriers of sustainable agriculture (β=0.775).

Table 4: Correlation between the barriers of sustainable agriculture and research variables

Research Variables	Pearson correlation	Sig.(2-tailed)
Farmers, attitudes	-0.940**	0.000
Channels for information	0.154	0.066
Sustainable agriculture practices	-0.903**	0.000
Income	0.147	0.080
Technical knowledge	-0.024	0.775
The years doing agriculture	-0.103	0.222
Age	-0.154	0.066
Level of education	-0.210*	0.014

* p <0.05, ** p <0.01.

Table5: Multiple regression analysis to identify the barriers to sustainable agriculture

Variable	b	β	t-value	Sig.(2-tailed)
Constant	1.370	-	15.81	0.000
Sustainable agriculture practices (X1)	0.107	0.176	2.16	0.031
Farmer's attitudes of the sustainable agriculture (X2)	0.647	0.775	9.49	0.000

The next variable that has the most effect on the dependent variable is sustainable farming methods with the standardized regression coefficient of 0.176 (Table 5).

The following formula suggests estimating the barriers of sustainable agriculture:

$$F=552.152 \quad Sig.= 0.000$$

According to b:

$$Y= a + b_1x_1 + b_2x_2 + \ldots + bnxn$$

$$Y= 0.107X_1 + 0.647X_2 + 0.370$$

According to **β**:

$$Y= 0.176X_1 + 0.775X_2$$

CONCLOSIONS

The perspectives which are provided by wheat farmers from across the Takestan county leads to the conclusion that there are several important barriers to adoption of sustainable agriculture practices. From the ten statments in the survey, the one referring to barriers to adoption of sustainable agriculture practices high cost has the highest response rate. The study of Lubell *et al.* (2011) show that private economic benefits outweigh the economic costs as innovation practices, whereby decision making should follow the diffusion of innovation model. Based upon the findings of Boone *et al.* (2007) sustainable agriculture leads to lower costs, profitability, low chemical input, productivity and more. These findings contrast with the findings of the present study.

However, the answers about barriers to adoption are more varied. There are more answers referring to barriers than those referring to the high cost of sustainable agriculture, their weak economic and government policies. Most farmers agree that the economic dimension of barriers to adoption of sustainable practices is an important issue. While many of them state that cost is a barrier to adoption, few clearly explained this point. Those that further explained their ideas of cost as a barrier indicated that if conversion implies great costs, such as new machinery or discarding old machinery, or additional new costs associated with the use of practices, the initial hurdle of implementation can be too high, and farmers will be discouraged from adopting. Additionally, respondents explained that transition costs are a great barrier to adoption, because the resource base is greatly depleted.

The Iranian Government has implemented economic incentive programs that intend to help farmers to make the transition. However, many problems seem to have impeded the effectiveness of these programs. At first, low budgets have limited their impact. Secondly, some respondents expressed their limited effectiveness due their highly restrictive requirements which

make them actually helpful only to large operators. While these approaches may intend to have more impact with the available scarce economic resources assigned to sustainable agriculture, it might be leaving behind small farmers, who can have more difficulties than large scale farmers in investing in new practices and marketing their products. More importantly, such approaches imply a disregard for the social goals of sustainable agriculture, which support small farms that bring greater economic and social benefits to communities. In addition to all the economic constraints encountered by farmers, there are also barriers to acquire information and knowledge needed to make a transition. A great number of farmers suffer from lack of knowledge about the implementation and benefits of sustainable agriculture practices. This is aggravated by the fact that sustainable agriculture is a highly skilled profession. These factors can limit the farmers' ability to adopt sustainable practices to a considerable degree. The research of Baughman *et al*. (2012) examined the impact of the Government Performance and Results Act on accountability and evaluation activities in two state Cooperative Extension Systems. Researcher emphasized the importance of stakeholder involvement in the program planning and evaluation process and had systems and processes in place to involve stakeholders. Dwyer (2014) emphasis towards systemic approaches, developed territorially in partnership with farmers, is needed. Emerging non-policy innovations and new initiatives may offer lessons for an improved approach.

Despite the farmers' needs of information, technical assistance, and education regarding sustainable agriculture, there is a lack of relevant information about sustainable practices and wrong attitudes. Lack of information, especially about the economic impacts and other long term benefits of sustainable agriculture, is an important barrier to adoption. The lack of research and local trial results in the inappropriate technology problem. The problem of lack of information and wrong attitudes to sustainable agriculture is related to the lack of research and the inadequate management of existing information regarding sustainable practices. Access and adaptation at the local level of existing information are significant barriers to the delivery of information, which does not complement the farmers and change agents' needs for locally adapted information. Moreover, the impact of a lack of relevant and reliable information is worsened by the fact that many giant corporations aggressively bring confusing information to farmers causing. Studies of Lillard and Lindner (2014) showed that Agricultural agents should receive information about sustainable agriculture and they must hold appropriate training for farmers. Also the study's Hutchins (2013) emphasis on the development of technology and technological innovation to increase sustainable agricultural productivity. As recent and current policies have tended to promote specialized, non-adaptive systems with a lower innovation capacity, farmers have to spend time learning about a greater diversity of practices and measures (Kesavan and Swaminathan, 2008).

On the other hand, if all the issues mentioned as barriers are compared, it can be observed that the most frequently mentioned barrier to adoption is reluctance to change. However, this issue was not fully explained by many respondents. This leads us to believe that many change agents only use these term to blame farmers for the non adoption, neglecting the reasons for such behavior.

RECOMMENTATIONS

Sustainable agriculture needs greater support from traditional information source agencies. This is being limited by the lack of funding for sustainable agriculture that these institutions are faced. However, data from this research supports the idea that better administration of scarce resources could have an impact on the spread of adoption of sustainable practices. Adequate allocation of financial incentives and grant monies, and constant evaluation of their impact, can generate positive results. Agencies need to be careful in choosing the allocation of economic resources. Targeting farmers and change agents that are really interested in sustainability, who need the economic help, and who can maximize the impact of such scarce resources, can lead to the wise use of economic resources.

Additionally, improved management of the existing information should lead to relevant and available information for change agents and

farmers. This in turn should help to overcome the many believes and uncertainties about sustainable agriculture and widespread acceptance of the idea. Practices need to be designed and delivered under a bottom up approach that allow for initial assessment of local needs. This can reduce unnecessary efforts and expenses. Additionally, the two way communication links between information delivery and research agencies need to be strengthened.

Agencies need to break the ideas that have been left behind by the traditional extension paradigm. The idea that farmers are to be blamed if the adoption does not occur, after information was provided, needs to be eliminated. If farmers fall under such criticism, this research shows that the farmers' decision of non adoption might be rational, under the current condition limitations to adoption. Agencies trying to promote sustainable agriculture need to examine how they can prevent such obstacles in the short and long run.

It is also clear that agencies need to address their efforts, not only to farmers but also to change agents, communities, and the general public. This can help to reduce some of the beliefs and perceptions that are hindering adoption, and at the same time increase public support for the concept. Public support in the long run will help sustainable agriculture to obtain more support from government, and from the other components of the infrastructure needed for agricultural production and commercialization.

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