

# Roger's Theory of Diffusion of Innovations and institutional changes in Brazilian Rural Advisory Services

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## Abstract

Rural advisory services (RAS) have played an important role in the Brazilian rural and agricultural development along the last fifty years. Since the sixties Roger's theory of diffusion of innovations has set the foundations for policies and strategies for technological changes in agriculture. However, in the last thirty years in Brazil, as well as in many other developing countries, the public organizations created to provide such services faced many critics, due to the fact that most small and family farmers hadn't developed technologically as expected and so remained poor. Most critics rested on the fact that the diffusion of innovations process itself would not be sufficient to guarantee the technological development of all farmers. Critics correctly argued that many other circumstances and institutions affect the pace of rural development, such as public policies, generation of adequate technologies, supply of rural credit, market prices of agricultural goods, market structures (such as oligopolies), climate and soils conditions, how well organized supply chains are, and the educational, organizational and cultural characteristics of rural population. These conditions visibly favored mostly bigger farmers and exported crops, in an environment of supply chains led by empowered multinational companies. So, public RAS organizations have undergone a structural crisis along the nineties and the initial decade of current century. Only recently progressive changes on regulation, increasing funds to public RAS provision and the creation of a national RAS organization pointed to the reconstruction of a public RAS System, although still incapable of advising all 4.36 million Brazilian family farmers. The article aims to analyze how much the principles of Roger's Theory of Diffusion of Innovations are still important in the shaping of institutions that support public and private RAS services in Brazil.

## 1. Introduction

Despite and simultaneously previous initiatives, an institutionalized rural advisory service (RAS<sup>4</sup>) began to emerge in Brazil only over the past 50s and 60s, with the creation of the first association of credit and rural assistance (ACAR) in the state of Minas Gerais, in 1948, with incentives from Rockefeller Foundation and an agreement with state government. ACARs were nonprofit civil entities, which provided rural advisory services and preparation of technical projects to obtain credit from financial agents. In the following years, until the middle of 70s, all Brazilian states created their ACARs, which were nationally coordinated by the Brazilian Association of Credit and Rural Assistance (ABCAR), created in 1956.

From a federal law of 1974 these associations were absorbed by each state government, originating the states RAS public companies (mostly named EMATER), and the ABCAR was absorbed by Ministry of Agriculture, becoming the Brazilian RAS national public company, named

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4 In Brazil, RAS is named "technical assistance and rural extension" (ATER) services. The usual conceptual difference lies on that "technical assistance" doesn't embody any educational action, as it is limited to the transmission of a technical information. Farmers are not capacitated. In contrast, "rural extension" focus on farmers empowerment processes and deals with issues as human health, familiar planning, farm management, farmers organizations, etc.

EMBRATER (officially created on 1975). Together, state companies and the federal Embrater constituted the Brazilian RAS System (named SIBRATER). Embrater had amongst its main roles, capacitating RAS agents and distributing federal budget to state companies.

From the 50s to 70s, Brazil faced a huge transition in which, from frankly agrarian, with export-based economy, mainly in coffee, turned into industrial. Simultaneously to the industrialization process, with the adoption of a rural development model based on the diffusion of modernizing technological packages advocated by the Green Revolution, the modernization of Brazilian agriculture was characterized by the consumption of raw materials (such as fertilizers, pesticides, genetically improved seeds) and industrial equipment. The intensive mechanization freed rural hand labor for industrial and construction sectors. The public policies for agricultural research, rural credit and RAS aimed at strengthening this model, and the political-economic structures favored large production for export products or raw material for industrialized goods for domestic consumption.

In the field of agricultural research, it is important to mention the creation of the Brazilian Agricultural Research Company (EMBRAPA), on 1973, which became one of the world's biggest and most successful company in this field of knowledge. Embrapa (which alongside universities and state research companies formed the National Agricultural Research System) played a fundamental role in developing science and technologies to explore the Cerrado ecosystem, on the Midwest region of Brazil. However, on the 80s and later on the 90s, public RAS in Brazil faced the same obstacles that emerged in other countries around the world, such as reducing budgets and accusation of inefficiency.

Sibrater played an important role on the modernization of Brazilian agriculture, providing the link between rural credit and imported or national technologies, developed by Brazilian research system<sup>5</sup>. For it was interpreted that the biggest rural development problem was the technical delay of agriculture, the early and main focus of public RAS was the diffusion of agricultural innovations. It was assumed that bigger farmers should firstly adopt the technical innovations, and playing a multiplier role, would naturally be later imitated by smaller farmers. However, this did not happen on the expected way. Many farmers lingered to adopt the more costly technologies, due to the lack of access to rural credit, or even to many of the simplest or cheapest ones, due to the lack of access to information or continuous and qualified RAS, or to educational, infrastructure and organizational deficiencies.

In consequence of this evaluation, many authors criticized the Brazilian agricultural modernization model of being economically, centered on the technological development of bigger farmers and export commodities, setting aside small farmers from public policies of rural credit and public RAS. Other paradigms were developed, pointing to a more demand driven public RAS, to the use of locally adapted technologies, elimination of organizational gaps, and participatory strategies of development.

Much of the failures of modernization model were credited to the diffusionist model that public RAS adopted. But, although the problems that conditioned the development of small farmer should be considered by public policies, this poses an important question. Despite the need of a more complex set of public policies, should the RAS policy makers take into account that the diffusion of innovation process still naturally occurs and must be considered on the formulation of such policies? Or is diffusion of innovation theory obsolete and should be discharged from agricultural or rural development strategies?

This article aims to present the diffusion of innovation theory, by reviewing some of the literature that focuses this subject, and to evaluate whether it is still worth to the agricultural development policies, and more specifically, the public RAS policies that are being set in Brazil.

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<sup>5</sup> Brazilian agriculture research system is composed of Brazilian Agricultural Research Company (EMBRAPA), founded on 1973, and several state agricultural research companies.

