

# THE INTERNATIONAL JOURNAL OF HUMANITIES & SOCIAL STUDIES

## Diffusion of Agricultural Innovation

**Koffi Jean Marius Boris Kouame**

Ph.D. Student, Department of Geography, University of Ibadan, Ibadan, Nigeria

**C.O. Ikporukpo**

Professor, Department of Geography, University Of Ibadan, Ibadan, Nigeria

### **Abstract:**

*The objective of this paper is to review the literature of the authors on the agricultural diffusion of innovation. Indeed, this paper allows understand the concepts and theories related to agricultural diffusion while bringing a critical contribution. The purpose at the end is to identify the gaps or aspects that some authors have not been able to address and will constitute our likely reflection for the development of science, especially in the field of economic geography.*

*In the literature on the diffusion of agricultural innovation, the authors do not emphasize on the socio-cultural environment that is likely to limit the diffusion of innovation because it is also depends on the social position that occupies its actors within the company as innovation is at a high cost. In addition, they do not explain in depth the underlying motivation of the rural environment face of motivation, which is partly due to financial profitability, because we believe that, the diffusion of innovation must put a surplus on the adopter. Finally, it is important to establish the relationship between innovation and adopter.*

*Agricultural diffusion assumes that if innovation is placed in a cultural combination, it is capable of ensuring a better valorization of work and remunerative outlets such is the goal of an innovation in rural environment. It is in this perspective that at the end of this literature and responding to the inadequacies of the authors, we will seek to understand spatial temporal dynamics of food crops production.*

**Keywords:** Diffusion, agricultural innovation, adoption of innovation, Monte Carlo model

### **1. Introduction**

This paper examines the literature on diffusion of agricultural innovations. The following are analysed:

- The theoretical/ conceptual literature
- The methodological literature
- The empirical literature

After the discourse of the above-named we will end by identifying gaps in knowledge and provide a conclusion.

### **2. The Theoretical / Conceptual Literature**

In this part of our analysis, it is a question of reviewing the literature on concepts or theories related to the diffusion of innovation.

#### *2.1. Theory of Innovation and Its Diffusion According to Rogers*

Innovation and its diffusion according to Rogers (1962) is the decision to use an idea on an ongoing basis. The diffusion of an innovation presents itself as the process of accepting a novelty (an idea, a product or a brand) by a unit (an individual or a firm) operating in a particular social system. Robertson (1971) confirms this definition and notes that diffusion is the use of a new product on an ongoing basis and that it is a commitment rather than a trial purchase. The diffusion of information technologies is one of the most commonly developed in information systems research (Benbasat and Barki 2007, Venkatesh et al., 2007). Several theoretical concepts and theories were developed in psychology and sociology (Venkatesh et al., 2003). These concepts and theories are used to explain the acceptance and use of technologies. Diffusion theory is widely used in the field of technology adoption and dissemination of various innovations. This model is mainly developed to explain the adoption of an innovation within a social group, and can also be applied to adoption behavior at the individual level (Moore and Benbasat, 1991). This theory assumes that the adoption of an innovation by a population is linked to several factors, namely the perception of the attributes of innovation, the type of decision (the voluntary use of innovation leads to easier adoption), The communication channel (mass communication makes it possible to reach a larger group of individuals), the social system (norms and values favorable to innovation and the cohesion of the social group will have a positive influence on the " Adoption) and finally the agent of change (adoption will be easier if an agent of change actively promotes it). As such, for Rogers (1995), the attributes of innovation refer to individual perceptions, i.e. relative advantage (perception of adoption benefits), compatibility (demonstrate Compatibility with existing values), complexity (easy to use and easy to experiment), testability, and observability (rapid visibility of results). Moore (1987) was one of the first authors to propose a model based on the diffusion theory of innovation to explain the

acceptance of technology at the user level. The results of his study confirm the influence of compatibility, relative advantage and complexity on the adoption leading to its diffusion. Another study by Moore and Benbasat (1991) also applied the Rogers theory (1995) to study the individual determinants of adoption by adding the concept of image to it. Some studies have confirmed in particular relative advantage, complexity and compatibility as factors influencing the spread of mobile technologies. In one of these studies, Nor and Pearson (2007) tested a model based on the theory of diffusion of innovation by adding confidence. To identify the individual determinants of the spread of Internet Banking in Malaysia, the study confirms that trust, relative advantage and trial opportunity have significant effects on attitude towards Internet banking. This last variable significantly affects the intention of using this technology. Therefore, Eriksson et al (2008) studied the adoption of banking services on the Internet in Estonia based on the diffusion theory of innovation. In the adoption and spread of mobile banking, Lin (2011) confirms the influence of three attributes of innovation (relative advantage, ease of use and compatibility) and cognitive trust (perceived competence and integrity) on the adoption attitude of mobile banking which in turn influences the intention of adoption. Other theories have been developed as part of the diffusion of innovation. It is about explaining and predicting the behavior of individuals in the face of innovation.

In the literature on the diffusion of agricultural innovation, the authors do not emphasize on the socio-cultural environment that is likely to limit the diffusion of innovation because it also depends on the social position that occupies its actors within the company as innovation is at a high cost. This is why we believe that the authors should focus on the cost of the innovation and strategies of diffusing the innovation in rural areas.

Again, they do not explain in depth the underlying motivation of the rural environment in the face of motivation, which is partly due to financial profitability, because we believe that, the diffusion of innovation must put a surplus on the adopter. It is for this reason that it is important to establish the relationship between innovation and adopter.

#### 2.1.1. Diffusion Model According to Hägerstrand

It is an important model for geographers because it illustrates the gradual adoption of an innovation in time and space. It encompasses a set of processes that describe and explain several phenomena of displacement or circulation in the spatio-temporal continuum. Two types of diffusion can be recognized: on the one hand, diffusion by expansion or adoption of an innovation. It is done by an increasing number of people in time; On the other hand, dissemination by relocation, where people move from one place to another, so that the number of adoptions does not necessarily increase. The best-known diffusion model in geography is that in which the two processes are involved: the propagation of innovation and its adoption. In this diffusion model, Hägerstrand distinguishes four phases in the diffusion of an innovation. The first phase is characterized by the diffusion of innovation according to the geographical distance (metric or non-metric distance) in an area where innovation is present in certain places. The second phase is where there is dispersion of innovation in the more and more remote areas. The third is characterized by a phase where disparities between places are less and less asserted. The fourth is where the adoption of innovation is complete and complete. In this model of diffusion of innovation, time is of paramount importance as well as the notion of neighborhood through the process of contagion.

In this model the author does not focus on people who are likely to spread the innovation. For space and time are fundamental elements for the diffusion of an innovation. Despite this, we also think that it is man who is the heart of this process, and it is necessary to emphasize the behavior and the capacity of man to diffuse an innovation.

