Research Report

Diffusion of Innovations as a Theoretical Framework for Telecenters

Raul Roman

rr66@cornell.edu
Department of Communication
Cornell University
338 Kennedy Hall
Ithaca, NY 14853

Abstract

Local information and communication resource centers, usually called telecenters, are springing up in developing countries with the objective of bringing the benefits of new communication technologies to the rural poor. Rural telecenters are calling the attention of academic and nonacademic researchers, but there is no theoretical framework to help understand the process of diffusion and adoption of these centers by the local communities. This paper uses diffusion theory to provide a conceptual framework for telecenter research and practice. After briefly reviewing the core of the theory, this paper focuses on the three aspects of diffusion that are most pertinent for telecenter application: (1) the perceived attributes of innovations, (2) the communication aspects of the diffusion process, and (3) the consequences of innovation adoption. The paper concludes with a summary of the implications of diffusion theory for telecenter research.

Introduction

In establishing telecenters, as in other areas of what is conventionally called development, the priority is to make things happen. And to make things happen, practitioners think in terms of planning and strategies. This planning and implementation of strategic action often uses applied research methods, mostly for different evaluation purposes. But the word *theory* is almost never mentioned: telecenters appear as an atheoretical object of study. There are some relevant compilations of articles containing telecenter case studies in different developing countries and analyses of telecenter issues (Colle and Roman 2001a; Gomez and Hunt 1999; Latchem and Walker 2001). These collections of papers are certainly useful for practitioners, policy makers, and academics, but generally they do not present theory-led research. Additionally, there is an increasing amount of scholarly articles about telecenters in developing countries being published in specialized journals and books[1] (Blattman, Jensen, and Roman forthcoming; Colle 2000; Colle and Roman 2003; Falch and Anyimadu forthcoming; Maclay and Best 2001; Tschang, Chuladul, and Thu-Le 2002). Many of these articles study important aspects of telecenter development but lack a solid theoretical background. Therefore, no particular conceptual model seems to guide telecenter planning, and no specific

1. In any case, it is important to point out that "until very recently, the entire literature on information systems and developing countries would struggle to fill a single bookshelf" (Heeks 2002b:102).

theory is inspiring research questions either. This is happening in a context that can be simplified in two connected points: (1) telecenters are conceived and implemented in an atmosphere of enthusiastic urgency to use information and communication technologies to help solve development problems and (2) research on telecenters is in its infancy, or phrased differently, telecenters are in their early years, and researchers are still dabbling around in the hunt for some common understanding. Briefly expanding on these two points provides an introduction to the rationale of this paper: placing telecenters within a theoretical framework.

The creation and sharing of knowledge and information are considered the key to economic and social development[2] (Chataway and Wield 2000; Conceição, Heitor, Gibson, and Shariq 1998; Mansell and Wehn 1998). The possibilities opened up by new information and communication technology in this direction are changing the way international development is envisioned (World Bank, 1998). Today, there is a knowledge-oriented and technology-focused development paradigm based on the optimistic belief that access to telecommunication services, particularly the Internet, will help bring prosperity to the most disadvantaged sectors of society. Telecenters constitute one of the many initiatives launched to test that belief. In this paper the concept of telecenter generally refers to a community information resource center situated in a rural area of a developing country. A telecenter is a shared access facility equipped with telephones, computers, television and video, and other technological devices. The basic objective of such a center is to provide demand-driven communication and information services for community development. As considered in this paper, a telecenter is an organization that receives external support, at least initially, by international donors, governmental and nongovernmental organizations, or other groups outside the community served. This terminological clarification is necessary because experience with telecenters is so varied around the world that the word *telecenter* may mean different things to different people. Even though the same phenomenon has received numerous names (Colle and Roman, 1999),

and different typologies are proposed in an attempt to achieve more conceptual clarity (Colle and Roman 2001b), the word *telecenter* can be considered a standard label to designate the phenomenon analyzed in this paper. Additionally, this paper concentrates on diffusion aspects once the telecenter is already in place; therefore, it does not deal directly with the initial diffusion process that precedes and leads to the establishment of a telecenter in a specific community.