## 2. Elements of Roger's Diffusion of Innovation Theory

Bryce Ryan and Neal C. Gross's classic of 1943 studied the diffusion of hybrid seed corn among Iowa farmers. This study, grounded in previously conducted anthropological diffusion work, traced the basic research paradigm for the diffusion of innovations. During the 1950s many diffusion studies were conducted, particularly by rural sociologists at land-grant universities in the midwestern United States.

Diffusion theories have their origins in the explanation of the adoption of technological change by farmers, beginning with Everett Rogers reviews of all kinds of innovations - agricultural innovations, educational innovations, medical innovations, and marketing innovations. He found several similarities in these studies and concluded that the diffusion process displayed patterns and regularities, across a range of conditions, innovations, and cultures. In 1962, Rogers published this review of literature, as the seminal *Diffusion of Innovations* book<sup>6</sup>, which provided a comprehensive theory of how innovations diffused, or spread, in a social system over time.

Rogers, describes diffusion as a dynamic process by which an innovation is communicated through certain channels over time among the members of a social system. So there are **four key elements of the diffusion of innovation process**:

1. an idea or innovation;
2. channels of communication to spread knowledge of the innovation;
3. time during which diffusion takes place; and
4. a social system of potential adopters in which this occurs.

The theory also embodies the notion not just of communication, but also of adoption (or rejection) of innovations by members of the social system, that will be discussed ahead.

The key aim of the diffusion of innovation literature is to understand when and why innovations are adopted or rejected. Then, the assumption often made is that a good diffusion system is one that results in swift and widespread adoption of an innovation, which tends to be regarded as a 'good thing', even despite evidence of negative and unanticipated consequences.

Although most observers agree that the diffusion of innovations is fundamentally a communication process, communication scholars constitute only one of the dozen research traditions and underpinning disciplines presently advancing the diffusion field, which, according to Nutley et alii (2002) are:

- 1. Philosophy** - the nature of knowledge and how knowledge is used in practices (epistemology). The study of whether certain innovations or technologies should be used (ethics).
- 2. Anthropology** - how cultures have evolved and have influenced each other, including how knowledge and technologies have diffused within and across cultures.
- 3. Sociology** - interpersonal and intergroup behaviours, including the influence of social structures and norms on behaviours and practices.
- 4. Library Science** - how knowledge dissemination can be facilitated, specifically how knowledge and information can be stored and catalogued so that it can be easily accessed.
- 5. Psychology** - human behaviour and the factors that influence individuals to act, particularly cognitive and emotional states.
- 6. Economics** - market forces that influence innovation diffusion, including how diffusion influences pricing strategies, and vice versa.

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<sup>6</sup> The last reviewed edition of the book dates from 2003.

7. **Education** - how knowledge can be shared so that it is understood, used and valued.
8. **Geography** - how knowledge is spread and adopted spatially, particularly how geographical structures and land structures influence the spread and use of knowledge.
9. **Business Studies** - the organisational characteristics that enhance the innovativeness of organisations as well as the ways in which innovations can be effectively marketed.
10. **Political Science** - how policies are implemented, including how centralised and decentralised governmental structures influence the implementation of policy.
11. **Technology Transfer** - how technology can be used and adapted for use in various practices.
12. **Communications Theory** - how various communications, including mass media campaigns, can affect dissemination, diffusion and knowledge utilisation.

Conceptions of research utilisation have been conventionally characterised it as a linear process, from research creation through dissemination to utilisation, assuming that well developed, research-based innovations will spread within populations of users, reducing the gap between what we know and what we do (NUTLEY et alii, 2002). But the process of utilisation is likely to be more complex than this, as shows the diffusion of innovation theory.

By the fourth edition of his book, in 1995, Rogers had articulated a typology of diffusion research based around the aspect of the innovation process that was the focus of study. **Eight categories of research** were identified (NUTLEY et alii, 2002):

1. **Earliness of knowing about innovations** - addressing the means by which initial knowledge of an innovation is communicated within a social system;
2. **Rate of adoption of different innovations** - focusing the relative speed with which an innovation is adopted by members of a social system, and the importance of the perceived attributes of the innovation;
3. **Rate of adoption in different social systems** – an attempt to explain differing rates of uptake by the characteristics of the social system and the context within which it is embedded;
4. **Innovativeness**: related to empirical research that examines the characteristics of individuals or organisations perceived as being innovative;
5. **Opinion leadership** - focusing on the role of opinion leaders and change agents in ensuring diffusion;
6. **Diffusion networks** - addressing the social interconnectedness of the actors in the social system where diffusion is being studied;
7. **Communication channels** - the various communication channels most effective either at different times in the diffusion process, or with different categories of potential adopters;
8. **Consequences of innovation**: assessing the potential impacts as innovations diffuse through social systems.

Wolfe (1994, cited on NUTLEY et alii, 2002) argues that it is important to distinguish between three streams of innovation research based on a conceptual differentiation:

- **Patterns of diffusion** - concerned with the patterns of uptake of new ideas through a population of potential adopters. The central unit of analysis in this stream of work is the identification of those innovation attributes that are said to influence diffusion process and/or on the classification of adopters who are presumed to have different characteristics and tendencies to adopt.

- **Organisational innovativeness** - focusing on the determinants of organisational innovativeness, or how the structure of organisations affects their ability and willingness to innovate, although no definitive set of characteristics for differentiating more from less innovative organisations has yet emerged from the research. Changes in an innovation during the adoption and innovation process are often ignored and attention is focused on the adoption decision rather than on its implementation per se.
- **Process theory** - concerning the innovation processes individuals and organisations go, labeling and ordering identifiable stages in the process of innovation.

## 2.1. The innovation element

Rogers' definition of an innovation as an idea, practice, or object perceived as new by an individual or other unit of adoption, and highlights that such knowledge need only be perceived as new by those whose behaviour is of interest (the potential adopters). It should be noticed that an innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them. Much diffusion research involves technological innovations, so Rogers usually used the word "technology" and "innovation" also as synonyms (SAHIN, 2006).

