Essay

Communication process, extension and adoption of technologies

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Abstract

This document addresses communication issues, as the basis for initiating an extension process, to achieve the ultimate goal of the adoption and management of innovation. These concepts are approached from an institutional perspective which denotes the transition from a vertical vision to a more participatory vision where the actors involved in bringing development to the rural environment take into account the conditions of the final recipients. The three concepts are closely linked in such a way that one cannot conceive that one is detached from the other and the final result must be the innovation of both components and processes.

Keywords: communication, extension, technology adoption.

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Introduction

Communication is a work tool in the agricultural sector, where capturing the attention of a person, a group or an entire community is a complex task. To get into the mood and taste of a particular person or group, the person who wants to sell an idea, a product or a service should plan a communication strategy to achieve its goal; that is, the interested party that wants to enter that circle of people, understand, communities, groups of producers or livestock farmers. From the outskirts of communication such is the case of Aristotelian rhetoric where "...Someone says something, through a medium and someone captures it"... and all with a purpose, to manage innovation so that existing knowledge is used by the potential users, for that reason it is necessary that the new extension workers or the modern extension worker have different tools to perform their work in a better way. The document contains the definition of the communication process; the extension process in Mexico and the adoption process. In this paper the concept of farmer, farmer, producer will be treated indistinctly, although there are differences due to market access, to technologies in the case of the latter and to the destination of production between the first and the second.

Communication process

The word communication comes from the latin "comunis", means to communicate, and according to the Spanish Royal Academy of the Language, means to transmit signals through a common code to the transmitter and the receiver. According to this definition, communication should be understood as the action of communicating, of establishing a community with someone, of sharing information, ideas, concepts and attitudes. Another definition mentions that communication is the mechanism through which interaction is possible and, consequently, reciprocal influences, it is also through the various forms of communication that are known and common ideas, concerns, feelings, beliefs and other sociocultural features of the members of society (Vejarano *et al*., 1982).

The inter-institutional extension group of Mexico (GIE) replaced the term of communication as the exchange of knowledge between academics and farmers or the different types of producers (GIE, 2015). For this, effective communication occurs when the sender and the receiver -given that this normally has a different perception of who sends the information- are in the same tuning, that is, they understand what one is saying and the other answers about the topic under discussion. However, there is noise, distortion or interference, which are those obstacles that may be deliberate or circumstantial, such as the environment, mechanical, electronic, etc., one or more elements as a whole generally affect negatively the clarity, fidelity and efficiency of our messages, distorting them.

A more complex process than a communication, exchange of knowledge or capacity building through non-formal education, are the processes of agricultural extension. Which despite government efforts to be the producers who pay for the process, has not been achieved, so they have operated with public resources and this has prevailed to date. The local government plays an important role in economic development and, given its character as a public good, justifies the investment made in such services (Anderson and Gershon, 2004).

For Cash (2001), agricultural extension systems have two common challenges: linking science to decision-making (horizontal), and science and decision-making at different levels of operation (vertical), in this regard Cadena (1995).), studied decision making in producers of the Sierra Madre of Chiapas and found that: if the producers obtain the complete information, without distortion, then the reasoning processes come into play to make a decision in this case to accept the innovation or modify it , later it is translated into an action, this is reflected in the work that the producer performs in his plot or in his farm (Díaz, 1971). On the other hand, Maier (1980), mentions that people can support certain decisions because they suit their circumstances, because they like it, because it has the backing of those who must carry it out, or for other reasons.

It is considered that an effective decision will be the one that produces the best desired results, the one that causes less collateral effects, has low cost and a minimum effort, as well as that the side effects are the most convenient to the interests of the person who made the decision. This concept is part of the process of changes considered in community or individual development. The concept lends itself to different interpretations, of which the psychological, economic and political stand out. In all three cases who makes the decision is a rational being that after analyzing the possible alternatives for the solution of a problem situation, selects those that present better advantages in the elimination of the problem, in terms of human communication is called "the receiver".

The decision-making process is constituted in three stages, which start from the deliberation of the problem, then the decision is made and finally the decision taken is evaluated. The first stage begins when there is a need in the individual or group to make a decision, a situation that arises as a consequence of having received new information during the development of a specific activity. The second stage occurs when the person or group has analyzed the possible alternatives for the solution of the problem and decides eventually to select the one that meets their needs. The third stage is evaluation, if the results of the decision taken are negative, the individual will try to reject that decision and begin to analyze other alternatives, (Edwards, 1977, cited by Cadena, 1995).

