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Investigating the Effects of Micro-enterprise Access and Use of ICTs through a Capability Lens

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Investigating the Effects of Micro-enterprise Access and Use of ICTs through a Capability Lens: Implications for Global Development

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Abstract
Technology has been shown to effectively enable economic growth at the firm and national level. Yet ICT's effects upon, and the process by which it is incorporated into, microenterprises, remain largely unknown. This paper explores, through two case studies, interventions that enabled micro-enterprises (businesses with low revenues and one to five employees) in underserved communities to connect to the Internet, obtain technical assistance, and take advantage of free and low cost software. The cases illustrate instances in which the introduction of ICTs increased microenterprise mobility, ability to organize customer information, and connected microenterprises to other microenterprises. The cases also depict a number of related (secondary) benefits arising out of the microentrepreneurs' improved technology usage and literacy. The contribution of the paper is in illuminating patterns of access and use, concepts, and relationships that enable micro-enterprises to use ICTs to achieve what is valuable to them. The implications for global development lie in highlighting ideas, research techniques, and practices that are working 'in the field' in relation to ICT adoption by microenterprises, so that these techniques may be deployed and improved upon by others.

Introduction

It has been suggested that the development of underserved communities can benefit from the use of IT (Steinberg 2003; Warschauer 2003), as both use and understanding of technology greatly improve per-capita productivity (Benoit et al. 2002; Kosempel 2007). Global development can be facilitated by technology if it enables people to achieve their potential. As Castells observes in his book, "The Internet Galaxy," economic productivity is increasingly tied to technology access and knowledge, wherein any connected networks of production are employed and discarded rapidly based on utility, utility being determined in part by the permeability of said networks to new information (Castells 2001). Qureshi, Keen and Kamal illustrate the transformative effects of information exchange, termed 'knowledge networking,' showing through vignettes how low cost communications technologies combined with basic technology literacy and collaboration reshape business processes. The authors also illustrate the flipside: how failures to assimilate information due to lack of literacy or connectivity can isolate businesses from the global economy and inhibit growth and development (Qureshi et al. 2009b). Thus, it becomes clear that a basic problem for global development relates to 'disconnected' communities, or communities that for whatever reason, have not been able to adopt technology associated with communication.

Within underserved communities, connectedness is a basic problem; the adoption of ICT has been shown to provide other benefits, however (Warschauer 2003) (Steinberg 2003), as both use and understanding of technology greatly improve per-capita productivity (Kosempel 2007) Information and Communication Technologies (ICTs) can be seen to bring about development by transforming business processes and practices in the areas of management, personnel, marketing, administration, service, sales, purchasing, and/or processing of goods (Knol et al. 2001) (Qureshi et al. 2009a). In this research, ICTs are the technologies that enable micro-enterprises to exchange information, communicate with each other and access needed resources. In particular these include computing, mobile and internet technologies and software that allows access and use of the capabilities enabled through the technologies. Through business transformation, ICT may enable an entrepreneur to achieve his or her goals by giving him/her the 'means to achieve,' the 'freedom to achieve' (Zheng 2009). Enabling a micro-entrepreneur to achieve his or goals enables local, and ultimately global, development.

It has been suggested that a primary driver of economic growth in underserved communities is the microenterprise (Qureshi 2005). In Nebraska, for example, microenterprises, or business with one to five employees run by a sole proprietor, constitute 87% of the economy (Qureshi et al. 2009a). Yet despite the fact that small businesses, or micro-enterprises, may serve as the basis for industrialization (Levy et al. 2001), seem to provide more stable jobs than larger enterprises, and have greater positive indirect effects on the communities in which they reside, micro-enterprises have been neglected both theoretically and from an integrative policy standpoint (Gillard et al. 2007; Schreiner et al. 2003) (Hollifield et al. 2003; Wolcott et al. 2007). If understanding processes of global development is the goal, the necessity of studying the capabilities and behaviors of micro-enterprises should be apparent.

This paper investigates the ways in which technology may enable microenterprises to survive and stay competitive in the global economy. In particular, it applies Sen's capability model to in service of scrutinizing how ICTs enable micro-enterprises to achieve what they think is valuable to them. This paper builds upon current research by considering not just the ICT effects of technology assistance, but also the preceding commodities and capabilities as described by Zheng (Zheng 2009). Two cases, involving use of and access to, ICTs, are used to illuminate patterns of behavior and effects that may be worthy of other researchers' consideration in conducting future investigations. The cases illustrate instances in which the introduction of ICTs increased microenterprise capabilities via increased mobility, ability to organize customer information, and by connecting microenterprises to the community as well as to other microenterprises.

The intent of the study is to twofold: to deepen and elaborate upon concepts suggested in related research, through a process of triangulation (see Kamal 2009), and to offer replicable techniques, tactics, and modes of analysis to microenterprise development practitioners in other parts of the word. Microenterprise development programs have not yet produced the kind of quantifiable impact hoped for (Nagle 2007). Often they are haphazardly distributed and poorly run (Schreiner et al. 2003). The findings in this study add mortar to the foundation upon which such programs can be built.

Theoretical Background

As structural economic barriers are removed, communities' potential for human and social development is unlocked (Norris 2002). Unfortunately, ICT Adoption remains poorly understood in the microenterprise context (Qureshi et al. 2009a). In general, it appears that ICT is not being adopted as readily due primarily to the high learning curve associated with technology, for the average entrepreneur (Piscitello et al. 2004). Technological solutions can be very difficult to implement when an organization has limited resources and support networks. As a result, it may be unclear whether the benefits of technological implementations outweigh the costs (Furuholt et al. 2006). Enabling micro-enterprises to grow with technology can enable an increase in firm-level competitiveness to be achieved with technological interventions targeted to business needs (Qureshi et al. 2009c). Studies have shown that when microenterprises adopt ICT they can grow by 3.4% and that the innovative uses of ICTs can provide new opportunities for microenterprises (Qiang et al. 2006).