#### 2.1.2. Theory of Planned Behavior

The Theory of Planned Behavior (TPB) states that an individual's behavioral beliefs, normative beliefs and control beliefs respectively determine his/her attitude towards a given behavior, subjective norm, and perceived behavioral control, which collectively influence the behavioral intention and actual behavior of the individual when participatory decisions in an action are voluntary and under an individual's control. The theory of planned behavior of Ajzen (1991) attempts to show the role of variables limiting individual freedom in the performance of a desired behavior. In this sense, the individual may intend to behave but some facilitating conditions are also required, but not necessarily at his disposal. This theory is widely used in information system research to examine the effect of different variables on behavior towards innovations and information and communication technologies (Rogers, 1983, Mathieson, 1991, Moore and Benbasat 1991, Taylor and Todd 1995). Specifically, on the adoption of mobile banking, Brown et al. (2003) combined the Theory of Planned Behavior and the theory of innovation diffusion to identify the factors that influence the adoption of mobile banking in South Africa. Their model shows that the perceived benefit, testing potential of mobile banking and perceived risk have significant effects on the adoption of mobile banking.

Still today existing scholarly communication practices largely happened within the circle of the researcher and scientists. The research to application or knowledge to decision pathway tend to be linear in that new finding and ideas flow from the research community to the agricultural community via same intermediary, which are often extension professionals or department. When implemented properly, studies have shown the economics (Davis, 2008; Marsh, Pannell, and Linder, 2000). The fact remains that in such a linear model of knowledge of diffusion, the research community largely operate in isolation and divorced from the need and priority of the farming community.

Although there is non-research knowledge that is often communicated to the farmer, when it comes to scientific knowledge.

One cannot speak of diffusion of innovation without citing Rogers, Hargestrang and Hoffmann. Drawing on his theory of 1962, Rogers (1995) and Hoffman (2005) adds the time variable. For these authors, innovation must take time

into account. However, these authors do not tell us clearly how long an innovation can spread, how is it disseminated? Time frame for innovation to be diffuse in space.

### 3. The Methodological Literature

This part of our study gives an overview of the methodological literature on the diffusion of agricultural innovation. It will be based on three methodological approaches, namely the 'subject' approach and the 'object' approach, the Monte Carlo approach and the phenomenological analysis.

#### 3.1. 'Subject' Approach and 'Object' Approach

According to Cheikho (2015), there are two main approaches to collecting data on firms' innovations: the 'subject' approach that starts from the behavior and innovation activities of the firm as a whole, Object 'which is centered on the number and characteristics of innovations considered individually. Indeed, the 'subject' approach starts from the innovative attitudes and activities of the firm as a whole. The aim is to determine the factors influencing the firm's innovative behavior (strategies, incentives and obstacles to innovation) and the scope of the various innovation activities, and above all to get an idea of the outputs and of the effects of innovation. Surveys of this kind are designed to be representative of each industry as a whole, so that after extrapolation of gross results it is possible to make comparisons between industries. The second approach consists of collecting data on specific innovations (usually a 'significant innovation' of one kind or another or the main innovation of a firm): this is the 'object'. Starting with a list of successful innovations often based on expert assessments or a list of new products advertised in trade journals. The objective is to collect a number of descriptive, quantitative and qualitative data about a given innovation at the same time as data are sought about the firm. However, there is still paucity of information on spatio-temporal in the factors influencing the farm's innovative behavior and the scope of the various innovation activities.

##### 3.1.1. The Sample Survey

In most cases, according to Cheikho (2015), innovation surveys are sample surveys of random samples. The literature suggests a wide variety of sampling techniques, such as simple random sampling techniques, stratification techniques, or cluster sampling techniques. In the past, surveys based on stratified samples were found to provide reliable results. If stratification techniques are used, certain general rules should be observed with regard to the selection of stratification criteria. In principle, stratification of the population should lead to strata as homogeneous as possible in view of the phenomenon in question, i.e. the strata of units used for innovation surveys should consist of units as similar as possible. At least as far as their innovation or non-innovation activities are concerned. It is now well known that the innovation activities of units belonging to different industries and sizes differ significantly in general. It is therefore recommended that the stratification of the random sample used for an innovation survey be based on the size and principal activity of the units. The size of the units should be measured by the number of personnel. To ensure high accuracy, the sampling rate should not be the same for all strata. It is generally recommended that the sampling rate of a stratum be higher as the number of its units in the surveyed population is smaller and that the population of the stratum is more heterogeneous. Sampling rates should be as high as 100 per cent, for example in strata with few units, as might be the case for strata with large units in certain industries (or regions). Another factor to be considered when setting the various sampling rates is the response propensity observed in the strata. Examples of strata in which the propensity to respond may be relatively low are those made up of small units that may not be very familiar with the concept of innovation. To obtain information on the population subject to the survey, the results of the sample surveys must be extrapolated. There are various methods of extrapolating the results obtained by sampling. The simplest is the free extrapolation technique, in which the different results are weighted by the inverse of the sampling rates applied to the units surveyed (extrapolation factors). If the survey is based on a stratified sample, the free extrapolation technique should be applied separately to each stratum, especially when sampling rates are different across strata. The extrapolation factors can be modified in the case where the non-response rate for the unit exceeds a certain threshold. Extrapolation techniques are applied to both quantitative and qualitative variables, but in different ways. In the case of quantitative variables, the observed values can be weighted directly, whereas in the case of qualitative variables, the frequencies must be calculated.

#### 3.2. Monte Carlo Approach According to HÄGERSTRAND

According to Daudé (2002), Hägerstrand introduced a new methodology in the field of geography, that of simulation using a Monte Carlo procedure. Indeed, it allows to generate results and forms observable at an aggregated level from the modeling of the individual behaviors. According to T. Hägerstrand (1965), diffusion must be considered as one of the essential phenomena of geography because it is often the result of some universal processes. Indeed, for an innovation to spread in space, to be transmitted from person to person, there must exist mechanisms of contacts that it is essential to identify. Considering the individual's point of view, these contact mechanisms, or communication channels, are the reflection of the relational networks of each agent likely to adopt an innovation. The information that is the source of the diffusion takes the form of messages, whether they come from the media (radio, television, newspapers etc.) or from individuals who have already adopted the innovation. Communication channels can be analyzed as networks, with arcs and nodes. Arcs represent the links between individuals, which can be measured in physical, economic, social, etc. distance, the nodes representing individuals and their ability to react to information. The mechanisms of diffusion are thus connected at the level of the individual, both micro and macro-scale (Hägerstrand 1965). The Monte Carlo random

procedure consists in approaching the solution of a mathematical or physical problem. This table is in the form of a sequence of digits between 0 and 9 (assimilable to a draw with reset) that can be read from left to right, top to bottom, bottom to top, right to left, diagonally. The numbers can be read separately, in groups of 2, 3... n, continuously or by hops, from any point of entry into the table. It is therefore necessary to adopt a rule of reading before beginning to read the tables and to respect this rule throughout the simulation. This procedure is used to locate individuals who receive the information or to pass the innovation on to an individual once it has become aware of its existence. This method is, according to Hågerstrand (1965), likely to represent at best what happens in reality and makes it possible to free oneself from assumptions that are certainly realistic but which would increase the procedure. Thus, the time interval between the appearance of an innovation and its acceptance is considered representative of the evolution of the behavior of the individuals, an interval of time that evolves at random for each individual. The living space of individuals is materialized by a grid decomposed into  $n \times n$  cells. This space will be in turn isotropic, a simple support on which individuals act without spatial constraint, and heterogeneous, space constraining the behavior of individuals through effects of distance and barriers.