Returning to what was mentioned by Cash (2001), the first challenge is related to a linear approach associated with the perspective of technological change (Stoneman and Diederen, 1994), while the second has a greater relationship with technological innovation under an orientation than Lundvall (2011) called the innovation system. For this, Reynolds *et al*. (2012) mention that it is necessary to close the gaps between agricultural research and the needs of rural communities. For this, within the agricultural extension system there are intermediary organizations whose main objective is to maintain links that generate benefits between producers and users of knowledge.

Based on the form of operation of those involved and the type of innovation, other terms are known to refer to the process of mediation of knowledge, among which are: intermediaries of innovation (Howells, 2006; Klerkx *et al*., 2009), innovation intermediary organizations (Tura and Bishop 2011; Dutrénit *et al*., 2012), open innovation intermediaries (Alexander and Martín, 2013; Hallerstede, 2013), innovation intermediaries in open collaboration or crowdsourcing (Silva and Ramos, 2011; Billington and Davidson, 2013), grassroots intermediaries (Hargreaves *et al*., 2013), collateral organizations (Cash, 2001) or simply intermediaries (Peng *et al*., 2014).

Regarding the concept of innovation, the COTEC Foundation (2006) and taken up by Aguilar *et al*., (2010); (Roldan, 2013), they define it as any change based on knowledge that generates wealth. This wealth is understood as the generation of tangible and intangible satisfactions, which becomes a determining factor for the reduction of the existing social gaps in rural Mexico, where agricultural activity is the main economic activity. The generation of wealth in the national agricultural sector faces three major challenges: 1) improve its competitiveness and productivity; 2) reduce rural poverty; and 3) increase the sustainability of natural resources (Aguilar *et al*., 2010). As of the year 2000, the institutions of the agricultural and higher education sector in Mexico in response to the partial absence of the technical assistance processes, consciously or unconsciously began to plan and operate extension processes, more of demand than of supply of technologies, so from that date on in any extension process the management of innovation is sought.

The extension model applied in Mexico has its origins in the North American model of the "Land Grand Collegue", which is defined by three main characteristics: 1) research and extension by the government through the national institutes of agricultural research, livestock and forestry, and extension agencies; 2) focuses on solving agronomic problems to increase productivity; and 3) in this model, both research institutes and extension agencies were part of a network of companies and parastatal agencies through which credit was offered, crops were purchased and supplies were provided (Aguilar *et al*., 2010; Zavala, 2011). However, this extension model in Mexico has presented changes in its orientation. At first, the focus was corporate, to be subsequently implemented under a free demand scheme, concluding with the creation of a professional services market (Aguilar, *et al*., 2010).

However, for McMahon *et al*., (2011), they point out the total absence of a national extension system, even though all the elements necessary for its formation exist, official sources of the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) of the Government of Mexico indicates the existence of a register of 25 thousand extension agents, without them being occupied by the State. Freire (1973), attributes the low impact of extension systems to the naive vision of reality, and in the most common case, to a clear sense of superiority, of domination, with which professional service providers face the peasants, who are inserted in a traditional agrarian structure.

On the other hand, Engel (2004) attributes it to five characteristics of current extensionism: 1) linear character widely surpassed by participatory approaches operationalized in Mexico; 2) contempt for non-scientific knowledge; 3) lack of orientation towards the demands of producers and the demands of the market; 4) paternalistic approach; and 5) attention to the producer individually. This approach is completely overcome with the participatory methods promoted by the Non-Governmental Organizations (NGOs), Higher Education Institutions and public research institutions of the Mexican Government.

The processes of rural extension have presented a series of inconsistencies, among which the unidisciplinarity of the method stands out, to the providers of professional services (PSP) they are hired for a specific rural sector and the components or structures of the rural extension system. the most generalized is the training and demonstration in producers' fields, in which technologies are exhibited, generate demands and validate technological solutions, which introduces a technical element and rigorous control that guarantees the result of the technologies in the productive processes to the be taken.

In Mexico, this demonstrative component has received different denominations in the various extension initiatives such as: demonstration plot (Castro, 2002, Martínez and Sagastume, 2005, Sánchez, 2007), technological showcase (De la Garza, 2005, Cadena *et al*., 2009, Deschamps and Escamilla, 2010), model ranch (Aguilar *et al*., 2003), field schools (Guevara *et al*., 2003, Lopez *et al*., 2008, FAO, 2013, Gallagher (2003), Morales and Galomo (2006), Morales (2007), Morales (2008), Cadena *et al*., (2009), Cadena *et al*. (2013), Cadena *et al*., (2015), Cadena (2016) and Morales *et al*., (2016), peasant school (Mata *et al*., 2007), producer experimenter (Villarreal, 2000) and recently demonstrative module (CIMMYT, 2013).