A number of theories have been proposed to explain ICT Adoption in small businesses; it is important to review these theories, even while recognizing that they may not apply specifically to microenterprises. One theory holds that ICT capacity building in small businesses may be strongly linked to a concept known as 'internal transparency,' this being the clarity with which an entrepreneur can understand the business he or she manages. Under this theory, the need to upgrade comes from changing informational requirements (Street et al. 2004). It has also been suggested that small business ICT adoption growth occurs when ICT can improve existing practices, when there is concern about competition, when ICT-focused consultants are used, and/or when a technically orientated manager is present. Growth may be inhibited by a lack of understanding of ICT, a lack of ICT-related skills, and a shortage of time or resources (Cragg et al. 1993) (Sadowski et al. 2002) (Iacovou et al. 1995). Some research posits that ICT Adoption in small business is a psychological process involving factors as Perceived Ease of Use, Behavioral Beliefs, Normative Beliefs, and Control Beliefs, interacting with Perceived usefulness, Attitude, Subjective Norms, to produce an "Intent to Adopt" (Riemenschneider et al. 2003). Another theory proposes that ICT Adoption is dictated by firm-level strategy and the kinds of customers a firm has and describes four situations that may arise from the interaction of these two factors, termed Coordination, Innovation, Efficiency, and Collaboration. The researchers suggest that market events and/or business decisions may propel a business into a different quadrant (Levy et al. 2002).

Wolcott et al. (Wolcott et al. 2007) and Qureshi et al. (Qureshi et al. 2008), have suggested that traditional models of technology acceptance (TAM and UTAUT), do not adequately explain technology adoption by micro-enterprises: despite understanding on a theoretical level the benefits and usefulness of ICT solutions and being given ICT resources, micro-entrepreneurs in these studies failed to adopt new technologies.

In a microenterprise, as opposed to a larger business, rigid hierarchies are absent by virtue of the (small) size of the organization. Moreover, it becomes difficult to argue that the interactions among 1-5 people comprise a culture, let alone that abstract intra-business 'subjective norms' and 'image' concerns drive ICT access and use. An evolving body of research has suggested that the *social relationship* is the most useful unit of

analysis for understanding concepts tied to microenterprises (Vargas 2000) (Greve et al. 2003) (Elfring et al. 2003). According to Vargas, micro-entrepreneurs who possessed strong community ties were more successful than those who lacked such ties.

Sen's (1992) capability framework can shed light into how micro-enterprises may access and use ICTs in ways that are of value to them. A cogent treatment of Sen's work comes from Zheng (Zheng 2009). Summarizing, Zheng notes that:

> *"The major constituents of the capability approach are 'functionings' and 'capabilities.' Functionings are the 'beings and doings' of a person, whereas a person's capability is 'the various combinations of functionings that a person can achieve.' Capability is thus a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another… In other words, functionings are considered constitutive of well-being. The term refers to realized achievements and fulfilled expectations, whereas the notion of capabilities 'represents a person's freedom to achieve well-being (Sen, 1987, p. 49)' and refers to effective possibilities of realizing achievements and fulfilling expectations."*

The capability model describes capabilities by illustrating how starting conditions (characteristics) constrain capabilities via personal, social and environmental factors. Zheng (2009) comments that:

> *The extent to which people can generate capabilities from goods and services is influenced by three sets of conversion factors—personal, social, and environmental characteristics (Sen, 1992, pp. 79–87). Personal characteristics, such as mental and physical conditions, literacy, and gender, influence the types and degrees of capabilities a person can generate from resources. Social factors are a number of characteristics of social settings, such as social norms (e.g., role of women, rules of behavior, materialism, religion), social institutions (e.g., rule of law, political rights, public policies), and power structure (e.g., hierarchy, politics). Environmental characteristics, including climate, infrastructure, institutions, and public goods, also play a role in the conversion from characteristics of the goods to individual functionings.*

This paper builds upon this research by considering not just the ICT effects of technology assistance, but also the preceding commodities and capabilities as defined by Zheng (2009). Following Sen's original idea, it suggests how processes involving increased knowledge results in a virtuous circle of 'capabilities enabling capabilities.'

The 'effects' of the ICT interventions are described in both structured and unstructured ways, to illustrate how ICT enables microentrepreneurs to achieve what they consider valuable. Qureshi's framework is useful for organizing the structured description of effects. As the reader may not be familiar with this work, it is summarized here:

Qureshi proposed that 'successful' implementation of ICTs in microenterprises may aid these businesses via improved access to information, knowledge, and expertise, improved competitiveness and access to markets, greater administrative efficiencies, and greater learning and increased labor productivity. The end result of these improvements is

a reduction of poverty (Qureshi 2005), which is an outcome desirable from the standpoint of global development. Detailed descriptions of each effect follow:

Access to New Markets:

The ability of businesses to reach new customers via, for instance, web advertising, social networking, or other methods of communication. This may be viewed, to some extent, as an ICT facilitated increase in an entrepreneur's 'social capital' (Greve et al. 2003), which permits an entrepreneurs to 'discover opportunities,' 'secure resources' and 'obtain legitimacy' (Elfring et al. 2003).

Administrative Efficiencies:

The ability to maintain day-to-day operations more efficiently. ICTs such as digital calendars, accounting systems, and timekeepers reduce the administrative overhead associated with basic business tasks (Qureshi 2005).