### 3.3. Phenomenological Analysis

This approach is entirely appropriate for the pursuit of our objectives as it focuses on phenomena as experienced and perceived by research participants. Indeed, this method requires describing a phenomenon as experienced and perceived by the participants (Creswell, 2007; Saulnier, 2004). Also, according to Creswell (2007), the phenomenological approach is appropriate for representational studies, because these represent the understanding of a phenomenon. Phenomenology is a methodological principle whose starting point is a return to things themselves (Bachelard and Joshi, 1986; Mucchielli, 1991; Seron, 2001), that is, a return to the original experience of Subject and its corollary, the world as it is lived (Creswell, 2007). In addition, she systematically studies experiential facts as experienced concretely and personally by the subject as an object. The phenomenological method requires, first of all, a careful and systematic description of what is perceived in the lived experience and, secondly, it aims at identifying and elucidating the genesis of its meaning (Bachelard 1986, Creswell, 2007; Mucchielli, 1991).

## 4. The Empirical Literature

It consists of reading a set of articles, journals, dissertations and theses in line with our concerns. These investigations enabled us to organize our work around the agricultural innovation, adoption of innovation and diffusion.

### 4.1. Agricultural Innovation

According to Muchnik (1998), the innovation can be defined as the practical application or the appropriation of an invention by the producers. But, in the agricultural sector, the innovation is perceived as the introduction of a new husbandry. Sometimes, the innovation represents a modification of a traditional practice, more rarely the adoption of a new socio-economic behavior (Chantran, 1972). As for Adams (1982), the innovation is like a new idea, a practical method or a technique making it possible to increase in a durable way the productivity and the agricultural income. This design corresponds to the perception which the farmers have of the innovation insofar as they seek with COM to take how the innovation will be widespread. Indeed, the rural medium is the place indicated for the production and the agricultural development. It is rightly that (Engel quoted Gueye, 2008) thinks that the innovation in rural medium is very often the product of a social interaction which results from an individual and collective reflection in order to improve a given situation. It returns to the process by which an individual or a group designs and applies new elements to achieve a given goal since, Rogers (1962) thinks that the innovation is "an idea perceived like news by the individual". It is according to FIDA'S (2013), "a process which adds value or brings a solution to a problem in a new way". Like any process, the innovation is done by stages. To know, first, there is the knowledge (information). This stage occurs when an individual or a group of individuals is exposed to the existence of the innovation and gains a certain comprehension of his operation. Secondly, there is the persuasion which occurs when an individual forges a favorable attitude towards the innovation. The third stage is the decision. It occurs when an individual engages in activities which lead to a choice to adopt or to reject the innovation. As for the fourth stage, it is the place of execution (test), which occurs when an individual puts an innovation to use and finally, the fifth is the confirmation. It arrives when an individual seeks a reinforcement compared to a decision which is already made. In this case, the individual can modify a former decision if it is exposed to conflict messages concerning the innovation. At the end of this process, there are the real adoptions or the practical application of the innovation if the individual continues to use the innovation (Fliegel, 1993; Rogers, 2003; Valente and Rogers, 1995). For better including/understanding the innovation, it is significant to go back to Schumpeter (1947) first half of the 20th century. Schumpeter adopted a narrow design of the innovation which is today considered too restrictive. Thus, one can define in a broader and more suitable way the innovation as being the application of resources and discoveries technological, institutional and human with processes of production leading to new practices, new products and walked, new institutions and organizations with the reinforced effectiveness. This effectiveness must be in all the fields in which one is because the innovation supposed is brought by an added value. In the case of the agricultural innovations, Chambers et al. (1994) show that the farmers do not think in terms of adoption or rejection as the researchers do. The peasant seeks to take note of this innovation, his functionalities, his advantages and disadvantages, then forms his own opinion of the new idea and determines the attitude to observe: either adoption, or the rejection. Indeed, this is why Rogers (1995) identifies two types of suspension to knowing: the suspension of disillusion: a decision to reject an idea because of dissatisfaction with regard to its execution and the suspension of replacement: a decision to reject an idea so as to adopt

the best. The profits of the innovation, the risk to be associated to him are considered among the major factors which influence the decision of the producers. For example, more than one object gives us pleasure and satisfies us, the more we are ready to invest time and money to acquire it. The farmer, who decides to adopt a new technique, chooses an innovation according to design features and of the state of the environment according to his selection criteria. In fact, an innovation will be adopted only when the individuals concerned are convinced, considering information they have, of the interest or of the profits which they can draw according to the traditional economic theory (Jevons 1875, Menger 1892, Walras 1874), the rationality of the individual is determined according to his only interest through the invisible hand (Smith, 1776). The adoption, on behalf of these individuals, is not any more the result of a social process to be strictly accurate, but a consequence of their particular, intrinsic characteristics: taste for the innovation, owing to the fact that they were taken as target of a particular marketing strategy or aversion with the risk (Steyer and Zimmermann, 2004). Most of the time, the innovation is born from a reaction to face a problem. To have direction, it must be useful to that or that which implements it (Delmas, 2004). Like AOPP (2013) says it, your country innovation is not something again to solve a problem or to benefit from an opportunity. That can be a tool, a material, a variety, an approach, a service, the installation of an organization which must answer an economic problem, social, organizational which relates to the peasants or the organizations. Like an innovation, the news (idea, product or approach) must have a positive value for their users and to bring solutions to countered particular inters or problems (FIDA, 2013). In the same direction, for Rezsóhazy (1985) the innovation is the introduction of techniques, in ways of making, ideas, knowledge, new behaviors which modify the way of life or increase the standard of living or answer interrogations or solve of the problems posed by the community. It is further saying than the innovation does not return inevitably to a new creation, but can also relate to the amelioration of a technology or an existing process (Gueye, 2008). However, what constitutes an innovation for an individual or a group cannot be for another. Each innovation is thus context-specific. Indeed, an innovation can exist elsewhere but it constitutes an innovation in a medium which discovers it for the first time and adapts it to its realities (Gueye, 2008). In its definition the read broad, the agricultural innovation corresponds to the introduction of "something" again locally (to the level of an exploitation, of a country organization), but which can sometimes exist elsewhere in the world. This "something" covers with very diverse realities. That can be: 1) of new cultivation methods, 2) of new seeds, tools for culture, 3) in new ways of storing, of processing, of marketing the products of agricultural and rural activities, 4) in new ways of communicating, of informing themselves in the agricultural medium (Delmas, 2004). For this reason, the principal characteristics of the agricultural innovation are: 1) to be a new process for the innovator or the community, 2) to bring a value added to an existing innovation, 3) to try to answer a local problem, 4) it must rise from a country initiative and 5) it is based on the local knowledge by developing it. However as had notified we, the innovation perceived in term of process of integration of a new fact can have or with limits. Indeed, these constraints or resistances like says it Hägerstrand can appear when the conditions economic, social, technical... slow down or do not allow the adoption of the innovation. In this case, which are the conditions of adoption or rejection of the innovation?