The development of the rural sector in Mexico has been the subject of agricultural policies to generate employment, improve productivity and raise the standard of living of families. Since the 1940s, regional development programs have been planned (Miler, 1975, Committee on Agriculture, 1996, OECD, 1997, Barkin *et al*., 1982, PESA, 2006, Herrera, 2009). These aims to take advantage of natural resources, improve the productivity of the countryside and reduce the poverty of the rural population in the regions of the country. However, aspects such as poverty prevail and increase (Commission of Agriculture, 1996, Millennium Summit of the UN, 2000 cited by Belik, 2004, FAO, 2006), so much so that in Mexico data from CONEVAL (2011) indicate that, of the 120 million Mexicans, 51% are poor and of these, 27 million are poor and marginalized.

The agricultural and forestry research, as well as the application of its results, are basic to boost the economic growth of the country. The National Institute of Forestry, Agriculture and Livestock Research (INIFAP) has generated innovations to increase the yield of crops per unit area, which have been adopted by producers of the agricultural sector, has also made the development of skills from the technologies both in technicians, or producers; however, they have forgotten or have not been able to comply with accuracy, the generation of value added to primary products and market plans to generate higher revenues and contribute to the management of innovation (Cadena *et al*., 2013).

The INIFAP has developed since its inception its own transfer strategy to bring the technologies and knowledge to the users of the primary sector in most of the time. These range from the green revolution type model to the generation of knowledge in order to contribute to food sovereignty and the supply of industry. Later, the extension system was in charge and it was understood that once it was made available to the producers, because it was superior to the technology used by them, it was used. The main shortcoming of this model is that the generators and promoters anticipated that the producers had the same productive, economic, social and cultural conditions, with which, by demonstrating the technologies or making them available to the producers, by this simple fact, all used it or incorporated it into their productive system (Cadena *et al*., 2013).

In the decade of the 80's, an attempt was made to change the productivist model by a transfer-extension scheme whose basis was the communication process, which started from the assumption that, in any transfer process, it should have an individualized treatment in each of the stage or elements that make up the communication model. However, this scheme did not work because of the powers of the INIFAP, which the State gave it was not precisely to promote extension, but rather to be the source of knowledge where PSPs were fed back and it was not until the year 2000, where the INIFAP, whose mandate, among other things, said that through research, contribute to the promotion of sustainable development and contribute to innovation..., it is in this part where the processes to encourage extension by a research institution.

Extension process in Mexico

Rural extension can be conceived in different ways, either from a theoretical or practical point of view (Bunting, 1986). According to Ardilla (2010), the extension may have the characteristic of being a public, private or semi-public good, this depends on the population to which the service is being provided. According to Freire (1973), this concept encompasses actions that transform the peasant into a thing, objects of development plans, denying it, as well as the subject of transformation of the world, something that in the sexennium of 2012-2108, the SAGARPA, in The New Integral Extension of the State, has considered the producers as part of decision making and primarily as a person, rather than as an economic agent, seeks to promote innovation and technological development and develops capabilities.

According to Dominic (2012), the extension must adapt to the profile of the production units; in which, due to its complex nature (Christoplos, 2010), there are multiple actors (institutions, producers, technicians, intermediaries, among others) integrated in networks (Rendón and Aguilar, 2013). Therefore, extensionism should facilitate the interaction of these actors (Aguirre, 2010), in which the research is aligned with existing demands (García, 2010). Therefore, it is necessary to create conditions that favor rural development more than productivity, in addition to generating collaborative ties in interaction between the different actors (Rodríguez *et al*., 2009).

Currently, extension in Mexico is offered as a service provided by public and private agents and to a lesser extent by educational institutions, whose main function is to transmit knowledge to the producer, in which in that process they can participate in a linear or systematic way. According to Evenson (1994) and Rath (1996), linear vision refers to the process by which the technology produced or generated in one place is applied directly in another; considers in that process the generation, validation, transfer (extension or dissemination) and adoption. This vision includes three actors: 1) researchers, who develop technologies and innovations; 2) extension agents who transfer the message standardized by researchers to farmers or ranchers; and 3) agricultural or livestock producers simply play the role of those who adopt or reject technologies developed by others (Haverkort, 1991).

Although in Mexico, the extension programs are convened in the first months of each school year, the windows for applications are opened in march and it is ruled and operated at the end of the first six months, in such a way that the contracted extension agents come to form their groups in the second semester of the year, on the other hand it is not certain that the PSP, change agents, facilitators, extensionists, have or have the communication resources, participation methods to give assistance technique so that producers can develop the extension processes and then they can incorporate the components or technologies to turn them into an innovation.

