

NEWS

OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN

SERIES OF SOCIAL AND HUMAN SCIENCES

ISSN 2224-5294

Volume 4, Number 320 (2018), 15 – 20

UDC 33:2964

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INNOVATION SYSTEMS: METHODOLOGICAL APPROACHES**

Abstract. The aim of this article is to study effective reformism: strategies that implement innovative networks to create changes in their environment in order to create a more favorable context for the implementation and long-term implementation of their innovative projects. Using an approach based on case studies, effective reform efforts are analyzed on the trajectory of technological innovation associated with the introduction of a new poultry system and an organizational innovation trajectory concerning new ways of cooperation between individual farms to achieve economies of scale. The results confirm the idea, arising from the point of view of complexity in innovation systems in agriculture, that the interaction between innovation networks and their environment is only limited to a limited extent.

Key words: agricultural innovation systems, innovation management in agriculture, methodological approaches of agricultural innovation systems.

1. Introduction

The modeling of agricultural innovation systems (AIS) has become an increasingly applied framework for analyzing technological, economic and institutional changes in agriculture. In the AIS approach, innovation is seen as the result of a process of networking and interactive learning among a heterogeneous set of participants, such as farmers, in-coming industries, processors, traders, researchers, producers, government officials and civil society organizations. The AIS approach emphasizes that agricultural innovations are not only new technologies, but also institutional changes; it requires alternative ways of organizing, for example, markets, labor, land use and benefit sharing.

Given the interaction between heterogeneous entities associated with several aspects of agricultural innovation, it was noted that AIS can be considered as complex adaptive systems (CAS). They are defined as self-organizing systems "whose properties can not be analyzed by studying its components separately [1], formed by many agents of different types, where each determines its strategy, reacts to the actions of other agents and changes in the environment and tries to change the surrounding environment in ways that correspond to its goals ". Elsewhere, this environment is referred to as the "social and technical regime" and efforts to change it in favor of the implementation and long-term implementation of innovations were called "effective reformism" [2].

There are several studies on the self-organizing nature of agricultural innovation systems and how this connects to effective reformism processes, but their analytical focus is often at a high level of aggregation, e.g. the macro-level of an entire country, and a very long time horizon, e.g. a change process that takes several decades. Examples are studies on zero-tillage innovation by Ekboir, Green Revolution developments in India [3]. Despite the usefulness of such analysis for understanding major forces in socio-technical change in agriculture, such a focus runs the risk of not fully grasping the activities of innovating

actors in the support of such change. The question this article therefore addresses is how forces at the micro level of individual innovation networks contribute to socio-technical change [4]. By yielding detailed insights on how actors interact with their environment across different scales in agricultural production systems and agri-food chains in their effort to innovate, we hope to contribute to building blocks for adaptive agricultural innovation policies that can deal with the unpredictability of innovation processes.

2. Innovation agency and structure

The interaction of AIS includes several types of interaction between subjects and their environment (for example, between human subjects and artifacts, ie, technologies), this article focuses on social interaction in innovation processes. This focuses attention on the relationship between the agency entities and the social structure described in Giddens' theory of structure formation. An agency is the ability to take action and change the situation in the course of events [5]. In the context of innovation, the "innovation agency" is defined by the resources and competencies that the actor or organization has at its disposal for innovation. It also includes institutional functions, such as the norms and rules of actors, the so-called "pattern of innovation" that guides and legitimizes actions.

In self-organizing innovation systems, no actor can pursue his innovative goals, without taking into account other participants, due to the lack of sufficient forces and resources for this. In this perspective, participants interactively form a support network to achieve individual and collective goals and to obtain resources whose nature and source are unknown to ex-ante [6].

The idea of a support network involves an innovative network with voluntary membership, called "innovative configurations" and "coalitions". This does not mean that the interests of partners in innovation networks are automatically aligned, as innovative networks are the arena of negotiations [7]. In addition, an innovative network in the sense of a support network is unstable: it may change over time in composition. Such innovative networks depend on many other peripheral actors in their institutional environment, whose participation may not be voluntary, but rather due to mutual interdependence. In Giddens' structuring theory, the actors and structures in which they are embedded have a dual connection, because "the structural properties of social systems are average and are the result of the practice that they recursively organize" [8]. This implies that the actors are conditioned by their surroundings, but by their actions they actively or passively change their environment, so that, in turn, it carries out another form of conditioning. In the study of innovative systems, this reflexive relationship between participants and their institutional environment, which actors can adapt, modify or supplement, was called interdependence [9].