#### 4.2. Adoption of Innovation

The adoption of the innovation concerns a rational behavior of the agricultural producer who grants more preferably since it gets the most utility to him. With this last. Performs a choice between the various innovations. Justifying, Negatu and Parikh (1999) use a model of simultaneous equations combining the approaches ordered to examine the decision and the adoption of a new variety (the corn). Indeed, the authors show that the size of the household and the income explain the adoption of the new variety. According to them, the variety is perceived like demanding out of fertilizers and in travail, less the level of its adoption is high. This is why, Savadogo *et al.* (1998) show that the nonagricultural incomes and the size of the agricultural household have a positive impact on the probability of adoption of the animal haulage in the zones of climates Guinean and soudano-sahelien of Burkina-Faso. They conclude that the use of the animal haulage improves the marginal productivity of the factor work and the agricultural outputs, and that the simultaneous recourse with the animal haulage and manures induce the best of results. Another example is that of Madagascar. Indeed, Randrianarisoa and Minten (2003) insist on the adoption of manures. For these authors, different factors from production, in particular good a master of the doubled water of a good knowledge of the innovation allow its adoption on behalf of the farmers. However, it is not however which that is possible on behalf of the farmers because the latter are much afraid of the innovation and perceive it in the form of risk. Moreover, Harvey and McMeekin (2005) think that it is necessary to carry out the reorganization of the systems of research to make our progress science. i.e., it must be adapted and to take account of the local situations. The risk was regarded a long time as the principal factor which reduces the rate of adoption of a new technology (Rosenberg 1976; Lindner 1987). This is why, Marra *et al.* (2003) proposes to distinguish various elements from risk in the decision-making process like the training (*learning*) and the perception of the producers of the distribution of the probabilities present and future of profits and losses waited of technology, covariance of the profits between the old one and the new technology and the times of return on investment of technology. Shapiro *et al.* (1992) conclude that adopting them could have a behavioral sedentary than not- adopting them. And, finally, the perception of the risk is a factor more determinant than the real attitude vis-a-vis the risk. These elements show well the difficulties with certain process of adoption. For not-adopting, the example at summer taken on the peasants Sahelians. Indeed, Malton and Spencer (1984), quoted by Lamers and Feil, (1997) affirm however that the weak rate of adoption of innovations by the peasants is explained partly by the lack of comprehension institutions and of research vis-a-vis the problems of the peasants. On the other hand, the different show the lack of information and sensitizing of the peasants to the innovation. According to Feder and coll. (1985), several organizations of agricultural research explain the weak rate of adoption of innovations by the failing the performances of the laws of the market, like by the existence of inappropriate

policies agricultural. For adopting, the innovation being perceived like a new fact, an added value as we had shown in literature review will lead to the diffusion of this innovation.

#### 4.3. Diffusion

The concept of diffusion made the object of several definitions. Samatana (1980) thinks that the diffusion is the advance of the innovation since the system source until the system receiver. As for Morvan (1991), it adds a concept i.e., the propagation. Indeed, for him the innovation is the process by which a new idea is propagated. If Barrel and Sabourin (1999) think that the diffusion depends basically on the medium in which it takes place, of the actors and the diffused object. Rogers (1995) will not say if it the opposite for him to develop a theory on the diffusion since 1962. He already conceived it like the process by which an innovation is transmitted to the members of a social system through certain transportation routes for one period of time. This last definition puts forward four elements essential to know: the innovation, channels of communication, time and the social system. To translate the idea of propagation or popularization, Gardner and Rausser (2001) sought to determine the diffusion in terms of penetration of an innovation in his potential market through the definition of a logistic curve of diffusion in time, as well as the velocity measurement of this penetration. The charts were consequently to be centered on the S-curve (Griliches, 1957; Rogers, 1962; Moore, 1991), which distinguishes the phase from growth, that of the maturity of the product and finally, the phase of decline of the product. With each one of these phases correspond to the particular types of adopting.

Various research tasks approaching the aspect of the process of diffusion of technology in the agricultural sectors howed at the beginning, is only one minority of farmers which adopts a given innovation, then it extends thereafter. With through the analysis of the various stages of the process of innovation, it appears that the innovation in its evolution is connected for a purpose "swell of snow". It is by this effect "swell of snow" that the innovation acquires more and more anchoring on the ground generates more and more agreements which could not then be completely called into question. The innovation is thus stabilized gradually. Moore (1991), in particular, brings interesting lighting on the rate/rhythm of adoption of new technologies by the various groups. This author highlights what it indicates by "pit" and which it locates right before the acceptance of the new technology by the early majority. For him, certain innovations cross the pit and pass in the market of mass while making, initially, the conquest of the majority of pragmatic then, naturally the remainder of the potential's users. Others sink in the pit, fault of convincing the early majority; the key of the success being located in the delicate passage enters the visionaries and the pragmatic ones. The last (pragmatic) adopt the innovation. Indeed, for them the diffusion it is the extension in time, it is to simplify and make available a new idea.

#### 4.4. Agricultural Diffusion

In the agricultural field, according to Maunder (1977) the diffusion is a service or a system which, by means of educational processes helps the rural population to improve the agricultural methods and techniques, to increase the productivity and the income, to improve high standard of living and to raise the social and educational standards of the rural life. The idea of origin of the diffusion rested in fact on the need for bringing a help to the peasants for their own good. But in the years 1980, one realized that one could not regard the diffusion anymore only as one help in the interest of the peasants. The agricultural diffusion is also a communicative intervention deployed by an institution to induce a change of behavior with one supposed public or collective utility (Röling, 1988). From this point of view, the agricultural diffusion remains however an action finalized and organized with the will to introduce a new fact into the agricultural medium considered as useful. It is this point of view which is contradictory and creates tensions between what is regarded as useful for the institutions and what is it for the peasants. Giving an answer on this point Leeuwis (2004), proposes a new definition, normative as much as descriptive of the diffusion adapted well to the field realities to the new challenges to which the peasants must face. It is rightly that the author sees it like a series of communicative interventions, mainly because it is seen here like a process. The peasants react to the interventions and these reactions generally generate other communicative interventions. The agricultural diffusion is in fact a dynamic where several actors interact, of which perceptions, the goals and the aspirations can vary. It is about a social process including training, construction, the decision- makings, the negotiation and the reinforcement of capacities (Leeuwis, 2004).