Access to Information and Knowledge:

The ability of businesses to discover previously inaccessible information via the use of ICTs. For example, ICTs may assist small businesses in obtaining information about local pricing fluctuations, or information about the competition (Grosh et al. 1996). Access to information is often taken for granted in the developed world context. Warschauer, however, points to cases in which unequal access to technology occurs across geographically close communities; he contrasts resources offered to students attending Beverly Hills High School in California, to those offered in Inglewood High School (a largely African American neighborhood) (Warschauer 2003). Other researchers have used case studies to illustrate similar disparities. In Switzerland, for example, large resource access differences appear when contrasting urban to rural communities, women to men, and older to younger individuals (Vodoz et al. 2007).

Productivity:

The ability of businesses to accomplish more in terms of their core functions via the use of ICTs. Research indicates that use and understanding of technology greatly improves per-capita productivity (Kosempel 2007) (Benoit et al. 2002) (Wolcott et al. 2007), although simply offering tools to increase efficiencies does not improve productivity unless attitudes and processes change as well (Dijk et al. 2006). Productivity may also imply the employment of previously underutilized individuals. The inability to exploit local talent in underserved communities leads to outsourcing, further depressing the economies of communities (Qureshi et al. 2009b).

The 'unstructured' portion of the case study probes the 'secondary' consequences of the direct effects in an inductive manner, the goal being to illuminate patterns of change arising out of the direct effects. The justification for this dual analysis format is that it offers both general and specific insights: where the descriptions of the direct effects illustrate, broadly, the consequences of simple, replicable technological interventions, the descriptions of secondary effects contextualize and deepen the case studies through the provision of insights into how ICT introduction alters 'vectors of functioning,' 'commodities,' and the microentrepreneur's environment.

It is hoped that the case studies (and the program that made them possible) are of some interest not only to private ICT-introducing organizations, but also to public policy makers. Governments have a strategic interest in reducing community-based divides by

fostering the growth of micro-enterprises (Servon et al. 2000). Whether that strategic interest is best served by simply lowering regulatory barriers or via some form of explicit public/private partnership, is as yet unclear (Peters et al. 2004). Recent efforts in Germany have investigated the possibility of matching University students with local companies in order to facilitate bi-directional knowledge transfer as a means of facilitating development (Rohde et al. 2007). Similar technology transfer programs exist around Universities in the US (Fisher et al. 2004), but have not yet born fruit (Nagle 2007). What is certain is that such skills/technology transfer programs and increasingly popular around the world (Rohde et al. 2007). Given this fact, research is needed to clarify whether such programs are needed, and if so, what form they should take and what kinds of policies they should adopt in order to facilitate sustainable development within communities.

Methodology

This research was carried out as part of an initiative called "eTeams" at the University of Nebraska, Omaha. eTeams are cross-disciplinary, student-led teams that assist micro-enterprises in using ICT to grow their businesses. This process is carried out by 'ICT Therapists' who administer customized solutions to address very specific business problems. The ICT Therapists administer these solutions through training, trust building, and technology implementation. The outcomes of these interventions are measured in terms of economic, social, and human development criteria. The training of ICT Therapists began in 2006 with the IT for Development course offered in the College of IS&T. These ICT Therapists became part of eTeams in 2007 when funding was secured for them through the NU Foundation.

The method of this study is case study research, involving an in depth qualitative analysis of situations over a period of approximately five months, including extensive journaling/observation, as well as two formal (pre and post) interviews for each micro-enterprise, from which verbatim transcripts were produced. Both ICT interventions were conducted by the same researcher.

Case studies employ semi-structured interview techniques to uncover the attitudes, relationships, and reasoning of individuals and social groups. Yin (Yin 2003) suggests that case studies are an optimal research strategy for answering 'how' or 'why' questions in poorly understood situations over which the investigator exercises little control. As discussed in the literature review, ICT Adoption in microenterprises has not yet been thoroughly investigated. As well, the process by which microentrepreneurs adopt ICT is entirely voluntarily, and subject to the microentrepreneurs' motivation, as well as a variety of economic and environmental conditions outside of the investigators' control. Thus, the case study method seems well suited to the subject.

In a relevant section of his book, Yin addresses the oft-repeated criticism that single case studies are not generalizable, by suggesting that case study research may be generalized to theory. Indeed, this research is meant to complement existing theory (Sen's capabilities) and deepen understanding of its relation to practice by applying said

theory to ICT-related events and conditions. It is hoped that, even if the associations produced are tenuous, they may still provoke creative thinking on the part of investigators in the microenterprise context seeking to address the same problems, and that the narrative quality of these case studies will lend them some conceptual power (Dyer Jr et al. 1991).

This study draws on Klein and Myers' seven principles of good case study research, which are as follows: 'The principle of the hermeneutic circle' asserts that case study research should cope with the 'interdependent meaning of parts and the whole.' The 'principle of contextualization' asserts that case study research should illustrate 'how the current situation under investigation emerged.' The 'principle of interaction between the researchers and the subjects' asserts that the researcher should attempt to understand "how the research..[is] socially constructed through the interaction between the researchers and participants." Other key principles suggest how case study results may be generalized, how contradictions may be resolved, how to integrate multiple interpretations from interviewees, and how to filter out biases (Klein et al. 1999).

The two cases were selected based on their applicability to the global development context, specifically because they illustrate ways in which the provision of internet connectivity, training, free software, added mobility, better organization of customer information and the use of internet social networking technologies can facilitate positive ICT outcomes. The two chosen microenterprises are paradigmatic in that they possess very limited resources in terms of time, money and the ability to access and use ICTs. The microenterprises selected also meet the criteria of underserved businesses as defined by previous work (Qureshi 2005); they are sole proprietorships with low relative incomes (less than 25,000 US Dollars per annum). Furthermore, one participant was an ethnic minority (Native American), whereas the other participant based her business in an underserved area (North Omaha).