Adoption process

Adoption is a series of acts that an individual goes through until the moment they use a novelty, be it an idea or a product. This process consists of five mental stages, which can cover a considerable period of time; for their better identification, they have been assigned the following categories: the first stage is the awareness or knowledge, in all the individuals before adopting a practice or an idea, it must be known what it is about, one becomes aware of its existence when the details are known or not.

The second stage is the interest, an idea or practice can intrigue the individuals, for that reason the questions arise: what is it about?, how does it work?, in this stage there is a general interest. The evaluation is the third stage, the general interest becomes personal interest, mentally the idea or practice is situated in relation to one's own, from this stage several questions arise, how can it be done?, will it result in the particular case?, will it be easy?, what will you get from it? if the idea passes the evaluation test, the subject will be able to test it; normally the evaluation or test is given in a small area. The last stage is the adoption of the idea or practice; if the test stage gave the expected result, it will be able to implement an entire project, this implies a large-scale application (American Association of Agricultural College Editors, 1973).

Aguilar *et al*. (2010), analyzed the extension processes in Mexico, and found that the results are not what are expected after having invested significant sums of money towards the hiring of the PSP, indicate that the adoption process depends not only on the advantages economic, productive, social or management of a technology *per se*, but in accordance with, Ayala (2014), indicate that technologies or methods of transferring knowledge are contextual and therefore adoption is not always the result of a process, but often it is a phenomenon that depends on the observation, intelligence, decision and risk of the producers themselves.

In this regard and in a study conducted in the south-southeast region of Mexico, in marginal areas of The Tuxtlas, Veracruz, it was found that the management of innovations for the economic and social development of the rural productive sector of these areas is a process of high social, institutional and organizational complexity, which requires institutional linkages with decision makers and providers of support and services (Zambada *et al*., 2013). Adoption is a process of appropriation of technology by producers and considers cognitive change as a prerequisite (Leeuwis, 2000).

Different studies carried out by national and international research organizations, such as INIFAP and the International Maize and Wheat Improvement Center (CIMMYT), have found several factors that influence the adoption of agricultural innovations are: cosmopolitanism and contact with institutions of the agricultural sector , contact with distributors of agricultural products, age, schooling, empathy, exposure to the media, income outside the farm (Castillo, 1996), level of training, occupational profile (Rigada and Cuanalo, 2005), available economic resources (Regalado *et al*., 1996), relationship with agents of change or extension agents, local policies, cultivated area. According to Floy *et al*., (1999).

The institutional requirement after the structural reforms of the agricultural sector, caused that the specialists in socioeconomics and the former network of divulgation, were dedicated to the accomplishment of another type of activities, like the proposal of investigation projects in areas where they had not been formed. However, some studies on the adoption of technologies in certain experimental fields of INIFAP have been carried out, such as the series of studies carried out by INIFAP and CIMMYT scientists in the states of Chiapas, Jalisco, Oaxaca and Guerrero, mainly focused on to the conservation of natural resources (Van *et al*., 1992; Van *et al*., 1994; Cadena, 1995; Erenstein and Cadena, 1997; Cadena *et al*., 1997; Erenstein *et al*., 1998; Erenstein, 1999). , in addition to the previous ones, works were also developed with PROFRIJOL and

INIFAP; This is observed in the works of Viana and Villar, 2001 and Villar and Lopez, 2005, on the impact of the bean variety and the adoption of the bean varieties generated by the INIFAP and the Cooperative Regional Bean Program for the Center. America, Mexico and the Caribbean.

On the other hand, INIFAP itself, sometimes with its own financing and in others with external financing sources, managed to do some adoption studies on beans, corn and natural resources, as well as agricultural policy analysis and the emergence of new actors in the agricultural sector (Cadena, 2004). For this Habit (1982), points to the transfer of technology through proper communication is part of a larger process such as extension, which is an interrelated educational activity, through the process of learning-doing, discussion and dialogue, where farmers, farmers, extension workers, technicians and researchers contribute their experiences, points of view and scientific knowledge, learning from each other, in the joint analysis of situations and problems.

Conclusion

The processes of communication, extension and adoption, are interrelated concepts and to achieve an adoption it is necessary, not only that a technology to be transferred is good or that in theory it is superior in several aspects than the technologies used by the producers, but that it is they require that the actors involved have the resources and tools to make them reach the final users of these, in addition to other points such as access to inputs, the risk of incorporating new elements into their production unit or their technological process, therefore that the programs established by the Government of Mexico are timely, that the selection of the PSPs postulated and subsequently contracted have the tools and methods of ad hoc communication to the circumstances of the producers, an interrelation of institutions that support the end users to that the adoption of technologies contribute to true innovation.

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