Diffusion of innovation research dates back around a century and since then the scope of diffusion theories and associated empirical research has broadened. There is a vast literature on innovation generally and on the diffusion of innovations more specifically, with more than 6.000 articles published. While the literature largely covers innovations in industrial and service settings, a good deal of attention has been paid to public service and public policy innovations.

Diffusion of innovations is concerned with explicit knowledge (rather than tacit), so this can take many forms, such as knowledge about ways of practice (process innovation), or knowledge embodied in specific technologies and products (product innovation). Many attempts to classify innovation types have been developed in the literature – ranging from the relatively simple technical versus administrative innovations, or product versus process innovations, to the more complex (Wolfe, 1994, in NUTLEY et alii, 2002, for example, identifies 17 attributes of innovations), but the predominant focus in the literature however has been on technical innovations (new products and practices). Hence the concept of innovation can be interpreted in at least four ways:

1. **Developmental innovations:** existing services to an existing user group are modified or improved;
2. **Expansionary innovations:** existing services are offered to new user groups;
3. **Evolutionary innovations:** new services are provided to existing users;
4. **Total innovations:** new services are provided to new user groups.

## 2.2. The communication element

For Rogers, communication is a process in which participants create and share information with one another in order to reach a mutual understanding. This communication occurs through channels between sources. A source is an individual or an institution that originates a message, and a channel is the means by which a message gets from the source to the receiver. Rogers states that diffusion is a specific kind of communication and includes these communication elements: an innovation, two individuals or other units of adoption (an organization, for instance), and a communication channel, involving interpersonal communication relationships.

Interpersonal channels are more powerful to create or change strong attitudes held by an individual because the communication may have a characteristic of homophily, that is, the degree to which two or more individuals who interact are similar in certain attributes, such as beliefs,

education, socioeconomic status, and the like. But the diffusion of innovations requires at least some degree of heterophily, which is the degree to which two or more individuals who interact are different in certain attributes. In fact, one of the most distinctive problems in the diffusion of innovations is that the participants are usually quite heterophilous (SAHIN, 2006).

The most effective communication channels seem to vary depending on the nature of the innovation and the size of the potential audience. In today's world, information technologies such as the Internet and cell phones – which combine aspects of mass media and interpersonal channels, represent formidable tools of diffusion (ROGERS et alii, 2008).

Many observers consider the Internet one of the great transformational technologies (ranking with the steam engine, railroads, electricity, etc.) that at first challenged, and then fundamentally changed, the way that people learn, play, create, communicate, and work.

The growth of the Internet has boosted interest in the study of diffusion, especially the study of communication networks. So, the proliferation of the Internet has also made possible a better understanding of how communication networks work in the spread of an innovation. Furthermore, the Internet is changing the very nature of diffusion by decreasing the importance of physical distance between people.

Few other areas of communication research have such a lengthy history and represent such a tremendous scholarly outpouring. Rogers (*et alii*, 2008) suggests that the popularity of diffusion research is due to its practical importance and its applied nature.

### 2.3. The time element

According to Rogers, the time aspect is ignored in most behavioral research. He argues that including the time dimension in diffusion research illustrates one of its strengths. The innovation-diffusion process, adopter categorization, and rate of adoptions all include a time dimension.

### 2.4. The social system element

Once diffusion of innovations takes place in a social system, it is influenced by the social structure, which is the patterned arrangements of the units in a system. Rogers further claimed that the nature of the social system affects individuals' innovativeness, which is the main criterion for categorizing adopters (SAHIN, 2006). But in a social system, often organisations are also involved and many studies focus on the process of diffusion that occurs within these organizations.

## 3. Models of process of diffusion

Four generations of models, that seek to represent how the above four elements interact with one another, have been identified to characterise the technology transfer process (NUTLEY, 2002):

1. **appropriability model** - emphasises the importance of quality research and competitive market pressures to drive the adoption and use of research findings;
2. **dissemination model** - experts inform potential users or the new technology;
3. **knowledge utilisation model** - stresses the importance of interpersonal communication between researchers and users, and the role of organizational barriers and facilitators in promoting research use;
4. **communication-based model** - characterises technology transfer as an interactive process where individuals exchange ideas simultaneously and continuously.

Other way of describing the model of diffusion is through the grade of centralization of which innovations should be diffused. The classical model is a relatively **centralised system**, often a government, which controls decisions about which innovations should be diffused, to whom and by what means should be made centrally. Diffusion of the innovation flows from the top down,

from experts to users, science pushed. Centralised systems provide central quality control over innovations to diffuse and can diffuse innovations for which there is as yet no felt need. But such system can encounter user resistance to central control, and may result in inappropriate adoption because of low adaptation to local circumstances.

In comparison, in a highly **decentralised system** there is a wide sharing of power and control among members of the diffusion system; peer diffusion of innovations through horizontal networks; and a high degree of local adaptation as innovations diffuse among adopters. Users tend to like such system, which promotes closer fit between innovations and user needs and problems. But in decentralised systems ineffective innovations may be diffused due to lack of quality control, and it depends on local users, who control the system, having knowledge about other users' problems and about the innovations available that could solve them.

Rogers' conclusion is that decentralised systems are most appropriate when innovations do not require a high level of newly acquired technical expertise and when users are relatively heterogeneous. But the potential for users to run their own diffusion system is greatest when the users are highly educated and technically competent practitioners.

It seems that a decentralised approach to diffusing innovations is likely to encounter less user resistance than a centralized approach. It is also likely to result in a greater level of reinvention (which concept will be discussed ahead) – although whether this is desirable will in turn depend on both the nature of the innovation and the knowledge/capabilities of the re-inventors.

The classical diffusion paradigm has been criticized for reifying expert-driven, top-down or science push approaches to address problems and thus, by default, overlooking, ignoring and rejecting local solutions. Diffusion of innovation experts now increasingly acknowledge the value of local expertise and wisdom in finding culturally-appropriate solutions to community problems (Rogers et alii, 2008).