All things considered, the diffusion of the agricultural innovation is comparable with an activity of communication during which information on a new idea is shared between the beforehand informed members and those which were not it. So that this innovation is propagated, it is necessary that there is a confidence between the various actors of this activity. So, some certain ideas take into account the purely rational choice of the producers in the process of transmission of the innovation of research to the producers, others go until considering that the choices concern the imitation. But some is the motivation, there are behaviors with the adoption, but also of the behaviors of refusal are observed.

This empirical study of the literature on the diffusion of agricultural innovation enabled us to understand the authors' views and ideological views on this topic. However, these authors focus on innovation as a creation or introduction of a new fact. This new fact, they say, is likely to provide financial income for farmers or adopters, but they do not tell us how this is possible especially in the agricultural field. Its cost? And especially in what spatial condition is this possible?

When Shumpter (1947) asserts that innovation is supposed to add value, it does not tell us how long this so-called added value will be perceptible and also in what environment. That is why we think that in the literature on the diffusion of agricultural innovation, the authors do not In the literature on the diffusion of agricultural innovation, the authors do not emphasize on the socio-cultural environment that is likely to limit the diffusion of innovation because it is also



depends on the social position that occupies its actors within the company as innovation is at a high cost. This is why we believe that the authors should focus on the cost of the innovation and strategies of diffusing the innovation in rural areas.

Again, they do not explain in depth the underlying motivation of the rural environment in the face of motivation, which is partly due to financial profitability, because we believe that, the diffusion of innovation must put a surplus on the adopter. It is for this reason that it is important to establish the relationship between innovation and adopter.

Agricultural diffusion assumes that if innovation is placed in a cultural combination, it is capable of ensuring a better valorization of work and remunerative outlets such is the goal of an innovation in rural environment.

## 5. Conclusion and Gaps in Knowledge

In this 21st century, agriculture must concern many challenges: to nourish humanity, with an unceasingly increased request coming from the emergent countries like countries in the process of development or from the poor countries; to reduce its environmental print, to take part in the fight against the climatic change and to adapt to it by carrying out the agro- ecological transition. The simultaneity of these challenges requires evolutions; innovations major of the agricultural economics, while keeping in mind that:

- At the end, the consumers are those who express deep respect for the foodstuffs of the various needs on the products themselves, but also on their modes of production (origin, animal wellbeing, impact social and environmental). But ultimately, they want on all occasions of the products which satisfy their needs and sensitivity of the moment, with a requirement raised in term of quality and safety, and that at a keen price.
- With the other end are the peasants or the farmer. For this last, the question of why and how its agricultural production justifies. Indeed, with the question of why, Kouame (2015) supported by Vidogbena (2013), thinks that the world population in constant evolution constitutes a market of consumption. Because, this population should be nourished. Like example, according to the UNDP 2011, the population of West Africa would pass from 301 million inhabitants in 2010 to nearly 737 million inhabitants in 2050. However, how to nourish this population?

Moreover, one attends the climatic problem of variability in our various countries. Indeed, agriculture is disturbed and the peasants do not encircle any more the farming calendar which remains still traditional in certain countries. Vis-a-vis this situation and to avoid the riots of the hunger that West Africa to known in 2008 (Charhon, opt OECD (2013). It is advisable to increase production and the productivity in order to satisfy the needs for the populations (Vidogbena, 2013). That implies the agricultural innovation. The innovation was developed much of your study. However, it is essential to answer these challenges and constitutes the base of an improvement of efficiency and creation of the added value. This is why, Röling (2010) and Lavigne *et al.*, (2004) perceive it like a processes technical and institutional change which is played on the level of the exploitation and higher levels of the system with impact on the productivity, the durability and the reduction of poverty. Its diffusion is a function of the innovation as Rogers (1962) shows it. Indeed, on the level of the complexity of the innovation, we adopt two attitudes which can occur in the farmers or the peasants. On the one hand if the innovation is not complex, the peasants will accept it while on the other hand, if the innovation is complex, one will attend a rejection on behalf of the peasants and that will affect its diffusion.

The field of study of the innovation relating to the agricultural field is vast and just the institutional, political and organizational innovations. It thus includes/understands: (i) material innovations (example: varieties of culture), (ii) institutional, social and organizational innovations (example: the setting in network structured of the producers for a better organization of the distribution system) and, (iii) innovations in terms of knowledge and practices (example: practical and technical farming). For each type of innovation, one can distinguish those endogenous (country innovations) or exogenic (innovations resulting from research, popularization). This design thus does not limit the innovations only to the new discoveries resulting from research. They can relate to the changes related to the mode of organization of the producers, the institutions and the companies. They can also relate to the processes of the changes induced within the communities and those related to the use of technologies or the husbandries already known in the world but not diffused in another area. Concerning each product or practical agricultural, it is the factor of innovation in each case which is most significant. The identification of this factor makes it possible to include/understand the key characteristics of the innovation and the obstacles related to its use in areas. Indeed, the difficult character of the innovation is that an innovation can be a new fact bringing a value added in an area while in the other area this new fact is growing old from where importance to standardize the innovation and its diffusion in the agricultural field.

Many waiting on behalf of the countries are expressed with respect to the contribution which can bring sciences and technologies in the agricultural sector in comparison of the enormous ambitions posted as regards economic growth, of food safety and fight against poverty in general. Even if the system of Research-development knows some instability as regards financing, it should be noted that efforts were authorized by the countries during these three last decades. However, and except the productions of revenue which according to Vidogbena (2013) profiting from innovation on the level of the varieties of production to the hectare, the report often fact is the weak access and use of the agricultural innovations by the majority of the producers who are the agricultural family owners in the food production. With what this situation; is it due in spite of the hopes placed at the agricultural system of innovation in the countries and especially the food production is that intended to nourish the human?

Beyond criticisms often made at the institutions of research and diffusion of agriculture for their weak performance or sometimes even with the peasants for their Passivity or their refusal to innovate, we ask for ourselves the role played by the institutional and political environment in the access and the utilization of the agricultural innovations. With U-beyond performance of the agricultural innovation and level of knowledge which the producers of this one has; the

institutional and political environment also had a role determining in the access and used its results of research and to put means for its diffusion. But the true challenge is of knowing how to create the institutional and political environment favorable to such services of accompaniment in a context of liberalization and globalization where the majority of the States were withdrawn from the sectors of support for the agricultural production like the supply of intrants, the agricultural council, etc. and where the private initiatives are often long in being concretized on the ground. That constitutes at the same time an interpellation for the institutions of research and development (R&D) which should grant a dominating place to analyses presented in the form of message facilitating the decision-making and the action at the level of the political decision makers. These analyses should especially show the interest to set up an inciting environment to invest in the agricultural innovation.