The use of telecenters for rural development is attracting the attention of academic and non-academic researchers. At this stage, telecenters are spread as pilot projects and field experiments. Therefore, the issue of project evaluation is critical. Above anything else, there is a strong interest in the effects of these projects on economic and social indicators, as impact evaluation would presumably have important policy implications. Accordingly, it is worth noticing that the "evaluation literature has rarely been concerned with the importance of theory in evaluating a program or with how to incorporate theory into evaluation processes" (Chen 1990:17). Evaluation research usually focuses on scientific methodological issues, without paying much attention to the theoretical implications of the program examined. The literature about telecenter research also deals exclusively with methodological and technical issues of evaluation (Hudson 2001; Roman and Blattman 2001; Whyte 2000), so far neglecting theoretical concerns (Montealegre 1999a). This is not an isolated case in development research. The complexity and heterogeneity of the realities of the Third World have gradually pushed researchers to more contextually impinged and problem-centered inquiry, and a "widespread abandonment of theoretical and conceptual strait-jackets" (Hulme and Turner 1990: 216). This move is also connected to the pessimistic realization that "we still have no better grasp of how to theorize or understand the reality of Asia, Africa, or Latin America in a way that leads to significant or lasting improvement" (Escobar 2000:165).

This paper analyzes ways in which diffusion of innovations theory (Rogers 1995) represents an attractive point of departure for telecenter practitioners

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2. However, despite this renovated emphasis on knowledge and learning, "the concept that the ability of human beings to learn is at the heart of development is not new. In fact, it can certainly be said that human competence in creating knowledge has been the crucial factor for development in any society, at any historical moment" (Conceição, Heitor, Gibson, and Shariq 1998:186).

and researchers. Diffusion of innovations is a suitable theoretical framework for telecenters for at least three reasons: (1) the predictive potential of diffusion theory makes it useful for telecenter planning and design, (2) diffusion theory provides a fertile incentive to stimulate telecenter research—research that, in a circular way, can contribute to further shape the theory, and (3) diffusion theory is versatile and can be adapted to fit the needs of multidisciplinary inquiry.

One of the key strengths of diffusion theory is its capacity to provide a general framework for telecenter researchers and practitioners. Diffusion theory is not presented here as an exclusivist or exclusionist model but as a conceptual meeting point that embraces other theoretical approaches to help illuminate telecenter research and practice. In this sense, it is important to underline that some other theories should be included in the study of telecenters under the guiding framework that is presented in this paper. Some of these relevant theories are social learning or social cognitive theory (Bandura 1977), the theory of reasoned action (Fishbein and Ajzen 1975), the theory of planned behavior (Ajzen 1985), the decomposed theory of planned behavior (Taylor and Todd 1995), institutional theory (King, Gurbaxani, Kraemer, and McFarlan 1994; Montealegre 1999b), the recent technology acceptance model (Davis 1989), and the theoretical body of the knowledge gap hypothesis (Olien, Donohue, and Tichenor 1984; Tichenor, Donohue, and Olien 1970), and the communication effects gap (Rogers 1976c). These theories are mentioned in the following sections.

After briefly reviewing the core of the theory, this paper focuses on the three aspects of diffusion that are most pertinent for telecenter application: the perceived attributes of innovations, the communication aspects of the diffusion process, and the consequences of innovation adoption. The next section explains why these three aspects of the theory are selected over others. The paper concludes with a summary of the implications of diffusion theory for telecenter research.

Use of Diffusion Theory in Telecenter Research

In his seminal work, *Diffusion of Innovations,* Rogers (1995) synthesizes 50 years of diffusion research and distills it into a set of general principles that explain how a new idea or innovation propagates in a social system. This cogent set of conceptual generalizations is usually referred to as *diffusion theory.*[3] Diffusion of innovations can be considered a middle-range theory. Middle-range theories are "theories that lie between the minor but necessary working hypotheses that evolve in abundance during day-to-day research and the all-inclusive systematic efforts to develop a unified theory that will explain all the observed uniformities of social behavior, social organization and social change" (Merton 1968:39). Middle-range theory organizes a body of findings from replicated studies into a structured system of principles. Theories framed in this way must be amenable to empirical testing and falsifiability (Chaffee and Berger 1987). In fact, middle-range theory is principally used to guide empirical inquiry (Merton 1968).