Mode of Analysis

The study describes the members of the underserved communities, as well as any ICT Artifacts important to them (Orlikowski et al. 2001) through what is essentially a 'capability' lens. The capability lens, drawing on Zheng (Zheng 2009), is formulated as a description of the evolution of the characteristics and potential functionings of an individual, which equates in this context to a description over time of the capabilities that an individual undergoing ICT Therapy has to succeed, success being defined in terms of obtaining *Access to New Markets*, *Administrative Efficiencies*, *Access to Information and Knowledge*, and *Productivity* improvements (Qureshi 2005). Attention is paid to the research questions suggested by Zheng for the ICT frame, including:

1. What contributions has ICT made to an individual's ability to achieve what they consider valuable?
2. What personal, social, and environmental factors interact with the ICT artifacts in the case to enable the individual's potential achievement?
3. What rationale do the ICT adopters hold for their needs and aspirations?
4. How did the ICT intervention address the disadvantages/deprivations present in the individual's situation?

Answers to the above questions will be arrived at using an inductive approach that enables patterns to be identified in the data, concepts and relationships to be discovered. These concepts and relationships will enable us to theorize about how micro-enterprises can use ICTs to achieve what is valuable to them. It is hoped that the analysis will shed light on how innovative deployment of ICTs can enable positive ICT Adoption outcomes.

Results

The results of this study for each case are structured as follows: In order to explore how micro-entrepreneurs use ICTs to achieve what they think is valuable to them a picture of the business' initial conditions is drawn. Subsequently, ICT interventions performed by the researcher on behalf of the business are described. Finally, the effects of the ICT Adoption are broken out using the Qureshi (2005) ICT effects to highlight pertinent concepts and relationships. For each case, 'secondary' effects of ICT adoption derived from inductive analysis are illustrated using conceptual diagrams as well as quotes and descriptions of observations on the microenterprise owners. The goal of these exercises is to provide the reader with a 'capabilities' perspective of what has occurred as a result of the ICT intervention, which is to say, to highlight both the direct and indirect changes to capabilities and functionings that permit the microentrepeneur to achieve what he/she considers valuable.

Case 1: EN, At Your Service Marketing

Initial Conditions

At Your Service Marketing (AYS), owned by the sole proprietor EN, greets newcomers to the Nebraska area with a gift package and flyers from local businesses. Local businesses pay AYS to include their flyers in the gift package. Though simple in concept, the business nonetheless faces severe logistical challenges and pressures.

The first major challenge is to acquire local advertisers, which entails soliciting and canvassing area businesses on a regular basis. The second challenge involves retaining said customers by maintaining a wide customer distribution network by finding and gifting as many newcomers as possible each month. The challenge is exacerbated by EN's 'guarantee' that if AYS does not reach a threshold number of newcomers, AYS' subscriber businesses will not be obligated to pay any fees. To address the first challenge, EN attends many social networking functions, such as chamber of commerce meetings, small business seminars, and so on, to push AYS' services. This approach has been successful in giving AYS leads.

The main issues for AYS revolve around the second challenge; customer retention implies the maintenance of an efficient, friendly, gift distribution operation that can canvas neighborhoods across the Omaha area. To address this challenge, EN employs a revolving cast of temporary employees -- in-person and phone greeters, who are paid on a per-greeting basis. Assigning, tracking and verifying greetings is a laborious manual process for EN. Additionally, due to the nature of the task involved, which involves 'customer rejection' of solicitations, AYS has a high employee 'churn' rate. According to EN, this fact greatly curtails her business' expansion, as she must constantly train new

employees, and then evaluate their greeting performance. Effective friendly greeters, are, according to EN, hard to find, incentivize, and keep.

EN's manual process of lead acquisition causes difficulties as well; to find leads, EN reads newspaper entries on property sales, scans spreadsheets from magazines, calls people 'in-the-know,' and uses potential customer lists issued via weekly updated spreadsheets from several commercial providers. EN types all this information into a single spreadsheet, types the spreadsheet into an online system, and then assigns greeters singly via the online system.

Given this description what are EN's initial capabilities in relation to ICT there are two ICT artifacts involved in EN's business. The first artifact is her Microsoft Excel spreadsheet tracking system. The second artifact is her online greeting tracker / reporting system. The spreadsheet enables EN to (inefficiently) consolidate information from commercial sources and informal sources. The online system enables her to track employee progress; employees mark customers as 'greeted' in a web form. Both artifacts assist EN in achieving her goal of maintaining a wide distribution network. The form of assistance the artifacts provide is, however, strictly administrative.

From a personal standpoint, the spreadsheet system is costly to EN. Maintaining it takes a great deal of time, because the spreadsheet lacks the intelligence to discard or merge 'duplicate' entries, consolidate entries from multiple sources, and 'vet' line items for compliance with certain basic standards (e.g. presence of a valid phone number). In interviews, EN indicated that spreadsheet maintenance was eating into her evenings and weekends. The web system, as a dumb entry and reporting terminal, is also costly to EN; due to the fact that it cannot import spreadsheets, EN must retype all spreadsheet information in order to enter data into it. EN's lack of knowledge about the kind of macro or other programming necessary to make the spreadsheet smart has limited her capabilities.