## 6. References

- i. Abate, R. 2012. Crise économique et politique de relance de la production vivrière dans l'espace rural d'Ebolowa II. Université de Yaounde I.
- ii. Adégbola, P. et Adékambi S. A. 2008. Taux et déterminants de l'adoption des variétés améliorées d'igname développées par l'IITA. Rapport d'étude.
- iii. Adekambi, Souleïmane A, Adegbola, Patrice Y and Arouna, A. 2010. Farmers' perception and agricultural technology adoption. The case of botanical extracts and biopesticides in vegetable production in Benin *Contributed Paper presented at the Joint 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa*,
- iv. Adesina, A and Baidu-Forson, J. 1995. Farmers' perception and adoption of new agricultural technology: Evidence from analyses in Burkina Faso and Guinea, West Africa. *Agricultural Economics* 13: 1–9.
- v. Akinola, A and Young, T 1985. An application of the Tobit model in the analysis of agricultural
- vi. innovation adoption processes: A study of cocoa spraying chemicals by Nigerian cocoa farmers. *Oxford Agrarian Studies* 14: 26–51.
- vii. Alston, J. 2010. "The Benefits from Agricultural Research and Development, Innovation, and Productivity Growth", OECD Food, Agriculture and Fisheries Working Papers, No. 31. Paris AOPP, 2013. *Conclusion de la foire Atelier de l'innovation paysanne*, 22 au 26 mars 2004, document provisoire.
- viii. Barbarawejnert, 2002. Integrating models of diffusion of innovations: a conceptual framework *Department of Human Development, G85 Martha Van Rensselaer Hall, Cornell University, Ithaca, New York 14853*
- ix. Bentz, B. 2002. Appuyer les innovations paysannes in: P. Bergeret, et al. (Eds.), *Dialogue avec les producteurs et expérimentations en milieu paysan*, GRET, Paris. pp. 88
- x. Blein, R. 2007. La souveraineté alimentaire en Afrique de l'Ouest: des principes à la réalité».
- xi. Document préparé pour le 1er forum régional sur la souveraineté alimentaire – ROPPA – Novembre 2006; Niamey; CSAO/OCDE; 63p
- xii. Bonnal, P. et Dugue P. 1999. *Mise au point des innovations et des méthodes de conseil aux exploitations agricoles. Leçons d'expérience, atouts et limites des méthodes de recherche utilisées pour le développement de l'agriculture tropicale*. P. Dugue (éd.), Références techno- économiques et conseil aux exploitations agricoles. Actes de l'atelier, 1er septembre 1999, Montpellier, France, CIRAD, 164 p.
- xiii. Chau, K. 1997. Factors affecting the adoption of Open Systems: an exploratory study, *MIS Quarterly*, vol. 21, n°1, pp.1-24.
- xiv. Chianu, J. Vanlauwe, B. Mukalama, J. Adesina, A. and Sanginga, N. 2006. Farmer evaluation of improved soybean varieties being screened in five locations in Kenya: Implications for research and development. *African Journal of Agricultural Research* Vol. 1 (5), pp. 143-150, December 2006.
- xv. Cinthia, P. 2007. La communication dans le processus de vulgarisation d'innovations agroforestières dans la région de Ségou, au Mali l'Université Laval 116p
- xvi. Clarke, R. 1996. A Primer in Diffusion of Innovations Theory. Web source: <http://www.anu.edu.au/people/Roger.Clarke/SOS/InnDiff.html>
- xvii. Claude, C. 1992. Communication et développement agricole: diffusion d'informations ou aide à la construction de connaissances? Etude comparative de deux approches Université Jean- Moulin - LYON
- xviii. Club du Sahel, 2005: Économie familiale et innovation agricole en Afrique de l'ouest: Vers de nouveaux partenariats. *Document de synthèse*.
- xix. David, P. 1969. A contribution to the theory of diffusion, Stanford Center for Research in
- xx. Economic Growth, Memorandum no. 71.
- xxi. David, S and David, Z. 2000. The Agricultural Innovation Process: Research and Technology
- xxii. Adoption in a Changing Agricultural Sector University of California at Berkeley.
- xxiii. Davis, K. 2008. Extension in sub-saharan African: overview and assessment of past cureat models, and future prospects. *Journal of international Agricultural and extension Education*, 15 (3), 15-28
- xxiv. Delmas, P. 2004. Dossier La foire-Atelier de l'innovation paysanne à Ségou (Mali, 22-26 mars 2004. dans Inter-Réseaux, *Grain de sel*, 27 juin 2004.
- xxv. Deslauriers, J-P. 1991. *Recherche qualitative. Guide pratique*. Éditions McGraw-Hill. 18 Montréal.
- xxvi. Devaux, A. 2005. Facilitating innovation for reducing rural poverty in the Andes. Paper presented at the IFAD Innovation Mainstreaming Initiative workshop 'What are the Innovation Challenges for Rural Development?' 15-17 November. Rome: International Fund for Agricultural Development.