One such inside-out approach to innovation diffusion is exemplified by the **positive deviance approach**, that questions the role of outside expertise and enables communities to discover the wisdom they already have, and then to act on it. Social change experts, usually, make a living discerning of the deficits in a community, prioritizing the problems, and then trying to implement outside solutions to change them. In the PD approach, the role of experts is to identify the uncommon but effective things that positive deviants do, and then to make them visible and actionable to the community. Evaluations of PD initiatives show that PD works because the community owns the problem, as well as its solutions, changing themselves with the help of outside expertise and facilitation. The positive deviance approach to innovation diffusion is located at the intersection of theory, method, and praxis.

Many of the early models of the diffusion process were criticised for presenting an overly rational view of how change is achieved. However, when a simple innovation is borrowed or adapted from an external source, the stages tend to occur in the expected order, while when innovations are complex and/or originate within an organisation, stages tend to be more muddled and overlapping. However, a linear stage model still remains at the heart of many studies.

Whereas classical theories of innovation have tended to define innovations, evidence and organisations in fixed and unproblematic ways, newer perspectives, focusing on the innovation process, have begun to recognise the fluidity of boundaries between social contexts, objects and knowledge.

Certainly those who advocates of an evidence based practice are interested in diffusing an ideology: the objective is to win over the hearts and minds of practitioners, to get them to adopt a frame of reference that values research evidence. But we need to recognise the limitations of the predominant focus on rationality and linear stage models of decision making within the diffusion of innovation literature. Such models may not necessarily provide accurate maps of an empirical reality.

There is a recognition on the need to pay more attention to the institutional context and norms than so far.

#### 4. **The innovation-decision process**

The interactions amongst the key elements are usually brought together in some form of model of the various stages of the diffusion process. There is a wide variety of stage models, with greater or lesser gradations between stages, but the most frequently cited is Rogers' **five-stage representation of the innovation-decision process**, below presented.

1. **Knowledge** – the individual (or decision-making unit, for instance, an organisation) is exposed to the innovation's existence, gains some understanding of how it functions and seeks information about the innovation. This knowledge stage is more cognitive (or knowing) centered.
2. **Persuasion** – the individual (or decision-making unit) forms a favourable or unfavourable attitude toward the innovation, but does not always directly or indirectly adopt or reject it. This persuasion stage is more affective (or feeling) centered, and may involve, for example, a matching of the innovation to a perceived problem, and some kind of appraisal of the costs and benefits of adoption.
3. **Decision** – the individual (or decision-making unit) continue to search for innovation information, and engages in activities that lead to a choice to adopt or reject the innovation. This may include interaction with forces of support or opposition that influence the process.
4. **Implementation** – the individual (or decision-making unit) puts an innovation into use/practice. However, uncertainty about the outcomes of the innovation still can be a problem at this stage. Thus, the implementer may need technical assistance from change agents and others to reduce the degree of uncertainty about the consequences.
5. **Confirmation** – the individual (or decision-making unit) seeks reinforcement for an innovation decision already made, but may look for support for his decision and reverse it if exposed to conflicting messages about the innovation. Depending on the support for adoption of the innovation and the attitude of the individual, later adoption or discontinuance happens during this stage. *Discontinuance* may occur during this stage in two ways: 1) *replacement discontinuance*, when the individual rejects the innovation to adopt a better innovation, replacing it, and 2) *disenchantment discontinuance*, when the individual rejects the innovation because is not satisfied with its performance.

Mass media communication and cosmopolite channels are usually more effective when there are large numbers of potential adopters and low levels of complexity. Mass media and cosmopolitan channels are also relatively more important at the knowledge stage, particularly for earlier rather than for later adopters. In contrast, interpersonal and local channels are relatively more important at the persuasion stage of the innovation-decision process (SAHIN, 2006).

The process of adoption can also be characterised as a decision-making process, where three other distinct **types of knowledge** may be important (NUTLEY, 2006):

1. **Awareness knowledge** – the awareness that an innovation exists, knowledge of its key properties, and understanding of how the innovation relates to current practices.
2. **How-to knowledge** – the information necessary to the proper use of an innovation, as an essential variable in the innovation-decision process.
3. **Principles knowledge** – information dealing with the functioning principles underlying how and why the innovation works. An innovation can be adopted without this knowledge, but the misuse of the innovation may cause its discontinuance.

All three types of knowledge are important in shifting potential adopters from an ignorance status through awareness and to an adoption attitude. The utilisation of knowledge, even when

considered in quite instrumental terms, may be more subtle and more complex as adopters adapt and integrate external knowledge with their own pre-existing knowledge-base, both tacit and explicit.

While invention is the process by which a new idea is discovered or created, the adoption of an innovation is the process of using an existing idea. Early diffusion studies assumed that adoption of an innovation meant the exact copying or imitation of how the innovation had been used previously in a different setting. But the nature of the utilisation of knowledge in diffusion of innovations is further complicated by contrasting direct adoption (replication) *versus* reinvention (adaptation).

**Reinvention** is the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation, and usually happens at the implementation stage. Reinvention has some important drivers:

- adopters' lack of complete knowledge about the innovation may lead them to reinvention.
- relatively complex innovations are more likely to be reinvented and simplified.
- An innovation that is an abstract concept or a tool with many possible applications is more likely to be reinvented.
- When an innovation is implemented in order to solve a wide range of problems, reinvention is more likely to occur.
- Local pride of ownership may be a cause of reinvention.
- a change agency may encourage reinvention.

In general, **reinvention** is not favoured by research and development agencies, who tend to consider reinvention as a distortion of their original technologies. In addition, reinvention is resisted by those promoting an innovation because it makes it more difficult to measure the impact of that innovation.

