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Review

Agricultural sustainability: Implications for extension systems

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Extension could play a key role in fostering sustainability through its educational programs but there has been a growing realization that traditional extension models have not been sufficiently effective in promoting adoption of sustainable agricultural practices. Since sustainable agriculture is a knowledge-intensive system, it requires a new kind of knowledge, which differs from other forms on the basis of conventional agricultural practices. In fact, conventional extension system cannot accomplish sustainability in agriculture; because today's agricultural extension must consider environmental implications, social issues, and overall economic growth within the agriculture sector. The purpose of this paper is to describe new extension model to achieve sustainable agriculture.

Key words: Agricultural extension, sustainability, system.

INTRODUCTION

In Iran, like other developing countries, agriculture is one of the most important economic sectors and comprises a considerably high percentage of production and employment. The Iranian agriculture sector provides employment to about 25% of the labor force, accounts for 25% of the Gross National Product (GNP), contributes over 4/5 of total domestic food supply, 1/3 of non-oil exports (excluding carpet exports), and 9/10 of the raw material demand of national industries(Karbasioun, 2007). Nevertheless, considering to dependency on pesticide and insecticide imports, a growing population, limited arable land, increasingly destruction of natural resources, soil erosion and degradation, water pollution, decreasing ground water tables, bio-system degradation, air pollution, excessive use of chemical inputs and loss of job etc. led to unsustainable agricultural conditions in Iran (Allahyari and Chizari, 2008; Allahyari and Chizari, 2008; Allahyari, 2008) Considering the progress of these problems and with emphasis on water and soil which are basic resources for agricultural activities, importance must be given to the conservation and sustainability of these resources (Faham et al., 2008; Chaudhry et al., 2006). In response to these conditions, programs, poli-cies and strategies are developed to achieve sustainable agriculture and conservation of natural resources. Sus-tainability of farming system is so important that in case of disregarding it, alarming results would be expecting for Iranian people in supplying their food security. The necessity of considering sustainable agriculture in Iran could be seen in the policies made in the development plans, showing the solicitude of policy makers to achieve sustainability in agriculture. There are about 46(27%) articles (out of 166 articles) in the forth development plans of Iran regarding environmental and sustainability that indicate the importance of this issues.

There are many definitions for sustainable agriculture and has different meanings to different people (Jayaratne, 2001). According to the dictionary, “sustainable” can be defined as what can be kept up or prolonged over a long time period (Wagner, 1999) Sus-tainable agriculture is defined as successful management of the resources of agriculture to satisfy changing human needs, to conserve the environment, and increase biological resources (Karami and Mansoorabadi, 2008). Rao and Rogers (2006) defined sustainable agriculture as a practice that meets current and long- term needs for food, fiber, and other related needs of society while maximizing net benefits through conservation of resources to maintain other ecosystem services and functions, and long-term human development. It seems that sustainable agriculture is more than a shift in farming practices; rather, it must be focus on raising consciousness (Somers, 1998). Knowledge and related information, skills, technologies, and attitudes will play a key role in the sustainable agriculture (World Bank, 2006). Consequently, sustainable agriculture system is is an information-

intensive system (Mazumadar, 2006) because inputs have been replaced by skills, labors, and management (Roling, 1994; Pretty, 1995; Chizari et al., 1999; Cho and Boland, 2004; Lawrence and Garforth, 1997). For example, for farmers that practice sustainable agriculture to be successful in managing their farmlands, there must be a continuous network of information, new technologies, and innovations that are available to them. The extension service can play a crucial role in providing this network of information on sustainable agriculture education (Hersman, 2004) Thus, the role of extension is very important to support sustainable agriculture (World Bank, 2006; Toness, 2001; Ahmadvand and Karami, 2007; Karami, 1995). Nevertheless, there is a question: will the current agricultural extension system be able to accomplish sustainable agriculture?