- xxvii. Diana, A and Christina, B. 2011. Agricultural innovation for food security and environmental sustainability in the context of the recent economic crisis: Why a gender perspective? Background Paper World Economic and Social Survey.
- xxviii. Dugué, P. Djamé, N. Faure, G. 2015. Dynamiques d'adoption de l'agriculture de conservation
- xxix. dans les exploitations familiales: de la technique aux processus d'innovation. Cah Agric 24: 60-8. doi: 10.1684/agr.2015.0748
- xxx. Dumont, R. 1962. *L'Afrique noire est mal partie*. Collection Esprit Frontière ouverte». Editions du Seuil.
- xxxi. Engel, P. 1995. Facilitating innovation: an action-oriented approach and participatory methodology to improve innovative social practice in agriculture. Wageningen University, Wageningen.
- xxxii. Eric, A. 1999. Re-Thinking the Role of Information in Diffusion Theory: An Historical Analysis with an Empirical Test Iowa State University 75P
- xxxiii. EU SCAR, 2012. Agricultural knowledge and innovation systems in transition – a reflection paper, Brussels.
- xxxiv. EU SCAR, 2011. Sustainable food consumption and production in a resource-constrained world – 3rd SCAR Foresight Exercise, Brussels
- xxxv. FAO, 2011. *The State of Food and Agriculture 2010/2011: Women in Agriculture - Closing the Gender Gap for Development*. Food and Agriculture Organization of the United Nations. Rome.
- xxxvi. FAO, 2010. *The State of Food Insecurity in the World 2010: Addressing Food Insecurity in Protracted Crises*. Food and Agriculture Organization of the United Nations. Rome.
- xxxvii. FAO, 2009. *Investing in food security*. Food and Agriculture Organization of the United Nations. Rome. November.
- xxxviii. FAO, PAM. 2004. *Rapport spécial – Mission FAO/PAM d'évaluation des récoltes et des disponibilités alimentaires en Côte d'Ivoire*.
- xxxix. FAO, 2001. *Étude prospective du secteur forestier en Afrique (FOSA) – Côte d'Ivoire*.  
FAO. 1999. Côte d'Ivoire – Éléments de stratégie nationale de développement de la petite irrigation et plan d'action opérationnel.
- xl. FAO (1998) *Improving Agricultural Extension, A Reference Manual*, Edited by Burton E.
- xli. Swanson Robert P. Bentz and Andrew J. Sofranko, <http://www.fao.org/docrep/W5830E/W5830E00.htm>
- xlii. FAO et Banque Mondiale. 1998. Côte d'Ivoire – Programme de sécurité alimentaire et petite irrigation, Note de stratégie et projet de première phase. Rapport provisionnel. 98/079 CPIVC.
- xliii. FAO, 1996. Stratégie du secteur agricole à l'horizon de 2010.
- xliv. FAO, 1993. *Agricultural extension and women farm workers in the 1980s*. Food and
- xlvi. Agriculture Organization of the United Nations. Rome.
- xlvi. FAO, 1991. Les femmes dans le développement agricole: plan d'action de la FAO, Rome.
- xlvi. FAO, 1983. *Le rôle des femmes dans la production vivrière*, rapport de formation, Rome,
- xlvi. Inades-formation Burundi.
- xlix. Fischer, A. Arnold, A. Gibbs, M. 1996. Information and the Speed of Innovation Adoption
  - i. Gacdj, T. 1978. *L'écoute des silences, les institutions contre l'innovation?* Paris, Union Générales d'Éditions.
  - li. Gershon, F. Richard, E. and David, Z. 1984. Adoption of agricultural innovations in developing countries: a survey Working Paper No. 225 Division of Agricultural Sciences University of California
  - lii. Hall, A. Mytelka, L. and Oyeyinka, B. 2006. *Concepts and guidelines for diagnostic assessments of agricultural innovation capacity*, The Netherlands: Working Paper Series - United Nations University - Maastricht Economic and social Research and training centre on Innovation and Technology
  - liii. Harvey, M. and McMeekin, A. 2005. Brazilian genomics and bioinformatics: Instituting new innovation pathways in a global context. *Economy and Society* 34(4): 634.
  - liv. Harvey, D. 1969. *Explanation in Geography*. The Johns Hopkins University. Edward Arnold Ltd, London .
  - lv. Hausman J & McFadden D, 1984. A specification test for the multinomial logit model. *Econometrica* 52: 1219–40
  - lvi. Heckman, J. Urzua, S. and Vytlacil. E. 2006. *Understanding instrumental variables in models with essential heterogeneity*. Working Paper 12574. <http://www.nber.org/papers/w12574>.
  - lvii. Hoffmann, V. 2006. Knowledge and Innovation Management, Reader, University of Hohenheim, Stuttgart, Germany.
  - lviii. Hoffmann, V. 2005. Rural Communication and Extension, Reader, University of Hohenheim, Stuttgart Germany
  - lix. Hycenth, T. and Al, 2010. Adoption Decision Theories and Conceptual models of Innovations
  - lx. Systems, *CA2Africa Inception Workshop, 2-4 March Nairobi Session 3 Overview of existing modelling approaches*.
  - lxi. Ichaou, M. 2015. Perception et adoption des innovations techniques agricoles dans le bassin cotonnier de Banikoara au Bénin [*Perception and adoption of agricultural technical innovations in the cotton basin of Banikoara in Benin*] *African Journal of Agricultural and Resource Economics* Volume 10 Number 2 pages 87-102
  - lxii. Jean-François, B. Pierre-Marie, B. Guy, F. Stéphane, F. Bruno, L. 2002 Quel avenir pour les agricultures familiales d'Afrique de l'Ouest dans un contexte libéralisé ? Département Territoires, Environnement et Acteurs (TERA) du Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD). CIRAD-TERA, TA 60/15, 73 rue J-F Breton, 34398 Montpellier Cedex 5, France. [www.cirad.fr](http://www.cirad.fr)
  - lxiii. Jean-Pierre, C. Marie-Christine. Cormier-Salem. Mollard, E. 1999. L'innovation en agriculture