The kind of diffusion theory discussed in this paper does not relate to the classical diffusion model—linear and effects-oriented in nature and methodologically stagnant—that has been much criticized (Beltran 1976; Díaz-Bordenave 1976; Melkote 1991) and self-criticized (Rogers 1976a, 1976b) in the past.[4] Diffusion theory stands today as a fertile ground for conceptual and methodological creativity.[5] It cuts across different social science disciplines and is applied in very different contexts (Rogers 1995; Downs and Mohr 1976). The emphasis of the theory is on the process of social change. It incorporates the "stochastic evolutionary nature of innovation" and leaves room for the "diversity and complexity" of the change process (Nelson and Winter 1977:48).

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3. In this paper, the terms diffusion *and* diffusion theory *refer exclusively to diffusion of innovations as framed by Rogers (1995). This disclaimer is important because different social sciences use the word* diffusion *with a different meaning.*

4. In this sense, Mansell (1996:20) points out that there is a "demise of linear models of innovation" and a "birth of models that are collectively referred to as complexity models. These models recognize that living systems are dynamic, and that they are characterized by non-linearity and an inherent instability."

5. Diffusion of innovation studies keep growing. In the forthcoming fifth edition of Diffusion of Innovations, *Rogers counts up to 6,200 innovation publications, compared with the 4,000 publications he counted for his 1995 edition (E. Rogers, personal communication, October 2002).*

Diffusion of innovations theory describes the social process of communication of a new idea among the members of a community over time. The focus of the theory is not only on awareness and knowledge but also on attitude change and the decision-making process that lead to the practice or adoption of an innovation (Rogers and Singhal 1996). The objective is to explain the dynamics of social construction and gradual assimilation of an innovation. The theory includes conceptual generalizations about (1) how and through what media an innovation is communicated, (2) the attributes of innovations, (3) the decision process that leads to adoption (or nonadoption), and (4) the characteristics of adopters. Additionally, there is an increasing theoretical concern about the consequences or effects of innovation adoption (Rogers 1995).

The consideration of contextual factors in shaping the diffusion and adoption of innovations is an aspect that cuts across all aspects of diffusion theory (Rogers 1995). Contextual variables are even more emphasized in diffusion research in developing countries (Yapa and Mayfield 1978). In this regard, there are many studies stressing the multidimensional nature of environmental contexts that influence the diffusion of information technology in developing countries (Avgerou and Walsham 2000; Azad, Erdem, and Saleem 1998; Davis 1992; Jain 1997; Lind 1991; Loch, Straub, and Kamel 2003; Mahmoud 2002). The focus is not only on economic and general infrastructure indicators but also on local value systems, living habits, social norms, and culture. Attention to such contextual factors helps prevent the usual "misfit between models and reality" (Lehmann 1995:156) and "the gap that can sometimes exist between the rationality of information systems design and the political/behavioral actualities of developing country organizations" (Heeks 2002b:107). Austin (1990) provides an excellent framework for the study of environmental factors conditioning management operations in developing countries. The environmental analysis framework proposed by Austin is divided in four major categories: economic, political, cultural, and demographic factors. This framework could be use-

ful for researchers to identify systematically contextual variables that operate in telecenter diffusion. In addition, the application of institutional theory (King et al. 1994; Montealegre 1999b) provides a model to assess the influence of the broader institutional environment on rural telecenters. According to King et al. (1994:162), "The role of institutions must be considered an essential component in any theory of innovation." This institutional perspective can provide a comprehensive systemic approach and a macro context to explain the diffusion process of telecenters.