CURRENT SITUATION OF IRANIAN AGRICULTURAL EXTENSION SYSTEM

Extension system of Iran with about 60 years activity still has some obstacles, limitations and problems. In Iran, like many other Middle Eastern countries, a mixed approach is used with a focus on governmental or common extension approaches. In Iran the "transfer of technology" (ToT) model has been the prevalent practice for developing and spreading innovations. It is based on the assumption that a transfer of technology and knowledge from scientists to farmers will trigger development. Applied to agriculture, this model assumes that farmers' problems can be solved by people and institutions that have this 'modern' knowledge. This top- down model creates a rigid hierarchy, which discourages the feedback of information. Researchers work independently from farmers and extension workers, resulting in a poor understanding of farmers and the opportunities and constraints they face. The transfer approach is fragmented, both institutionally and in terms of disciplines. Research concentrates on technology and researchers, and extensionists are seen as technical agents. Social competence is not required as complex socio-organizational issues (e.g. land-use regulations, power structures, conflict resolution mechanisms) are neglected or reduced to a technical level (Cho and Boland, 2004; Dart, 2000; Moyo and Hagmann, 2000). In addition, to weakness in legal basis on extension, the basic problem of this system is lack of personnel skill, especially for field personnel to satisfy the requirements. In consequence, during these years, offering services to the farmers was not successful and satisfactory. In Iran, apart from limited number of active units, the agricultural extension services are mainly offered in governmental form, which the Ministry of Agriculture (jihad- e-Keshavarzi) is responsible for these kinds of activities. In general, the main particulars of Iran agricultural extension system are: the incorrect definition and understanding of the role of extension, the preference of idea of technology transfer in activities, parallel works, lack of transferring the responsibilities and authorizations proportionately, and lack of extended extension networks for coverage of sufficient addressees.

According to Rezaei-Moghaddam and Karami (2008) the major obstacle to sustainable development of Iran is insufficient knowledge of people with regard to environmental hazards. As a result, the people's knowledge and environmental awareness to achieve sustainability must be increased. To achieve this objective, extension program could play a key role in helping farmers for the application of sustainable agricultural practices. Studies showed that traditional extension systems have not been sufficiently effective in promoting adoption of sustainable agricultural practices (Vanclay and Lawrence, 1995; Van den Ban, 1999) because the traditional roles of transferring and disseminating of agricultural technologies are proving insufficient in today's global context (Toness, 2001).

Historically, the rhetoric of agricultural extension worldwide has shifted from an emphasis on production, at the beginning of the century, to productivity (or efficiency) based agriculture, to the more recent philosophy of sustainability (Dart, 2000). Extension systems have been gradually shifting from a knowledge transfer to a knowledge-share concept and farmers are no longer assumed as the sole recipients of new technology and science; instead, they are now contributing to the learning and teaching processes. The role of agricultural extension agents is also changing from transferring knowledge and technology to consultants, advisors and facilitators of the farmer learning processes (Karbasioun, 2007). Pretty (1995) suggests that we are currently entering an era of social capital, where farmers are now considered to be the potential solution rather than the problem that is the role of individual capacity is paramount. There has been a growing realization that traditional extension methods have not been sufficiently effective in promoting adoption of sustainable agricultural practices (Vanclay and Lawrence, 1995). In general, Iran agricultural extension does not have a desirable status and it could not be promoted in the manner of selecting the approaches and extension methods, development of objectives and duties, organizing of structural organizations.

With respect to current problems and limitations, Iranian agricultural extension system requires being reassessed and basic transformation. On this basis, the main purpose of this paper is to explore new extension mechanism to achieve sustainability. To accomplish this objective, after extensive literature review, we proposed the following pattern.

EXTENSION SYSTEM AS AN OPEN SOCIAL SYSTEM

Today, it is almost considered that agricultural extension will have effective performance when it has activity in the framework of a system. In the present model, agricultural extension is seen as an "open social system". First, we

discuss about system perspective. What dose “system perspective” mean? According to Seepersad (1994), first, it emphasizes the need to view a situation as a whole and not as separate parts. Holism is, thus, a recurring theme. Indeed, system performance must be judged not simply in terms of how each part works separately, but in terms of how the parts fit together and relate to each other and in terms of how the system relates to its environment and to other systems in that environment (Roling and Wagemakers, 1998). Second, it recognizes the interactions of components inside the system as well as the effect of the immediate external environment upon the system in the process of transforming inputs to outputs. Finally, the systems perspective also stresses “system hierarchy”, whereby every system is part of a larger system and is itself composed of sub-system. In this model, “forces of change” is defined as external environment of system. The changes in the external environment force the extension organizations to make necessary adjustments if they want to continue functioning efficiently (Figure 1).

The changes in the working environment, which is being called as “forces of change”, vary in nature and scope, that is, they could be political, technical, economic or social. The effects of these forces of change are very important in dynamism of extension system toward sustainability, since the extension systems are directly or indirectly affected by the changes and, in response, must make internal and external adjustments in order to keep functioning at the same or higher level of efficiency to accomplish sustainability. In this model, the main forces of change, which are affecting or are abound to affect the existing extension systems, are: globalization and market liberalization, privatization, decentralization and participation, information and communication technology breakthrough, biotechnology and genetic engineering and holism perspective.