The ICTs in the case interact with EN's (stressful) environment in a way that is not favorable to her goals; by requiring a large amount of tedious manual labor to maintain, the ICTs have been eroding EN's ability to expand her business by making and maintaining strategic connections, and actively monitoring and encouraging her employees. The ICTs were developed in a manual-labor-intensive environment to save time and reduce stress. Ironically, EN claims that she experienced less stress under her earlier paper system, which also apparently produced superior results. The fact that her data providers have switched to electronic only formats, however, has forced her to abandon the paper process. EN's stated rationale for using these particular ICT artifacts is necessity; she needs to track greeters and customers in order to make money, and she has no other way of accomplishing that than via these particular artifacts.

EN's goal and primary challenges are summarized below:

Goal	Business expansion, via maintenance of strategic relationships and management of employees
Challenge (1)	Acquire local advertisers *(requires time,*

	business networking, research)
Challenge (2)	Customer lead acquisition *(requires acquisition of newcomer lists, merging of said lists to weed out incomplete entries and duplicates)*
Challenge (3)	Employee management *(requires monitoring employees, encouraging them, and recruiting new employees due to high turnover)*

Table 1 : *AYS' Goals and Challenges*

Interventions

AYS marketing was referred to the eTeams group at UNO through the Nebraska Business Development Center, as an established but small and low income business that would benefit from an ICT intervention. Based on initial conversations with EN, it was determined that EN's ICT-related needs were primarily informational. EN had a functional need to integrate spreadsheets and data from a variety of sources. EN also had a need to better understand how technology might help her expand her social networks.

(1) Organizing customer information

Based on EN's needs, sessions were conducted with her over the course of several months. The early sessions involved specifying a desktop application that would successfully integrate information for EN (dropping duplicate entries, intelligently merging entries, etc.). Based on the specification from the early sessions, the primary author constructed a Java desktop application to read 'newcomer' text files from county sources and Excel files from commercial providers. Via Apache text recognition libraries (for matching mis-spelled and sound-alike words) and some simple custom algorithms, the application was given the ability to intelligently merge entries and suggest duplicates where detected. The final output of the application was an Excel file with column order driven by the field order of the online data entry system (due to liability and data integrity issues, the desktop application did not directly integrate with the online data entry system).

(2) Blogging

It was readily apparent that a great deal of EN's business depended upon her ability to network with others. Therefore, the researcher determined it would be beneficial to introduce EN to the concept of blogging and its uses a marketing and social networking tool. EN signed up for a blog account, and began writing about her general issues, as well as her own business. She also began following other blogs.

Effects

EN experienced multiple positive effects due to the interventions. These effects can be characterized as 'usage driven' because they were based on EN's active role in the ICT adoption process.

Administrative Efficiencies

Post-adoption interviews with EN indicated that the tool saved her about two hours per week of spreadsheet time and improved her morale. Use of the tool also improved the quality of the data used by the greeters to contact newcomers to the Omaha area, and cut down on professionally embarrassing 'double greetings.'

Access to New Markets

EN indicated that the discussion of blogging and social networking technology with both the IT Therapist and web developer EN subsequently hired to create an informational website resulted in her creating a blog and actively promoting it among her customers. The effects of this blogging have yet to be quantified, though EN feels it is helping raise awareness about AYS' services, and raising AYS' comparative page rank for Google searches. On a concrete level, EN's quest to find material for her blog has led her to recruit friends and associates as 'guest contributors,' with the result that her social network is deepening and broadening. EN's focus on blogging is making her more authoritative in her area and more aware of the steps she needs to take to expand her company's reach.

Access to Information and Knowledge

EN indicated that the technology intervention has encouraged her to explore the instrumental possibilities of technology further. For instance, she read blogs on CNET in order to inform her purchase of a netbook computer, a device that she says has been useful to her business. Additionally, EN selected a web designer for her new website based on the guidance she received from the primary author.

Quality of Life

By alleviating an administrative burden, the artifact allowed EN more time to focus on strategic tasks. Since these strategic tasks constitute her 'core' contribution to the business as a manager, the reduction in administrative burden can be considered an indirect productivity enhancement. EN's conversion of formerly administrative time back to free time allowed her to improve her morale and quality of life.

On a social level, the artifact reduced the possibility of embarrassing interactions with greeting recipients, which could ultimately harm social relationships with AYS' client businesses. Indirectly, by reducing EN's stress levels, it is possible that the artifact improved the quality EN's social relationships. Though this is not easily verifiable, it might bear investigating in the future. The training EN received on blogging is definitely impacting the ties and breadth of her social network, though the exact nature of this impact is unknown.

Outcomes

In this section the outcomes of the interventions performed on *AYS* are illustrated in terms of the patterns identified, concepts and relationships discovered. These outcomes represent the activities that were enabled as a result of the interventions and how they affected the microenterprise's *capabilities*. Figure 1a below shows that helping EN organize her customer information enables her to be more administratively efficient and blogging enabled her to access new markets, knowledge and information.

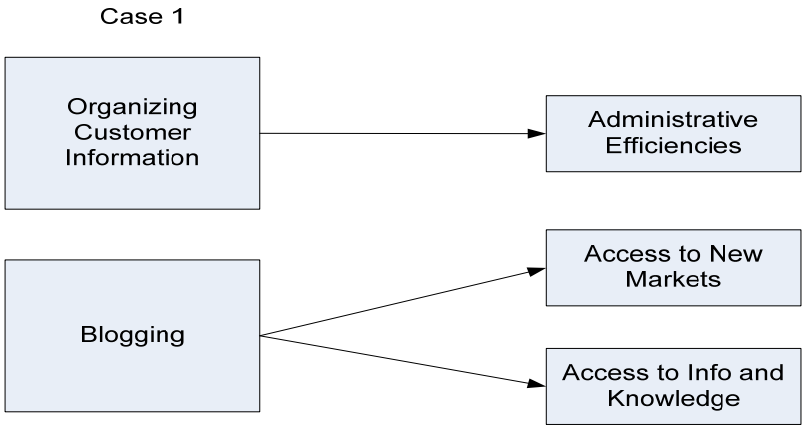

Figure 1a: Outcomes from the IT Therapy Interventions

This outcome aligns with EN's aspiration to be a *manager*. EN wants to focus her energy on expanding her business while maintaining high standards of customer service. EN values being able to deploy her strategic and demographic knowledge of the Omaha community. Trivial administrative tasks take up time and detract from EN's ability to leverage her core competency.