Most diffusion researchers exercise an extenuating replication of studies about the well-known S-shaped curve of adoption and the categorization of adopters. Although that investigative redundancy has helped consolidate an important part of the theory, it has also paralyzed more challenging theoretical exploration. Consequently, the description of the adoption decision process and the classification of adopter categories are germane ideas for the planning of telecenter strategies but should not be a priority for telecenter research.[6] In applying diffusion theory to telecenter research, the most relevant points are to understand: (1) the perceived attributes of innovations: how the community perceives the telecenter and the services it provides, (2) the communication process: how telecenter innovations are communicated and shared and how other innovations are created or sought for at the telecenter, and (3) the consequences of adoption: studying costs and benefits and general socioeconomic impact of community telecenters. The next three sections elaborate on these three issues.

Perceived Attributes of Innovations

A centerpiece of diffusion theory relates to the perception of innovations by potential adopters. Rogers (1995) describes the characteristics of an innovation in terms of its perceived attributes. The old adage that perception is reality is resonant in this case. The principal perceived attributes of an innovation are relative advantage, compatibility, and complexity. Rogers describes two additional innovation attributes: trialability, or "degree to which an innovation may be experimented with on a limited basis"

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6. Nonetheless, it is important to understand that diffusion theory is a compact systemic body of interrelated concepts. In this sense, although the adoption decision process and the classification of adopters is not included in this paper for the reasons mentioned, these elements of the theory may be implicitly grounded or explicitly presented in research about other interconnected aspects of the theory, such as the consequences of innovations.

(p. 243), and observability, or "degree to which the results of an innovation are visible to others" (p. 244). These two attributes could also be applied to telecenter research. However, they are not analyzed in this paper because: (1) Rogers does not consider them as important as the other three and (2) these two attributes do not place much emphasis on community perception, as they mostly describe intrinsic characteristics of innovations. Furthermore, in their meta-analysis of diffusion studies, Tornatzky and Klein (1982) report that compatibility, relative advantage, and complexity are indeed the three attributes most consistently connected to innovation adoption in general.

Relative advantage indicates the perceived costs and benefits involved in the adoption of an innovation, mostly in terms of economic return but also in terms of immediacy of reward, social prestige, or savings in time and effort (Rogers 1995:216). Compatibility is the degree to which an innovation is perceived to match the needs, capacity, values, and surrounding social norms of potential adopters (p. 224). Finally, complexity is the "degree to which an innovation is perceived as difficult to understand and use" (p. 242). Not surprising, relative advantage and compatibility are positively related to innovation adoption, whereas complexity is negatively related to adoption.

The study of community perceptions has substantial strategic value for the design of telecenters. Perceptions of relative advantage and complexity are integral to telecenters, as telecenters aspire to become people-centered and financially sustainable projects for social and economic self-development (Roman and Colle forthcoming). Compatibility is also an issue of concern for telecenter practitioners. In this regard, some authors are advocating the promotion of needs assessment research (Roman and Blattman 2001) and community participation (Roman and Colle 2001) to ensure that telecenters are demand driven and contextually relevant. This issue is closely connected to the supply-push and demand-pull theory in innovation diffusion (Thirtle and Ruttan 1987; Zmud 1984). This theory basically states that "innovation is most likely to occur when a need and a means to resolve that need are simultaneously recognized" (Zmud 1984:727).

These three innovation attributes are still mostly unexplored in the telecenter context. However, they have already created controversy among critical scholars that perceive information technology as an inadequate (too complex, extraneous, or irrelevant) tool for rural poverty alleviation (Gumucio-Dagrón 2001; Wilson and Heeks 2000).

Together with the conceptualization of perceived attributes, Rogers (1995) introduces another important idea: reinvention. Reinvention is defined as "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers 1995:174). The concept of reinvention—the assumption that there is no one-size-fits-all innovation template—is generally embraced by telecenter practitioners. This happens because telecenters are supposed to be flexible and malleable tools (Colle and Roman 1999). As Rogers writes, "An innovation that is an abstract concept or that is a tool . . . with many possible applications is more likely to be reinvented" (1995:178). Consequently, the concept of reinvention should also be incorporated to the telecenter research agenda. This research would imply "a recognition of the interpenetration of technology with social forms and systems of meaning" (Pfaffenberger 1988:244). Reinvention should not be framed as a single descriptive snapshot of telecenter adjustment to a specific community but as a constant process of social construction and reconstruction of telecenters as a functional place. A comparative study of different telecenter reinvention—or local improvisation (Heeks 2002b)—processes could be useful in conceptualizing the social mechanism by which communities appropriate telecenters.