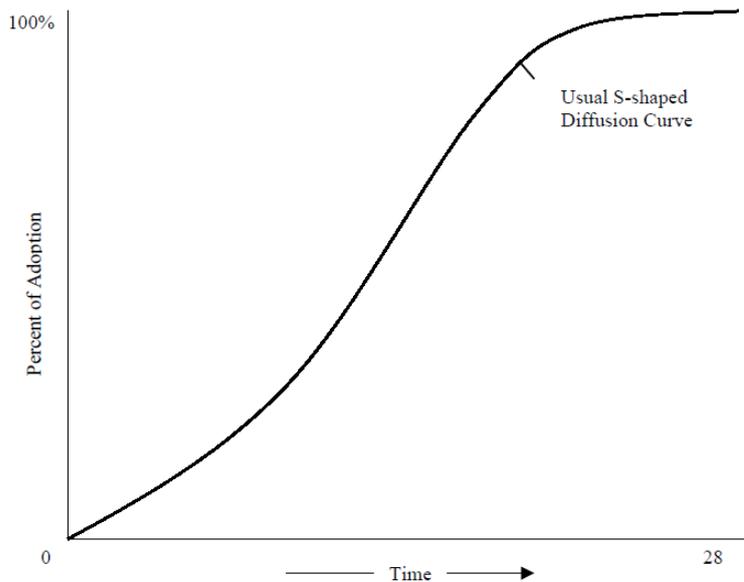
On the other hand, adopters tend to think that reinvention is a desirable quality and studies in education have shown that reinvention not only increases the likelihood of adoption but also reduces the likelihood of discontinuance .

However, **rejection** is also a possible attitude in every stage of the innovation-decision process. There are two types of rejection: 1) *active rejection*, in which an individual tries an innovation and thinks about adopting it, but later decides not to adopt it, or an individual reject an innovation after adopting it earlier, in a *discontinuance* decision (which may be considered as an active type of rejection); and 2) *passive rejection* (or non-adoption), when the individual does not think about adopting the innovation at all. These two types of rejection have not been distinguished and studied enough in past diffusion research.

## 5. The process of adoption

Gabriel Tarde was a French sociologist and legal scholar whose theoretical ideas were set forth in his book in 1903, *The Laws of Imitation*. He originated key diffusion concepts such as opinion leadership, the S-curve of diffusion, and the role of socioeconomic status in interpersonal diffusion, although he did not use such concepts by these names.

The S-shaped curve of diffusion (see figure 1) sets the rate of adoption of a usual innovation, and is reproduced in many descriptive studies of diffusion, although the time over which the innovation diffuses varies, as does the percentage of the population who ultimately adopt the innovation.



**Figure 1: The Rate of Adoption for a Usual Innovation**

For Rogers, adoption is a decision of full use of an innovation as the best course of action available and rejection is a decision not to adopt an innovation. The newness characteristic of an adoption is more related to the three first steps (knowledge, persuasion, and decision) of the innovation-decision process, above commented.

As Sahins (2006) states, **uncertainty** is an important obstacle to the adoption of innovations. An innovation's consequences may create uncertainty: consequences are the changes that occur in an individual or a social system as a result of the adoption or rejection of an innovation. To reduce the uncertainty of adopting the innovation, individuals should be informed about its advantages and disadvantages to make them aware of all its consequences. Moreover, Rogers claimed that consequences can be classified as desirable (functional) versus undesirable (dysfunctional), direct (immediate result) versus indirect (result of the immediate result), and anticipated (recognized) versus unanticipated (intended or not).

### 5.1. Characteristics of the adopters

Adopter categories which have been developed are classifications of members of a social system on the basis of their innovativeness. Only adopters of successful innovations generate this curve over time, so incomplete adoption and non-adoption do not form this adopter classification.

The S-shaped curve becomes a normal curve when plotted as the incidence of people adopting at various points in time rather than the prevalence of people who have adopted up to that point. The normal curve is used to delineate five different categories of adopters according to where they fall under the curve:

1. **Innovators** – usually are willing to experience new ideas and, prepared to cope with unprofitable and unsuccessful innovations. They have complex technical knowledge, but admit a certain level of uncertainty about the innovation and are the gatekeepers bringing the innovation in from outside of the social system. Innovators may not be respected by other members of the social system because of their venturesomeness and close relationships outside the social system.
2. **early adopters** - more limited with the boundaries of the social system, they are more likely to hold leadership roles in the social system. Other members come to them to get advice or information about the innovation, and their leadership in adopting the

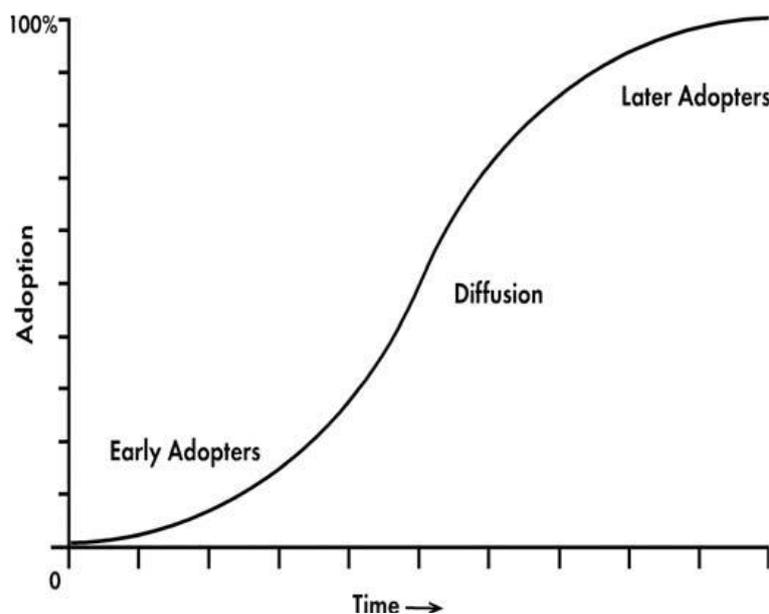
innovation decreases uncertainty within the social system about the innovation in the diffusion process.

**3. early majority**, - although they have a good interaction with other members of the social system, they do not have the leadership role. However, their interpersonal networks are still important in the innovation-diffusion process.

**4. late majority**, - includes one-third of all members of the social system who wait until most of their peers adopt the innovation. Although they are skeptical about the innovation and its outcomes, economic necessity and interpersonal networks of close peers should persuade or pressure them to the adoption of the innovation.