SUITABLE CONTEXT FOR EXTENSION TOWARD SUSTAINABILITY

Sustainable agricultural systems are situation-specific systems (Zhen and Routray, 2003), thus, in order to support them, extension systems should be situation-specific, too (Qamar, 2002). The meaning of situation-specific is that sustainable agriculture systems should be acted on the base of available assets (Van Loon, 2005). In this model, we put these assets as the context of extension activities and functions to achieve sustainability; because the success of extension systems is related to identify assets, assess their vulnerabilities and then take steps either to enhance or strengthen those assets or to reduce vulnerabilities placing stress on those assets (Worth, 2006; 2002). These assets are human capital, social capital, natural capital, financial capital and built (manufactured) capital. Human capital refers to skills, abilities, education, indigenous knowledge and health of community. Social capital refers to the networks both within and outside the community; sense of place belonging and the extent of opportunities existing for participation in local activities and decision-making. Natural capital refers to the existence and health of environmental assets. Financial capital refers to the financial resources in or available to the community. Built capital refers to community infrastructure (Gasteyer and Flora, 2002; Flora, 1997). Each form of capital can enhance the productivity of other forms of capital (Flora, 1997a; 1997b). In addition, these assets are sub-system for "forces of change" and are interacting to them.

COMPONENTS OF SUSTAINABLE AGRICULTURE EXTENSION

Components of extension system compose the internal parts of the model. These components are as similar as the traditional components of extension systems, but based on new paradigm of development, we have defined new function and objectives for them as they can support sustainability of agriculture.

One of the most important tasks of an extension organization is to choose the objectives of the extension program (Van Keulen, 2007). Agricultural extension objectives in developing countries have been changing in recent years to reflect a new development paradigm that emphasizes sustainability (Vanclay and Lawrence, 1995). Probst and Hagmann (2005) reported while participatory extension approach as a suitable approach for sustainability is emerging, objectives of extension system are shifting toward enhancing adaptive management capacity, emancipation, and social capital at local level, building of stakeholder platforms for negotiations and learning processes. Cho and Boland (2004) wrote that extension objectives toward sustainability could range from the effective transfer of technology to the building up of strong rural organizations, which can exert influence over future research and policy agendas, and also take and enforce collective decisions over natural resource management. A shift towards the latter will promote more sustainable agricultural development. Bartholomew and Bourdon (2002) have utilized anthropological concepts to define extension toward sustainability. They state that the purpose of extension is to ‘help people help themselves.’ This idea is still the most appropriate for extension and sustainable development.

Within this new paradigm, sustainable agriculture cannot accomplish by only using conventional extension methods; rather it requires a new kind of learning process-facilitation of learning (Allahyari and Chizari, 2008). Currently agricultural extension systems apply group methods, networking for exchanging and sharing information, social and participatory learning methods, giving attention to learning styles rather than the subject of learning, placing emphasis on problem solving,