For telecenter research, the study of perceived innovation attributes needs to consider that a telecenter is an innovation that contains an inventory of innovations. Therefore, there are two different (but closely interrelated) levels in the study of community perceptions: (1) telecenters as a functional entity composed of technology, management, organization, and people (telecenters as an institutional innovation in the community) and (2) telecenters as a package of communication and information services (telecenters as a cluster of innovations). This is what we could call the hardware and software aspects of telecenters. However, the use of these words is made here with some reservation. Although the concepts *software* and *hardware* (borrowed from Rogers [1995]) are useful to explain the attributes of innovations, they may cause some terminological

confusions: on the one hand, hardware aspects of telecenters refer not only to technology but also to the idea of telecenter as a place, the place itself as a community organization, and the people that run it; on the other hand, the word *software* here includes all the services provided by a telecenter, and these may entail more than just content or information. Additionally, it is not clear how perceptions of technology are separated from the perception of the uses that technology provide. Therefore, telecenter researchers still need to formulate a more rigorous conceptual classification of what constitutes the hardware and software of telecenters.

In any case, both levels deserve close research attention. The interest of research on hardware aspects of telecenters (telecenters as a new organization, as an innovation in itself) is particularly compelling. However, the most important issue is to understand the interdependency between the hardware and software aspects of telecenters, for example, the interrelationship between perception of computers (a hardware issue) and the use of telecenter services (a software aspect). Moreover, not everything in the telecenter is necessarily an innovation or perceived as new by members of the community. In this case, new ideas and old ideas live side by side under the same roof. It is then pertinent to study how familiar services or customary aspects of telecenter operations influence the diffusion and adoption of neighboring innovations.

The technology acceptance model could be useful in the operationalization of technology perceptions for telecenter research (Davis 1989; Davis, Bagozzi, and Warshaw 1989; Adams, Nelson, and Todd 1992). The technology acceptance model theorizes that perceived usefulness and perceived ease of use are fundamental determinants of computerized information system use. The technology acceptance model is also connected to other social psychology theories of behavior change, namely, the theory of reasoned action (Fishbein and Ajzen 1975), the theory of planned behavior (Ajzen 1985), and the theory of social cognition (Bandura 1977)—that are already integrated in research and theory building on information technology perceptions in the diffusion tradition (Mathieson 1991; Moore and Benbasat 1991; Taylor and Todd 1995; Venkatesh and Davis 2000). However, once the relevance of the technology acceptance model and other related technology perception theories for telecenter re-

search has been indicated, it is important to remember that telecenters do not only provide access to computers (and not always direct access to computer services), as telecenters may offer access to other relevant technologies such as video, audio cassettes, and print materials (Colle 2000; Colle and Roman 1999). Additionally, rural telecenters function in societies where interpersonal discussion, word-of-mouth communication, and other traditional channels are extremely important. Nevertheless, it is certainly possible and desirable to adapt the technology acceptance model constructs (Davis 1989; Venkatesh and Davis 2000) and other related measurement instruments (Moore and Benbasat 1991)—as well as the recent decomposed theory of planned behavior (Taylor and Todd 1995)—to study perceptions of the different dimensions of telecenters and how these perceptions may lead to social change. In any case, these theoretical constructs should always incorporate sociostructural and other contextual indicators that influence behavior change, most noticeably in rural developing countries. Failing to do so may produce the common individual blame bias or the predisposition to hold individuals responsible for their problems, ignoring their environmental constraints (Rogers 1995:114).