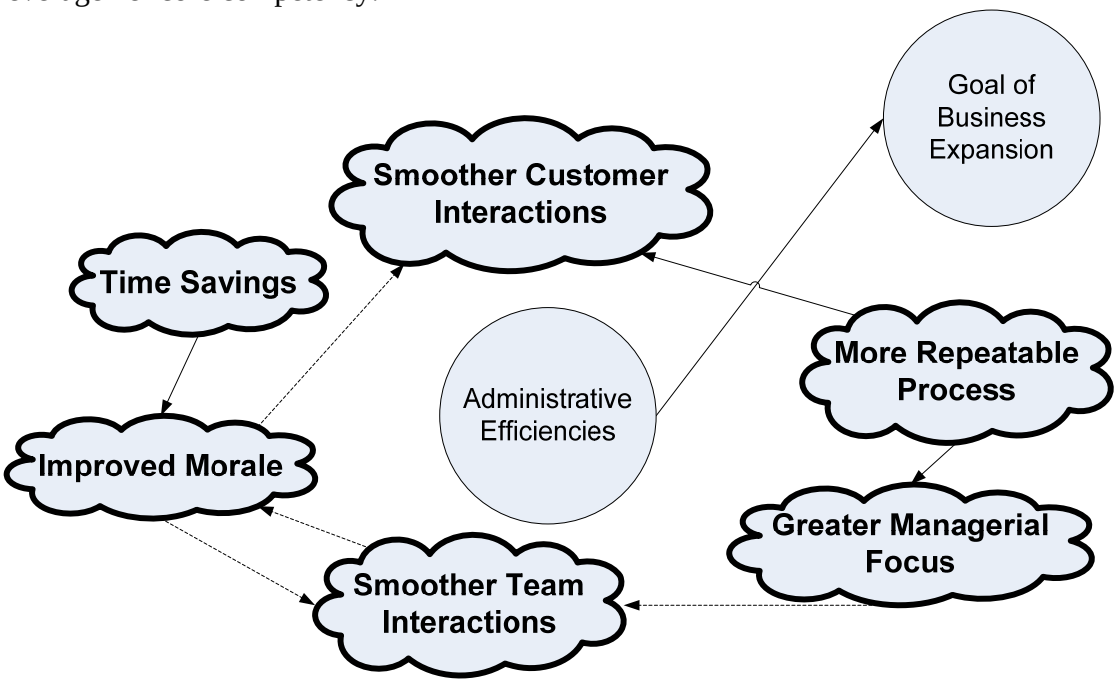

Figure 1b: Conceptual Map of Secondary Effects of Improved Administrative Efficiencies

Secondary Effects of Increased Administrative Efficiences

EN indicated that her goal was to expand her business. Assessing EN's process after providing her with a system that improved administrative efficiencies revealed a variety of 'secondary' effects arising out of system use.

Figure 1b illustrates some of closely inter-related beneficial secondary effects. These secondary effects were identified based on periodic observation of EN over the course of several months, as well as through direct questioning during an assessment interview.

Time Savings/Morale/Customer/Team/Focus:

EN indicated that the program was offering her a direct time savings of 'two hours per week.' She also said:

"As I expand it will save time, money and in terms of personnel [interactions]…It cuts down on duplication of effort, improves my ability to track what customers are being served, and eliminates the embarrassment of contacting the same person twice."

Given her positive experience, EN indicated that she felt better about technology:

"*I know now what I don't know. I think the whole experienced has helped me sharpen my focus on what I want to get done, and what can technology do for me. I am more excited about using IT, I can see it will further my objectives…"*

Moreover, over the course of follow-up conversations, the investigator observed that EN seemed less harried than before the intervention. EN made some comments to the effect that now that she was not 'spreadsheet merging,' and caught up in 'nitpicky details' that she felt more focused. She characterized the old process as an 'annoying distraction' which the new process removed.

Repeatable Process:

As described earlier, EN's process changed from an ad hoc row to row comparison of spreadsheets, to a structured interaction with a program, in which she selected spreadsheets to merge and then pressed a 'merge' button. The 'merge' function formalized judgment calls that EN had previously made based on limited information, into an algorithm that acted predictably. The benefit was twofold: Not only did EN understand her own prior decision making better, but also she could delegate the spreadsheet merging task to others with a high degree of confidence that the results would be acceptable.

Besides showing the outcomes of 'Organizing Customer Information,' Figure 1a also presents the fact that teaching EN about blogging gave her access to new information, and markets, in line with EN's aspiration to leverage her community and business knowhow to reach new customers— not only newcomers to Omaha, but also businesses wishing to advertise with her.