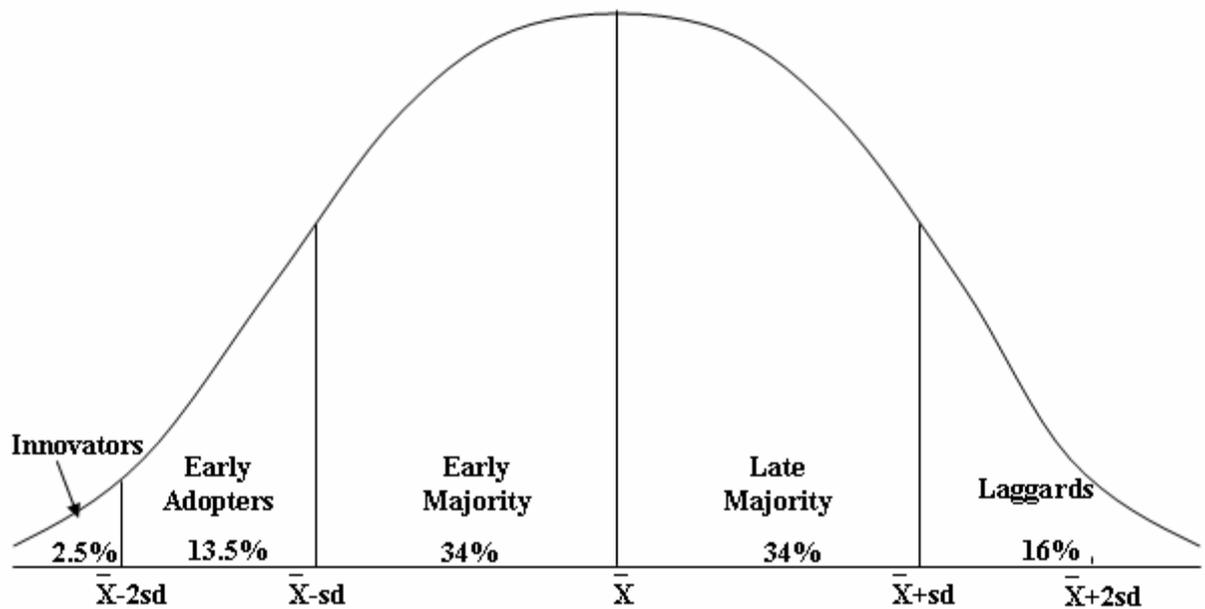
**5. laggards** - have the traditional view and they are more skeptical about innovations and change agents, and their interpersonal networks mainly consist of other members of the social system from the same category. They do not have a leadership role and have limited resources and the lack of awareness-knowledge of innovations. Laggards' innovation-decision period is relatively long.

Of course, no one is an innovator or a laggard about all new ideas. In reality, most people are majorities about most things, and innovators or laggards about only certain specific things (NUTLEY, 2006). So the figure 2 below shows where the categories of adopters on the S-Curve:



**Figure 2. The Diffusion S-Curve**

When plotted on a frequency basis, the number of adopters over time formed a normal, bell-shaped curve (which later scholars utilized to divide the variable of innovativeness into the five adopter categories in a standard way), as seen in the figure 3.



**Figure 3: Adopter Categorisation on the Basis of Innovativeness**

Rogers further described his five categories of adopters in two main groups: earlier adopters and later adopters, differentiated in terms of socioeconomic status, personality variables, and communication behaviors, which usually are positively related to innovativeness. For instance, the individuals or other units in a system who most need the benefits of a new idea (the less educated, less wealthy, and the like) are generally the last to adopt an innovation (SAHIN, 2006).

The rate of adoption may also be influenced by the communication channels involved. The organisational context within which adoption decisions are made also shapes the rate of adoption – particularly an organisation’s structure, culture and resources, and its wider institutional setting.

Diffusion strategies need to recognise that adoption decisions are frequently made in order to seek legitimacy. The characteristics of those promoting the innovation and the communication channels that they use also affect the likelihood that an innovation will be adopted. According to Rogers, **intermediaries** are considered to play an important role in convincing others to adopt an innovation. Two categories of intermediary are identified:

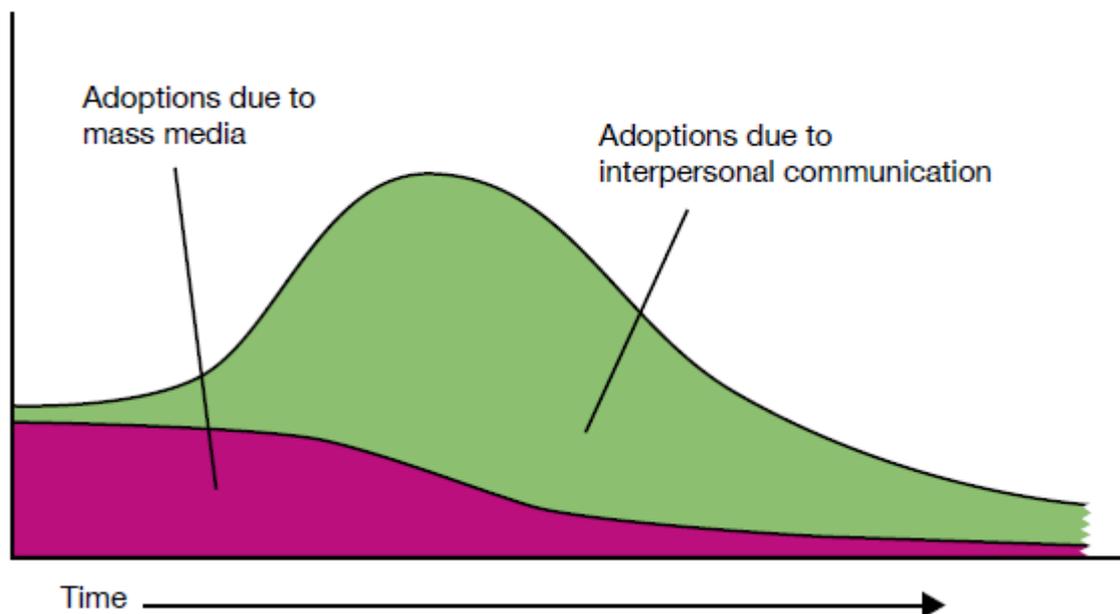
1. **Opinion leaders** – who are of higher economic, political or social status, and somewhat more innovative than their near peers, and have a vital role in persuading the unconvinced majority of them (the middle and late adopters of an innovation), overcoming caution about the risks and costs of adoption.
2. **Change agents** – who work proactively to expedite and widen innovation. They create demand for the innovation by reducing barriers to adoption, persuading adopters and supporting adoption decisions, and acting as bridges between technical experts and their clients, without being a member of either group. They are most effective when they work in partnership with opinion leaders.