The Communication of Innovations

Communication is the heart of diffusion of innovations theory. "The essence of the diffusion process is the information exchange through which one individual communicates a new idea to one or several others" (Rogers 1995:18). In general, mass media are considered the best channels to create awareness about innovations, whereas interpersonal channels are crucial for persuasion and adoption of final decision. Diffusion theory emphasizes interpersonal communication more than any other area of communication research (Rogers and Singhal 1996). In this sense, diffusion of innovations is closely linked to the study of social networks (Rogers and Kincaid 1981; Coleman, Katz, and Menzel 1966). Diffusion theory states that "individuals who are isolates or on the periphery of local social networks . . . are less likely to hear about an innovation, will hear about it much later, and will not have as much opportunity for social comparison" (Kincaid 2000:218).

The adequacy of these communication concepts for telecenter practitioners is manifested in different forms. One example is the use of intermediaries be-

tween the technology and their potential beneficiaries (Heeks 2002a). Some authors are proposing the use of intermediaries, such as representatives of self-help groups and other local organizations, to expand the reach of rural telecenter services (Roman and Colle forthcoming). Research shows that "small groups are an effective means for changing individuals' attitudes and behavior, especially if there is a channel by which new ideas can come into the group from external sources" (Rogers and Kincaid 1981:258). This idea is connected to Rogers's concept of homophily—"the degree to which two or more individuals who interact are similar in certain attributes, such as beliefs, education, social status, and the like" (Rogers 1995:19). According to Rogers (1995), the most effective communication occurs when participants share a high degree of homophily. This concept translates into another common lesson of telecenters: the crucial role of local telecenter champions and telecenter staff—people who share homophilous traits with the rest of community members—in promoting telecenter adoption (Colle and Roman 2001b). Finally, regarding the diffusion of telecenter information, researchers are proposing a mix of mass media and interpersonal channels as the most promising communication approach (Blattman et al. forthcoming).

The consideration of diffusion as a communication process has important implications for telecenter research. In the case of telecenter projects, innovations do not only diffuse in an outward fashion: innovations are not necessarily externally directed ideas. In a telecenter, innovations can be created, sought for, and diffused from inside: people from the community can look for innovations, or they can communicate their own ideas, which may be perceived as innovations by other people inside or outside a given community. This is connected with the question of telecenter content production and dissemination (Roman and Colle forthcoming). The issue of local knowledge has been pushed

high on the agenda during the last decade, impregnating both the research and practice of rural development (Chambers 1997). However, new information technologies have also amplified the prospects for external knowledge transfer, consequently sparking debates with a critical theory flavor (Schech 2002).

In any case, research on this distinct characteristic of telecenters can add to conceptualizations of communication in diffusion theory. It is a process of indigenous and autonomous initiative that could be called communication of innovations management. This process is related to a change in communication behavior that deserves the attention of telecenter researchers: how people at a telecenter-hosting community may become information producers and information-seeking individuals. This connects diffusion theory to social cognition theory (Bandura 1977). Bandura's (1977) concepts of social modeling and self-efficacy are significantly useful for the task of studying how individuals learn and adopt new communication and information behaviors as a result of telecenter availability.[7]

Consequences of Innovations
The study of the consequences of innovations is a theoretically less developed subject probably because it is conceptually separated from the rest of diffusion theory. Also, the subject is more unequivocally connected to evaluation concerns. Theorizing possible or desirable outcomes of innovation adoption is not so descriptive as it is prescriptive; that is, theorization of consequences is more prone to be led by value judgments. Furthermore, research on innovation consequences is admittedly challenging (Rogers 1995). The theory underscores how the sociostructural environment affects innovation diffusion and adoption. This systemic approach, applied to the study of consequences, further complicates research technical and logistical problems.[8] The most significant conundrum in measurement of conse-

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7. Regarding this link with cognitive theory, Rogers (1995:18) writes that "most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have previously adopted the innovation. This dependence on the experience of near peers suggests that the heart of the diffusion process consists of the modeling and imitation of potential adopters of their network partners who have adopted previously."

8. This picture resembles the difficulties faced by telecenter researchers (Roman and Blattman 2001). For example, in reference to the measurement of cause-effect relationships in telecenter research, Hudson (2001:171) estimates that "such a chain of inference is very complex, for telecenters are typically intended to serve a variety of community needs, which may not be as clearly defined as in projects designed for particular sectors or target groups."

quences is "untangling cause-and-effect relationships" (Rogers 1995:412).