- lxiv. *Questions de méthodes et terrains d'observation* Éditions de l'IRD (ex-Orstom) Institut de Recherche pour le Développement Paris 365 p
- lxv. Knickel, K. Tisenkopfs, T. and Peter, S. 2009. *Innovation processes in agriculture and rural development: Results of a crossnational analysis of the situation in seven countries, research gaps and recommendations*, IN-SIGHT - Strengthening Innovation Processes for Growth and Development.
- lxvi. Kouame, B. 2015. Développement du vivrier dans l'ex boucle du cacao : la sous-préfecture de Dimbokro, IGT.
- lxvii. Kriesemer, S. and Grötz, A. 2008. The Adoption and Diffusion of Small-Scale Pond- Aquaculture in Africa with special Reference to Malawi
- lxviii. Laura, G. Jeremias, M and Margaret, K. 2005. A methodology for tracking the "fate" of technological interventions in agriculture Agriculture and Human Values (2006) 23:353–369 \_ Springer 2006 DOI 10.1007/s10460-006-9008-2
- lxx. Leeuwis, C. 2003. Communication for Rural Innovation: Rethinking Agricultural
- lxxi. Leroux, B. 2009. Stratégies, innovations et propriétés spécifiques des agriculteurs biologiques.
- lxxii. Éléments d'analyse sociologique du champ professionnel agrobiologique École des Hautes Études en Sciences Sociales (EHESS Paris) Extension, CTA.
- lxxiii. Linder, J. and Dolly, D. 2012. Extension and outreach : Not a question of if, but how. Journal Of international agricultural and extension Education
- lxxiv. Lindner, R. 1987. Adoption and diffusion of technology: An overview. In: Champ BR, Highly
- lxxv. E & Remenyi JV (eds.), Technological change in post-harvest handling and transportation of grains in the humid tropics. ACIAR proceedings series, 19. Australian Center for International Agricultural Research
- lxxvi. Manage, 2007. *Course 102 Communication and Diffusion of Agricultural Innovations* Post
- lxxvii. Graduate Diploma in Agricultural Extension Management (PGDAEM), Published by National Institute of Agricultural Extension Management, Rajendranagar, India.
- lxxviii. Marco, J. 2015. Scaling agricultural technologies and innovation diffusion. University of Chicago 57P.
- lxxix. Marc, S. Jonne, R. Laurens, K. Lammert, B. 2014. Systems approaches to innovation in crop protection. A systematic literature review for this publication at:  
<https://www.researchgate.net/publication/259223537journalhomepage:www.elsevier.com/locate/cropro>
- lxxx. Mario, M. Daniel, H. 2008. How Change Agents and Social Capital Influence the Adoption of
- lxxxi. Innovations among Small Farmers international food policy research institute 2033 k street, nw washington, dc 20006-1002 USA
- lxxxii. Marsh, S; Pannell, D; and Linder, R. 2000. The impact of agricultural extension on adoption and diffusion of lupins as a new crop in western Australia. Australia journal of experimental agriculture 40 (4): 571-583.
- lxxxiii. Mercer, D. 2004. Adoption of agroforestry innovations in the tropics: A review. *Agroforestry Systems*, 61-62(1-3): 311-328.
- lxxxiv. Meriam, K. and Morana, J. 2011. Théorie de la diffusion de l'innovation de Rogers et traçabilité : application au secteur de la datte tunisienne Vol. 19 – N°1, 2011 Logistique & Management
- lxxxv. Meyer, A. and Goes, J. 1988. Organisational assimilation of innovations: a multilevel contextual analysis, Academy of Management Journal, 31.
- lxxxvi. Morvan, Y. (1991), « Théorie de l'innovation et systèmes productifs », dans *Fondements d'économie industrielle*, 2ème édition.
- lxxxvii. Nagel, J. 1997. Alternative Approaches to Organizing Extension, In; Swanson, B E; Bentz, R
- lxxxviii. P; Sofranko, A J. (eds) *Improving Agricultural Extension, A Reference Manual*, FAO, Rome.
- lxxxix. Ndah, T. 2008. Adoption and Diffusion of Fish Farming in Cameroon, An empirical study carried out in the Centre, Southwest and Northwest Provinces of Cameroon. VDM Verlag Dr. Muller Aktiengesellschaft & Co. KG, Saarbrücken, Germany.
- xc. Nigel, P. 2006. L'innovation: enjeux, contraintes et opportunités pour les ruraux pauvres FIDA
- xc. Ntsama, E. 2007. *Analyse de l'impact de l'innovation sur la productivité agricole : cas du maïs dans la province du centre- Cameroun*, mémoire de DEA-PTCI, Université de Yaoundé 2- Soa, Cameroun
- xcii. OECD, 2010. The OECD Innovation Strategy: Getting a Head Start on Tomorrow. OECD Directorate for Science, Technology and Industry.
- xciii. OECD, 2010. Environment Working Paper No. 16. Environmental Policy Design Characteristics and Technological Innovation: Evidence from Patent Data. By Nick Johnstone, Ivan Haščič and Margarita Kalamova, OECD Environment Directorate. Available at: [www.oecd.org/env/workingpapers](http://www.oecd.org/env/workingpapers)
- xciv. OECD (2010): Challenges for Agricultural Research, Paris.
- xcv. OECD (2005): Governance of Innovation Systems, Vol.1, Paris
- xcvi. Reij, C. 2005. Innovation in Africa: methodology and experience. Paper presented at the IFAD
- xcvii. Innovation Mainstreaming Initiative workshop 'What are the Innovation Challenges for Rural Development?' 15-17 November. Rome: International Fund for Agricultural Development.
- xcviii. Reij, C. and Waters-Bayer, A. (Eds.). 2001. *Farmer Innovation in Africa: A Source of Inspiration for Agricultural Development* London: Earthscan.
- xcix. Röling, N. Ascroft, J and Chege, F. 1976. The diffusion of innovations and the issue of equity in rural development. Communication Research 3: 155–170.
- c. Rogers, E. 2003. Diffusion of innovations, fifth edition. Free Press, New York, U.S.A. Rogers,

- ci. E. 1995. *Diffusion of innovations* (4th ed.). New York: The Free Press.
- cii. Rogers, E. 1983. *Diffusion of innovations* (3rd ed.). New York: The Free Press. Rogers, E. 1962. *Diffusion of innovations*. New York: Free Press
- ciii. Roussy, C. RIDIER, A. CHAIB, K. 2015. Adoption d'innovations par les agriculteurs : rôle des perceptions et des préférences Working Paper SMART – LERECO N°15-03
- civ. Ryan, B. and Gross, N. 1943. *The diffusion of hybrid seed corn in two Iowa communities*. Rural Sociology, 8, 15-24.
- cv. Savadogo, K. Reardon, T. and Petiola, K. 1998. Adoption of improved land use technologies to increase food security in Burkina Faso: Relating animal traction, productivity, and non-farm income. *Agricultural Systems* 58(3): 441–64.
- cvi. Schmitz, A. And Seckler, D. 1970. Mechanized agriculture and social welfare: The case of the tomato harvester, *American Journal of Agricultural Economics* 52(4),569–577 .
- cvi. Schumpeter, J. 1947. The creative response in economic history. *The Journal of Economic History*, 7(2): 149-159.
- cvi. Smith, A. and Grin, J. 2010. Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges, in: *Research Policy*, 39: 435-448
- cix. Soumahoro, M. 2013. L'attitude du paysan Toura face à l'innovation : blocage culturel ou méconnaissance ? Université laurentienne 50ième colloque de l'ASRDLF
- cx. Spielman, J. 2006. A critique of innovation systems perspectives on agricultural research in developing countries. *Innovation Strategy Today* 2 (1): 41–54.
- cx. Spielman, J. 2005. Innovation Systems Perspectives on Developing-Country Agriculture: A Critical Review. ISNAR Discussion Paper 2
- cxii. Steven, K. 2012. Literature review on the Diffusion of Innovations and Best Practice for Technology Transfer Health Analysis & Information For Action (HAIFA) Published by Environmental Science and Research Limited P O Box 50-348 Porirua 5240 New Zealand
- cxiii. Tosan, F. Mundi, N and Awolumate, S. 2008. Diffusion and adoption of innovations. national open University of Nigeria.
- cxiv. Vidogbena, F. 2013. Spécificités socio-économiques des innovations agricoles en Afrique de l'Ouest
- cxv. Wolfe, R. 1994. Organisational innovation: review, critique and suggested research directions. *Journal of Management Studies* 31(3): 405-431.
- cxvi. World Bank, 2012. Agriculture innovation systems: An investment sourcebook. Washington. World Bank, 2007. *Enhancing agricultural innovation: How to go beyond the strengthening of research systems*. Washington, DC: World Bank.
- cxvii. Yates, B. (2001) *Applying Diffusion Theory: Adoption of Media Literacy Programs in Schools*.
- cxviii. Paper presented to the Instructional and Developmental Communication Division, International Communication Association Conference.
- cxix. Zegeye, T. Tadesse, B. et Tesfaye, S. 2001. Determinants of adoption of improved maize technologies in major maize growing regions of Ethiopia. Second National Maize Workshop of Ethiopia. November, 12-16, 2001, Ethiopia.