Early research on the diffusion of innovations also concentrated on the adoption behaviour of individuals. This has been criticised for over-simplifying what is often a complex *organisational* change process, and over time attention has shifted towards the organisation as the main unit of adoption, but there is still a tendency in much of the literature to treat the organisation as if it were an individual.

It is also important to consider the contextual infrastructure for innovations, which include: conducive institutional norms, a sufficient level of basic scientific knowledge, the availability of

both financing mechanisms and a pool of competent human resources, and a ready market of educated and informed consumers.

However, as an innovation spreads from early adopters to majority audiences, face-to face communication therefore may become more essential to the decision to adopt. This principle is embodied in the Frank Bass Forecasting Model (see figure 4 below), which illustrates how face-to-face communication becomes more influential over time, and mass media less influential.



**Figure 4 - The Bass Forecasting Model.**

Source: Mahajan, Muller and Bass (1990), in Robinson (2009)

## 5.2. Characteristics of an innovation

In addition to the characteristics of the adopters, the perceived characteristics of an innovation are also considered to affect its adoption. Five innovation attributes are typically identified as being important for rapid diffusion:

1. **Relative advantage** – the extent or degree to which the innovation is perceived to have significant advantages over current alternatives, for instance, the cost and social status motivation.
2. **Compatibility** – the degree to which the innovation is seen or perceived as being consistent with past practices or experiences, existing values and needs of potential adopters. Thus, even naming the innovation is an important part of compatibility.
3. **Complexity** – the extent to which the innovation can readily be understood or perceived and easily used. Complexity is negatively correlated with the rate of adoption.
4. **Trialability** – new ideas that can be tried out at low cost before wholesale adoption are more likely to be taken up. It is positively correlated with the rate of adoption: the more an innovation is tried, the faster its adoption is.
5. **Observability** – the degree to which the use and benefits or results of the innovation are visible to others, and therefore act as a further stimulus to be adopted by others. Observability also is positively correlated with the rate of adoption of an innovation.

Other attributes have also been identified as being potentially important, such as: *adaptability*, *centrality* to the day-to-day work of the organisation, and *little requirement for additional visible resources* (NUTLEY et alii, 2002).

Moreover, Rogers categorized innovations into two types:

- 1) **preventive innovation** - a new idea that an individual immediately adopts in order to lower the probability of some unwanted future event, but has a slow rate of adoption so its relative advantage is highly uncertain, and
- 2) **incremental (non-preventive) innovations**, which provide beneficial outcomes in a short period.

## 6. Key findings from diffusion of innovation research

More recent studies have characterised innovation as a journey that is not sequential or orderly, but messy and unpredictable. More recent research on diffusion of innovation has drawn upon institutional theory to counter the rationalist tendencies and has moved towards thinking in terms of non-linear dynamic processes.

Diffusion of innovations research promises to enhance our understanding of how social change occurs, a fundamental issue for all scholars of society. There is no reason to expect that the scholarly popularity of diffusion research by communication (and other) scholars will decrease in the foreseeable future. Innovations continue to be generated and studied. The overwhelming focus on the individual as the unit of adoption needs to be broadened to the levels of organizations and communities-of-practice.

### 6.1. Transfer, convergence and translation

In a recent paper Stone (2012) looks backwards to the political science diffusion literature, and forwards to the expanding multi-disciplinary social science literatures on policy ‘learning’, ‘mobilities’ and ‘translation’ which qualify many of the rationalist assumptions of the early diffusion / transfer literatures. According to this author, it is more likely to encounter an American trained scholar using the term and framework of ‘diffusion’ whereas Europeans often work with the term ‘transfer’. While the approaches share many similarities, transfer studies tend to prioritize proactive knowledge utilization or ‘lesson-drawing’ from policy developed elsewhere.

Early policy transfer studies targeted the role of agency in transfer processes and decision-making dynamics internal to political systems, and embodied the notion that transfer is a voluntary process undertaken by civil servants and politicians seeking to emulate ‘best practice’. Nevertheless, there was relatively quick recognition that transfers can be more or less coercive. There are some modalities of transfer (Stone, 2012):

1. transferring policy ideals or goals at a broad level. Here the focus is on achieving a common outcome;
2. transfer of institutions. This is the most familiar understanding of policy transfer. It involves the creation of similar structures;
3. regulatory, administrative or judicial tools can be transferred.
4. ‘transfer of ideas and ideologies’. A broad category, such transfers are difficult to map but are intuitively known. It is distinguishable from the first modality because ideas and ideologies are inputs to policy development rather than outcomes.
5. ‘transfer of personnel’ is apparent with short term staff exchange and longer term

In political economy, particularly in the new-institutionalism framework, there has been stronger interest in explaining why there has been convergence. Scholarly thinking on ‘**policy**

**convergence**' suggests that transfer is less the consequence of agency and more the outcome of structural forces.

Where diffusion/transfer attends to the conscious spread of policies and ideas between countries, convergence represents an important counter-factual proposition that challenges the logic of choice.