Actors reflexively follow the actions and aspects of the environment in which they move, taking into account past, present and future events (Edwards, 2007), thereby striving to achieve their goals and reduce uncertainty in their achievement [10]. Often, the goals of innovative actors are embodied in more or less formulated visions that have an influential leadership, convincing, binding and undetectable softening function [11].

The latter is particularly important, since innovation provides many uncertainties to innovation actors. These include, for example, the complementary acquisition of resources, the development of consumer demand, political and legislative inability or instability, and the behavior of network partners and competitors [12]. Although actors can consciously try to influence their institutional environment in order to reduce these uncertainties, they are always limited in their influence.

The unintended consequences of the agency's activities, as well as external events that lie outside the sphere of influence of the agents themselves, play an important role in limiting or training further actions. Thus, they are an important source of structural change [13]. Innovations are influenced, for example, by consumer preferences, government policies and market factors at the regional, national and global levels [14]. From this review of the innovative agency it became clear that the formation of innovations involves the "sale of a good story" (for example, visions, discourse) that the right people (with conviction, trust, power) say, at the right time, in the right place and the right people (acquiring additional resources,

creating and capitalizing the momentum and using opportunity windows. Considering the fact that innovative actors must constantly respond to them, in turn, are active, following the ideas from the general management literature of CAS [15]. This means that the policy of innovation in agriculture should not aim to fully plan, monitor and manage the agricultural innovation system, but to manage the probability of events, I reduce the chances of achieving the desired results and reduce the likelihood of undesirable results [16]. Although the AIS approach proved its value as an analytical basis, it still needs to be transformed into an operational concept with policy options and targeted measures to improve the everyday innovation potential [17]. This study hopes to contribute to understanding micro-levels of innovation and, thus, will allow the development of adaptive innovation strategies that optimally support these micro development.

3. Methodology

The perspectives of both the participants in the innovation network and the institutional environment for restoring agent-structure interaction were analyzed. This analysis was supplemented by an analysis of a number of internal network documents (for example, meeting minutes) and external documents (for example, political documents and newspaper articles). In addition, this multiwire approach allows triangulation: a research methodology that prevents the risk of distortions in post-fact accounts, increasing internal reliability. We discuss two cases of innovative travel, in the social, ecological and economic sense, through technological and non-technological innovation. Non-technological innovation is increasingly seen as important for more socially sustainable agricultural systems, for example, through the reconfiguration of the value chain and new cooperation agreements between various farm and non-agricultural enterprises [18].

4. Results

In modern conditions of economic development, an important feature of both the national economy and the agro-industrial complex is the need to accelerate scientific and technological progress, based on innovative developments that allow continuous updating of agricultural production on the basis of mastering the achievements of science and technology. At the same time, innovation processes should be constantly regulated by the state with the help of an appropriate innovation policy, the implementation of which will promote systematic, economic, technical and technological renewal of agro-industrial production and increase its efficiency.

The agro-industrial complex is characterized by the fact that the innovation policy covers various branches of the economy that are diverse in their technology and production orientation: the agricultural system, the processing industry, the feed and microbiological industry, agricultural machinery, machine building for the light and food industries. In our opinion, the key moments in the implementation of the innovation policy of the agro-industrial complex are the availability of investment activity that characterizes the degree of willingness and aspiration of economic entities at all hierarchical levels of management to introduce innovative models and projects for the development of agricultural production, as well as the innovative potential that ensures the availability of financial, material and labor resources, necessary to solve the tasks. The interconnection of these components contributes to the development of innovative activities.

Innovation activity allows solving the problems of increasing resource returns, transforming scientific and fundamental discoveries into practical solutions, and determines the competitive advantages of organizations and products. Noting the features of the activities of agricultural enterprises, he points out that innovation activity reflects: a wide range of products; diversity in production technologies, storage and distribution conditions; high biological value; The need for strict compliance with sanitary standards in its production, processing, storage and distribution [19]. These circumstances make it possible to determine the innovative activity of organizations of the agro-industrial complex as a multidisciplinary,

united by a single technological process, a risk-based activity that is dependent on natural and climatic conditions for the creation, use and dissemination of innovations.