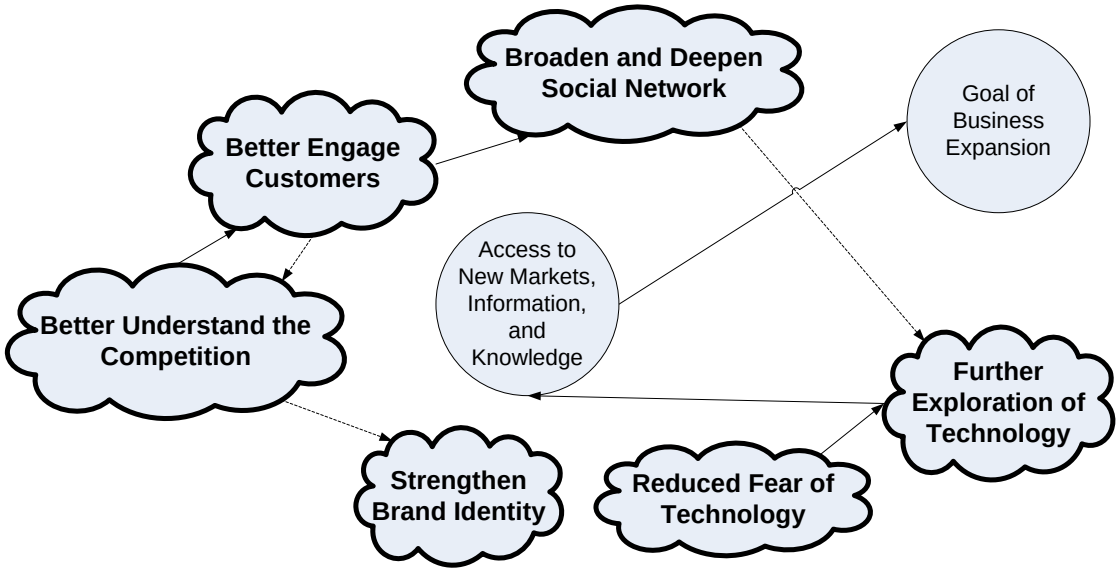

Figure 1c: Conceptual Map of Secondary Effects of Access to New Markets, Info, and Knowledge

Secondary Effects of Improved Access to New Markets, Information and Knowledge

As described by Figure 1c, EN's access to blogging technology permits her to understand how other similar businesses are engaging the community, as well as engage that community herself. It also facilitates her ability to establish a unique brand identity in contrast to similar services.

EN spent a good deal of time talking to the investigator about how she was using the blog to make others 'continuously' aware of her microenterprise. Indeed, her interaction with this technology, and her comparison of her own work to others she had found on Google ended up reducing her fear of technology and sparking her curiosity in relation to it. EN said, for example:

"I am doing things now I wouldn't have done before. I got a Netbook and GoToMyPC. I read reviews on CNet. I am more into it [technology], yeah… [As a result of undergoing the intervention] I must spend about 5 additional hours a week working on the website and additional technical things."

EN's reduced fear and her learning are the most significant outcomes of the intervention. As the conceptual map shows, it is not simply that the intervention enabled specific technical capabilities, but that it empowered EN to explore a previously inaccessible world. This outcome, particularly the learning aspect, is of a piece with other outcomes observed during the course of the eTeams initiative. For those interested in related research, a number of case studies are presented in Kamal (Kamal 2009).

Case 2: AE, Touch Omaha Bodywork

Initial Conditions

AE of Touch Omaha Bodywork operates a straightforward massage business driven by word-of-mouth referrals. She operates out of two locations, a massage office and a

chiropractor's office. AE has some similar challenges to EN in terms of customer acquisition. She has no formal method for advertising, other than giving out business cards at events she occasionally attends. In terms of record keeping and customer management, she attempts to use Quicken and a piece of software called "Massage Office Pro," but ends up entering most of her notes and invoices in a disorganized group of Excel spreadsheets due to the aforementioned programs not being setup properly. At year end, the disorganization of AE's Excel records has posed significant tax problems for her.

On the customer tracking front AE has a specific challenge in migrating data on patients from the chiropractor's office to the 'Massage Office Pro' software in her main office. The issue is that she has only one license for Massage Office Pro, and cannot access her copy of it remotely (from the chiropractor's office). Just before the intervention, AE purchased a laptop which she had been unable to setup on her own. This had become a source of concern to her.

On the record keeping front, AE's Quicken software does not function because she does not know how to login properly, and/or retrieve her password for the existing login. AE could do her invoicing for tax purposes using Massage Office Pro, but does not do so for aesthetic reasons; the resulting documents do not display her logo. AE just purchased a new laptop which she intends to use as a desktop replacement. Unfortunately, (as mentioned) she does not know how to transfer any of her software licenses or data from one computer to another. The result is that the laptop has been 'sitting in its box.' Similarly, AE has an IPod she would like to use to play music to customers. She cannot get the ITunes software working on her computer, and so the IPod is also sitting in a box. She has been using a playlist of songs on her desktop computer, but the computer often crashes while playing, thus disrupting her massage sessions in a minor but irritating way.

Touch Omaha (hereafter TO), has the following ICT artifacts: laptop computer, Massage Office Pro software, Quicken software, Microsoft Office software, IPod/Windows Media Player. Given these artifacts, what are AE's initial capabilities? The artifacts are intended to assist AE in managing her client relationships, billing appropriately, and, creating a certain kind of customer experience. As it turns out, however, AE's capabilities arising out of her use of these artifacts are severely limited. The laptop is not serving as a platform for cross-office administrative tasks because AE does not know how to configure it. The Massage Office Pro software is being used for record-keeping only, and only in one office at a time, again because of configuration issues. Quicken is not being used at all due to login issues. Microsoft Office software is being used in an inefficient way to keep records. The IPod is going unused, and Windows Media Player is being used on a limited basis due to crashing issues.

From a personal standpoint, the ICT artifacts are causing some friction in AE's life. The ones that work are taking up time and not producing good results, causing her frustration. The artifacts that do not work are also frustrating her, because she can see their potential but not exploit it. AE's frustrations, like EN's, appear to stem from, as Zheng might say, a knowledge 'deprivation.' She cannot configure her artifacts the way that she needs to, and thus is suffering from poor productivity. Moreover, she does not know enough to be able to resolve her questions via typical reference materials, such as online help websites.