The mimetic institutional isomorphism of organisations is explained as resulting from entrenched *path dependencies* and the taken-for granted aspects of political life where actors follow rules, shared interpretations, schema and meanings.

Studies of convergence are more focused on policy and institutional outcomes. Consequently, the approach can be considered a different genus from diffusion/transfer studies that start with inputs and processes of dispersion.

Divergence and hybridization, adaption and mutation have increasingly been used in conjunction with the above concepts. Consequently, the idea of **policy 'translation'** and 'variation' has gained traction. This analytic theme reflects a "move away from thinking of knowledge transfer as a form of technology transfer or dissemination, rejecting if only by implication its mechanistic assumptions and its model of linear messaging from A to B". Translation is "a series of interesting, and sometimes even surprising, disturbances can occur in the spaces between the 'creation', the 'transmission' and the 'interpretation' or 'reception' of policy meanings". Though focusing on the field of transfer and translation policy studies, Stone's paper brings interesting concepts which could be used in a future agenda of research on diffusion of innovations.

## **7. The Brazilian agriculture case and some final considerations**

Brazil's Agricultural Census of 2006 showed that 78% of rural farmers declared that didn't receive any kind of rural advisory service (RAS) during this year, and other 13 % declared that received RAS only occasionally. The 9 % remaining fit among the biggest and more developed farmers that get RAS from private providers. This information shows the huge challenge for Brazil to deliver quality and continued RAS to all farmers in the short term (VIEIRA FILHO, 2010).

It's expected that these data haven't changed too much since 2006. But Brazil still lacks official statistical data on RAS provision, so it's very difficult to forecast what has changed in the recent years. To worsen this situation, there's no expectancy on the provision of government funds to implant a new Agricultural Census in the next years.

This leads us to other demands in RAS publicly funded in Brazil that is the lack of accountability on the amount of public expenditures and, mostly, the results achieved.

On 2004, after many meetings and seminars involving farmers and extension agents throughout the country, in a collective construction of a new national RAS policy, the Ministry of Agrarian Development (MDA<sup>7</sup>) instituted a National Policy on RAS for Family Farmers and Land Reform (named PNATER). But such policy faced difficulties in its implementation, due to an absence of legal support, regarding the processes of outgoing. Then, but only in 2009, after years of social pressures, the federal government sent a law project to the National Congress, under an urgency regime of political processing (which demands only 90 days to be approved by deputies and senators).

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Brazil has two ministries that deal with agriculture and rural development: Ministry of Agriculture, Livestock and Supply MAPA), dedicated to technical regulation and to medium and bigger farmers, and Ministry of Agrarian Development (MDA), dedicated mostly to family farmers. MDA also takes the responsibility on the public RAS policy.

The new Law n. 12.188 (named General RAS Law) was quickly approved in January, 2010. Among others, it has an important innovation, which is the institution of monitoring and evaluation of results. However, this policy has still faced innumerable problems in its implementation, including insufficient funds to extend access to RAS from all small farmers, and until now there's no available data regarding the outcomes or its implementation.

Moreover, there is a deficiency on Brazil's RAS policy. Because public RAS funded through federal budget needs to be provided freely, at no charge (this is determined by Agricultural Law and charging is almost a paradigm), the process of accreditation and contracting public (states) and private (NGOs) RAS providers is totally controlled by federal government. However, federal government institutions have no structural conditions and enough bureaucrats to well perform their duties.

Because of this, and despite the increasing in public funds to public RAS, debates raised on the necessity of creation and empowerment of a national organization whose role should be the coordination of reconstruction of Brazil's RAS National System (similar to Embrater<sup>8</sup> in the past). In 2013 the federal government sent to the National Congress another act project, by the same urgency process, creating the National Agency for RAS (named ANATER<sup>9</sup>), with the responsibility to coordinate the RAS National System. The new Act n. 12.897 was approved on the end of 2014, but the Agency hasn't any structure, budget or bureaucracy yet. At best, it will begin its activities by 2016 (PEIXOTO, 2014). So it will take some years until we may have any information about its development and the public RAS policy under its responsibility.

Brazilian recently experienced strong social discussion and political pressures, involving diverse organizations and social movements, which resulted in an effective commitment of authorities in renewing the existing public policies on RAS, after many years of disruption. The discourse and rhetoric of these social movements points do the importance of the value of local expertise and wisdom in finding culturally-appropriate solutions to community problems. But the direction of the new public RAS policy points to a highly public and centralized system. This new policy doesn't take proper account of international trends in RAS policies, like pluralization of RAS providers and cost recovery systems.

Brazil's agriculture has an enormous heterogeneity of social actors and even among family farmers there are big differences that impose different strategies in funding and providing RAS. A centralized diffusion of innovations system may not be the best way to address RAS to all farmers. The positive deviance approach and a demand driven RAS model should be reinforced and much more power on decision of how to access RAS should have been addressed to farmers and their organisations.

That is why some important law projects that are being processed at the National Congress should get attention from policy makers, RAS providers and farmers. These projects change the public credit policies to enforce the federal government to provide public funds to contracting private RAS providers directly by farmers at the market. The eventually resulting laws could provide necessary cost recovery strategies and would decentralize and reduce the government tutelage of farmers on process of contracting RAS. Why should farmers be able to pay credits for buying inputs and equipments to their activities, but RAS should be totally free? Why should the knowledge needed to apply such innovations be necessarily free? This imposition of free RAS impedes even access to

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8

Embrater was the Brazilian Company of Technical Assistance and Rural Extension, founded on 1974 and extinct on 1990. However, though it was a state company subordinated to the Ministry of Agriculture, it did not provide direct RAS, being responsible only to foster RAS at states level, delivering them federal and financial support.

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Anater is not a regulation agency, but a promotion one.

knowledge on innovations that doesn't require any input or equipment, but result in significant improvements for rural activities, such as managerial and organizational changes.

It is quite early to judge if the current public RAS policy of Brazil will be effective, but it's clear that it won't be able to provide access in the short run to RAS for all family and medium size farmers, that amount 5,1 million farmers.

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