The main innovative tool is innovation, which in a narrow sense contributes to the emergence of various innovative processes in the system and is the engine of the scientific and technical process in a broad sense. Continuous implementation of innovation in the agro-industrial complex, promotion of innovations predetermine the formation of innovative processes that, through interrelated activities, promote the introduction of research and development results into the practice of agricultural enterprises in the form of new varieties of plants, breeds and animal species, new or improved food products, materials, new technology in agriculture. plant growing and livestock, new fertilizers and products for the protection of plants and animals, methods of prevention and treatment of animals and birds. Our research shows that this role also seems to be a feature of broader, more heterogeneous innovation networks and agent-structure interactions, as was found elsewhere [20]. In addition to persons performing border-crossing functions, case studies confirm the role of visions as a guiding, convincing, binding and undeclared function in innovation [21]. As our results show, this is a process that continues throughout the innovation process, when partners leave or enter the network, or circumstances change. Apparently, it is important how the vision was realized, for example, detailed business plans and large-scale models in the process of implementing innovations. Tangible visions help create a common understanding and support for participants in an innovative network and institutional environment. Thus, they become so-called boundary objects [22], which allow several different actors to understand what innovation is, and thus increase the attractive value of the vision and help to soften the uncertainty of actors.

Observing innovative systems as complex adaptive systems and adopting the idea of self-organization of innovative networks limits the possibility of their full management, as evidenced in recent approaches to adaptive innovation management [23]. Although effective reformism is thus neither predictable nor fully manageable, this study has highlighted some key supporting factors. An important result of this research is that innovative networks can support their effective reform efforts using different types of border agents to protect and protect their interests, create new contacts and act as mediators in the event of conflict. In addition, the use of tangible visions and artifacts helps them create understanding and support for their ideas. However, when these visions become too rigid, they can lead to the fact that the innovation process will become locked up. Recognizing and accepting self-organization can increase opportunities for innovation when self-organizing initiatives properly facilitate the creation and use of windows of opportunity. As for the adaptation policy of innovation, unlike the rigid orientation toward planning and control, it becomes obvious the importance of simplifying the innovation system. A promising approach is the use of specialized innovative brokers, such as TransForum. Such innovative brokers help in the formulation and processing of the vision, the continuous formation and adaptation of the network and the promotion of multilateral interaction through coordination and mediation in the network [24], using monitoring methods and evaluations aimed at learning [25]. Given the interaction between different levels of the system in effective reform efforts, such methods should support a continuous reflection of the microposition of innovation networks and their goals compared to systemic capabilities and macro-level constraints

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АУЫЛ ШАРУАШЫЛЫҒЫНДАҒЫ ИННОВАЦИЯЛЫҚ ЖҮЙЕЛЕРДІҢ ДАМУЫ: ӘДІСТЕМЕЛІК ТӘСІЛДЕР

Аннотация. Осы мақаланың мақсаты - тиімді инновациялық желілерді енгізу, олардың инновациялық жобаларын іске асыру және ұзақ мерзімді іске асыру үшін қолайлы өзгерістерді енгізу стратегиясын

калыптастыру. Іс жүзінде жаңа құс фабрикасын құру мен технологиялық жетістіктерге қол жеткізу үшін жеке фермалар арасындағы ынтымақтастықтың жаңа жолдары туралы ұйымдастырушылық инновациялық траекториямен байланысты мысалдарға негізделген әдісті пайдалану тиімді реформаның технологиялық инновациялар траекториясы бойынша талданады. Нәтижелер ауыл шаруашылығындағы инновациялық жүйелердің күрделілік тұрғысынан туындайтын идеяны растайды, инновациялық желілер мен олардың арасындағы өзара әрекеттестік тек белгілі бір дәрежемен ғана шектелетіндігін көрсетеді.

Түйін сөздер: ауыл шаруашылығындағы инновациялық жүйелер, ауыл шаруашылығындағы инновациялық басқару, ауыл шаруашылық инновациялық жүйелерің басқарудағы әдіснамалық тәсілдер.

УДК 33:2964

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РАЗВИТИЕ СЕЛЬСКОХОЗЯЙСТВЕННЫХ ИННОВАЦИОННЫХ СИСТЕМ: МЕТОДИЧЕСКИЕ ПОДХОДЫ

Аннотация. Данная статья посвящена изучению эффективного менеджмента в развитии инновационных процессов АПК: стратегии, которые внедряют инновационные процессы для создания про инновационных настроений, с целью создания и реализации долгосрочных инновационных проектов. Методологический аспект исследования основан на изучении эффективных мероприятий по реформированию инновационных систем в АПК и анализе траектории развития технологических инноваций, связанных с внедрением новой системы управления в АПК.

Ключевые слова: инновационные системы в АПК, инновационное управление в АПК, методологические подходы управления инновационными системами в АПК.

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