Nonetheless, research on consequences of innovations has rendered a vital theoretical conclusion: "diffusion processes lead to inequitable development unless preventive measures are taken" (Röling, Ascroft, and Chege 1976:163). Diffusion of innovations, especially in the context of developing countries, tends to widen the socioeconomic gap between the higher and lower status segments of a social system (Rogers 1995). This is consonant with research and theory building on the knowledge gap hypothesis (Olien et al. 1984; Tichenor et al. 1970) or the communication effects gap hypothesis (Rogers 1976c). The knowledge gap hypothesis states that higher socioeconomic status segments of a population tends to acquire information at a faster rate than lower strata, so that the gap between these sectors tends to increase rather than decrease. The communication effects gap hypothesis is an extension of the knowledge gap: it expands the theory by focusing on behavioral and attitudinal dependent variables, in addition to mere knowledge or information gain. The popularity of this hypothesis and the considerable amount of research it has originated is consolidating a growing body of theory. In this sense, the knowledge gap hypothesis—arguably a part of the wider diffusion research family—could also be considered a middle-range theory or a "coherent research program" (Viswanath and Finnegan 1996:217).

There are basically two levels of analysis in the study of communication effects gaps: one is sociostructural (focusing on socioeconomic aspects and media system characteristics) and the other is more sociopsychological (focusing on aspects of motivation and information functionality; Ettema and Kline 1977; Kwak 1999; Lovrich and Pierce 1984). Research on the communication effects gap in developing countries is torn between researchers demonstrating how sociostructural barriers can hinder equal information dissemination and use (Yapa and Mayfield 1978; Fett 1975; Grunig 1971) and researchers studying the situational conditions under which those barriers can be overcome (Brown 1970; Galloway 1977; McDivitt 1985; Röling et al. 1976; Shingi and Mody 1976; Sinha and Mehta 1972). However, this theoretical model explores cross-level linkages and fosters a multilevel analysis of the issue (Viswanath and Finnegan 1996).

The application of the theoretical body of the communication effects gap to understand the impact of telecenter programs makes particular sense, at least for two reasons. First, there is the concept of differential effects. In many cases, the objective of international development programs—at least of more people-oriented and grass-roots trends in development practice, which some call popular development (Brohman 1996)—is to find ways to alleviate poverty by making sure that people most in need of positive change are reached. Therefore, many scholars study how to reach lower status groups, so that communication programs mitigate (or do not worsen) the already wide knowledge and communication effects gaps existent in developing countries, often characterized by a lopsided distribution of education and income (Shingi and Mody 1976). Evidently, the guiding principle of communication interventions such as telecenters is social change, not reinforcement of prevalent unequal social conditions (Galloway 1977). Second, the theory of communication effects gap has an underlying normative and practical value. Although research in this area is prone to bring about important policy implications, its supporting theoretical body may also help shape communication strategies. In other words, communication effects gap is a kind of normative conceptualization oriented to action, or a practical theory of communication (Craig and Tracy 1995) that can serve as a useful approach to conceptualize and design telecenter practice and research.

There are already empirical data that suggest the potential of telecenters to exacerbate existing socioeconomic inequities (Blattman et al. forthcoming). In the past, some researchers demonstrated that there are ways to avoid the communication effects gap in rural areas of developing countries (Shingi and Mody 1976:189). Today, research should reveal if, and under what conditions, a telecenter can become a local knowledge leveler (Rogers and Shukla 2001; Tichenor et al. 1970).