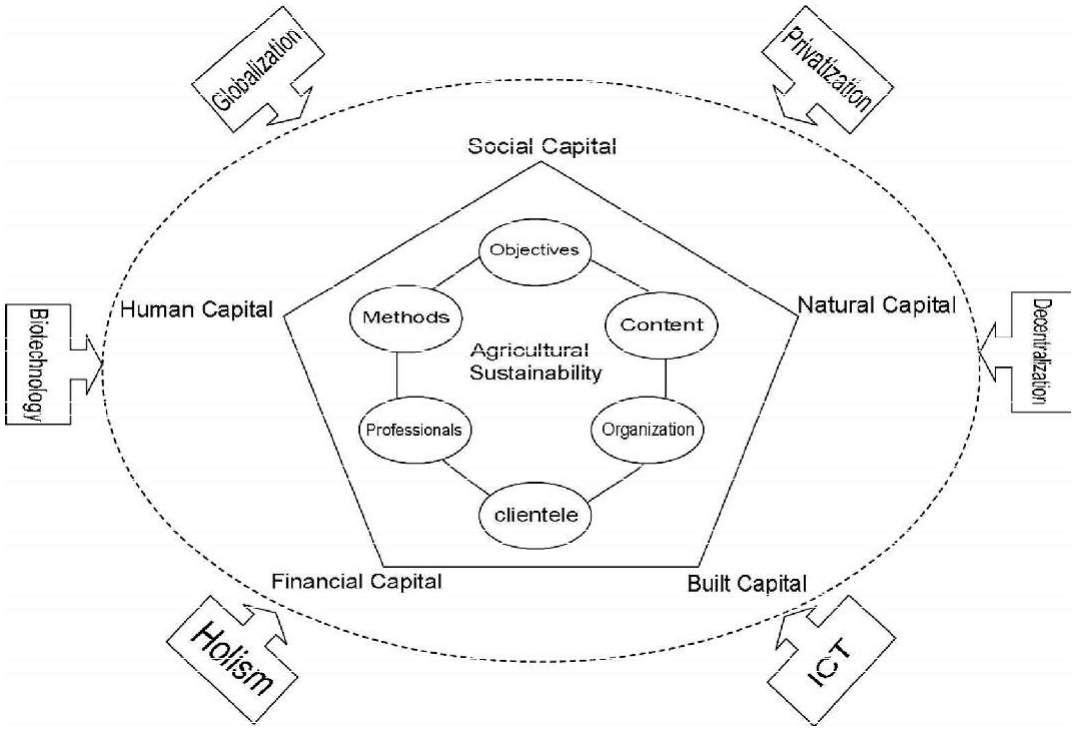

Figure 1. Extension mechanisms to support agricultural sustainability.

providing feedback from management activities, using indicators to make environmental problems visible, conducting regular field observations as the basis of decision making, giving attention to experiential and discovery learning, On-farm experimentations, placing emphasis on using new information and communication methods and etc. It is intended that these methods support better facilitation of learning in environmental agriculture. Also this study shows that to accomplish sustainability in agriculture, we must give attention to diversify extension-education methods.

Most of the existing organizations serve production and productivity, equity or stability, however only few organizations have been emerged to support sus-tainability. Public models for provisioning of agricultural extension are considered to have fallen into disrepute in many countries due to poor progress in achieving policy aims such as export, food security, sustainability and social well being. Now, Extension systems should be much broader and more diverse, including public and private sector and civil society institutions that provide a broad range of services (advisory, technology transfer, training, promotional, and information) on a wide variety of subjects (such as agriculture, marketing, social orga-nization, health, and education) (World Bank, 2006) . New alternatives of organizational arrangements have been emerged in worldwide. Decentralization and pluralism are two main characteristics' of extension organizations to-ward sustainability (Qamar, 2002; Rivera and Qamar, 2003; Davis, 2004). In order to adapt agricultural extension organizations to sustainability, it has been argued that organizations must become “learning organization” (Pretty, 1995; Ommani et al., 2008; Leeuwise and Van den Ben, 2004). A learning organization expects its members to “act as learning agents for the organization, responding to changes in the internal and external environment of the organization” (Senge, 1990). Attendance of farmer associations and NGOs are other types of organizational arrangements toward sustainability. Finally, in promoting development of agricultural extension services, the importance of institutional linkage between the rural community and the development agents should be considered.

By shifting in philosophical foundations of rural and agricultural development's thoughts, and emerging new professionalism with new concepts, values, methods and behavior, extension agents should be adapted themselves with these changes. In this regard, Moyo and Hagmann (2000) believe that the role of the extension agent is to facilitate learning process. This involves the facilitation of:

(a) A process of community development and innovation;
(b) A process of collective and individual farmer learning about innovation (technical and social) to enhance the community's capacity to innovate and;
(c) Rural knowledge management.

The new role of managing and facilitating learning processes implies special skills and competencies that

are far from the present technical focus of extension agents and thus to be developed.

Currently extension clientele are more varied and shifted from large scale farmers toward marginal and poor resource farmers, women and local groups. Finally ecologically sound practices, accomplishments of biotechnology and genetic engineering, trade liberalization, participation and new communication technologies will compose content of extension programs toward sustainability.

Conclusion

Iran's agriculture is facing serious environmental pollution and degradation problems (Karami and Mansoorabadi, 2008) and extension has a key role to improve it (Ahmadvand and Karami, 2007; Allahyari, 2008), but current extension system in Iran does not have a sufficient competency for the achievement of sustainability and it needs to shift toward new approaches and models. It is concluded that agricultural extension systems toward accomplishment of sustainability should be departed from reductionism thoughts (Allahyari and Chizari, 2008), and they must focus on holistic and systematic perspectives. Being success and being dynamic the system-based extension models depends on identifying the environment and the context of systems and the interactions occur among them. Finally, re-thinking in agricultural extension components is mandatory and we must strive to find new functions, strategies and objectives for extension systems toward sustainability.

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