Summary and Conclusions

This paper argues that telecenter research spans different cross-linked conceptual levels of analysis and cannot be entirely framed within the bounds of a single theoretical perspective. However, diffusion theory provides a general framework to identify

relevant research areas that may integrate other theoretical perspectives within. After the foregoing analysis of diffusion theory, future telecenter research may concentrate on four main areas:

- First, there are the perceived attributes of telecenters and the issue of reinvention. The idea of telecenter is an innovation, a flexible new idea that can be reinvented according to the needs of the hosting community. At the same time, the idea of a telecenter, or the translation of that idea into reality, is an innovation that involves multiple innovations. A telecenter is a library of innovations, and thus a telecenter has multiple ramifications for diffusion research. On one side, researchers can study the process of diffusion and adoption of telecenters as new community institutions (a kind of ethnography of place). On the other side researchers can study the process of diffusion of specific telecenter services. The degree of interdependence of these two sides, the hardware and software of telecenters, is worthy of thorough exploration. Certainly, the study of these issues requires the effort of creative researchers. However, there are some theoretical approaches that can help in this task. Some new theoretical models such as the decomposed theory of planned behavior (Taylor and Todd 1995) and the technology acceptance model (Davis 1989) can help assess perceptions of information technology. In addition, the supply-pull theory (Thirtle and Ruttan 1987; Zmud 1984) provides an interesting standpoint to assist the planning of information and communication needs assessment research to facilitate the match between telecenter design and local user actuality (Heeks 2002b; Roman and Colle forthcoming).

- Research on telecenters can help stretch the boundaries of diffusion theory in meaningful ways. An example is the study of the process of endogenous search and promotion of locally relevant innovations explained previously. At the same time, diffusion of innovations can serve as an initial framework on which to build new conceptualizations of the role of information and communication in development. At this moment, one thing is clear: telecenters ap-

pear as an opportunity for an integrated study of small-media institutions, communication channels, and messages. The intersection of these three elements—a community-based organization that uses different media to create, search, and diffuse locally relevant content—makes telecenters a unique laboratory for researchers interested in studying how communication facilitates the process of economic, social, and cultural change. Social cognition theory (Bandura 1977), social network theory (Rogers and Kincaid 1981), and planned behavior theory (Ajzen 1985) provide attractive models for identifying the key variables in a mixed-methods study of the process of communication-related behavior change stimulated by telecenter availability and use.

- Research on the effects of telecenter diffusion and adoption is sorely needed. As suggested before, the application of the communication effects gap perspective (Rogers 1976c) seems particularly appropriate to conceptualize planning and research in this area. This approach applies cross-level linkages between structural variables (such as education and community structure) and individual sociopsychological variables (such as motivation to acquire information or perceived usefulness of telecenter services), to explain social-status-based differential access to telecenters.

- The role of environmental factors in innovation diffusion and adoption constitutes an essential element of diffusion theory. Clearly, there are many elements that could be considered in the assessment of the contextual environment of telecenter adoption (Austin 1990); however, the application of an institutional perspective might prove particularly useful, as indicated previously. As King et al. (1994:147) argue, "The incorporation of an institutional component in research related to IT development and use is both inevitable and valuable." Telecenters are indeed influenced by such institutions as international agencies, government authorities, research institutions, and a plethora of local institutions (including local government, cooperatives, self-help groups, and already existing local media). Researchers need to ascertain the role of these institutions in the

process of telecenter diffusion and adoption, and determine the dimensions of institutional intervention in the interplay of supply-push and demand-pull dynamics inherent in telecenter development (King et al. 1994). Drawing a map of the dimensions of institutional interventions (in terms of technology transfer, subsidy provision, knowledge building, mobilization and promotion, and other institutional functions) would be very useful for telecenter planning and implementation (King et al. 1994; Montealegre 1999b).

Diffusion theory is also an important reference to help develop a program theory (Chen 1990) or a practical theory (Craig and Tracy 1995) of telecenter projects. Such telecenter program theory would include both an explanation of interrelationships among program variables and value judgments on how to design and implement that program. A program theory of telecenters would help guide telecenter research and implementation. This is a kind of theory largely advocated by John Dewey (1930), whose concept of social science invariably linked knowledge to action.

Finally, understanding the multilayered nature of telecenters—in other words, framing telecenters as a question of multidisciplinary inquiry—is the first requisite to deciding where telecenter research may go, the variety of theories it may draw from, and the new theoretical possibilities it offers. In this endeavor, diffusion theory provides a common conceptual ground to bridge different conceptual and methodological approaches to the study of telecenters. ∎

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