From a social standpoint, AE's technology artifacts have caused friction; her chiropractor prefers on invoices the precise charts produced by Massage Office Pro, but has been receiving Excel documents instead. The crashing Windows Media Player has been irritating AE's customers. None of the artifacts is providing new social opportunities for AE.

From an environmental standpoint, what is striking is the lack of interaction among AE's ICT tools and her environment. Moreover, the lack of past interaction can be seen as a sort of basis for the current situation; because AE never has had a properly integrated, configured office, she is comfortable with a status quo that others might find intolerable. AE's rationale for adopting ICT is basically similar to EN's – necessity; she uses ICT to manage her day-to-day operations and retain customers.

Table 2 presents AE's goal and a summary of her challenges:

Goal	Retain customers by creating a positive customer experience
Challenge (1)	Maintain customer records *(requires specific software not available at all sites, configuration of existing software)*
Challenge (2)	Create a positive customer experience *(requires deployment and maintenance of music software/mp3 collection, enabling connectivity for music streaming and email based customer followup)*
Challenge (3)	Lack of funds to purchase software and hardware *(requires finding software to handle a portion of the functionality of Microsoft Office at low/no cost, use of existing resources)*

Table 2 : *Touch Omaha Goal and Challenges*

Interventions

Based on the investigator's analysis, it appeared that AE's challenges in relation to ICT related primarily to mobility, connectivity, and knowledge. Thus, the following interventions were performed:

1. Mobility

The intervention focused first on TO's most important artifact, the Massage Office Pro software. To enable this to be accessed remotely, the free LogMeIn software was installed on both desktop and laptop; LogMeIn permits terminal access to Windows machines for free.

2. Internet Connectivity

In setting the laptop up, it became clear that an older wireless standard was being used in the building. An adaptor was purchased to make the laptop compatible with the 'Wireless A' standard. A subsequent visit found the adaptor unnecessary; citing the

therapist as a technology authority, AE had requested that the building wireless be reconfigured or upgraded. The building manager complied!

3. Training

Training was conducted to make AE familiar with the Massage Office Pro invoicing functionality, and the therapist configured the invoice template to include the TO logo. As it turned out, placing the logo on the invoice required only three clicks and four minutes of time; this simple change made the invoices acceptable to AE and eliminated much duplicated effort. Quicken was discarded as no longer necessary given the capabilities of Massage Office Pro.

The therapist installed the ITunes software successfully on the laptop, and configured the IPod with AE's existing music collection. AE subsequently purchased, of her own accord, a dock for the IPod. Encouraged by the therapist, AE signed up for the Pandora Internet streaming radio site and expressed enthusiasm about it.

The therapist also trained AE on some basic windows functionality, including the copying and moving of files en masse. Finally AE, was taught how to back up Massage Office Pro data. Subsequent to learning that Massage Office Pro data could be backed up and moved, AE indicated that she wished to discard her desktop computer entirely. She reasoned that the laptop, as configured, was working so well that the desktop had become entirely superfluous. The therapist therefore moved Massage Office Pro data and supplementary documents over to the laptop.

4. Provision of low cost software

AE lacked funds to purchase an additional license for Microsoft Office, so the therapist installed OpenOffice on the laptop and transferred all documents from the desktop to the laptop, including the old record-keeping Excel Spreadsheets.

Effects

Compared to the original situation, the ICT artifacts now have a significant role in enabling AE to achieve her objectives of: storing client information, invoicing, interacting effectively with the partner doctor, and providing a pleasant aural experience for her clients. Helping AE overcome some basic obstacles allowed her to make much better use of available resources.

Productivity

AE estimated that the IT intervention saved her $2700 in time and money. Her laptop has been set up in just the right way to enable her job function. Additionally, with a properly configured audio system, she spends less time attempting to diagnose computer audio problems and more time giving massages. Similarly, she finds that she is as productive on the Open Office software as she ever was on Microsoft Office. Thus, a free piece of software is providing her with compelling benefits.

Administrative Efficiencies

AE had previously spent a great deal of time attempting to format her invoices appropriately, and correcting them due to synchronization problems between Microsoft Office and Massage Office Pro. She now feels that the quality of her invoicing has significantly improved. Furthermore, she can invoice at the doctor's office which has enabled her to manage her time effectively.

Access to Information and Knowledge

AE's comments also indicated that she believed her conceptual model of 'how computers work' to be broader and deeper as a result of the intervention. AE gained an understanding of the importance of backups to the maintenance of her business.

Quality of Life

On a personal level, post adoption interviews suggest AE now experience less stress due to the more effective IT setup. AE said she feels less afraid of technology. Interestingly, she views the current configuration of software as near-final, and does not wish to investigate any further productivity enhancements, saying: *"I'd rather have my hands on bodies than on technology."*

Socially speaking, AE's effective use of technology has reduced friction with the doctor with whom she works, as well as with clients annoyed by music interruptions. It is possible that these improvements will lead to client base expansion in the future – although this is not easily verifiable it bears further investigation. Of note was the fact that AE managed to motivate her building manager to upgrade the building wireless based on the authority of the therapist. Coupled with the fact of EN's being influenced by techies respected by her peers, this begins to suggest interesting ideas about how entrepreneurs might transfer affinities for fellow entrepreneurs into relationships with technical resources and subsequent purchasing/adoption decisions.

At an environmental level, AE's office is now a more pleasant place to work in due to the use of the IPod dock for music. The speed of the new laptop in comparison to the old one also appeared to be a factor motivating her to use Massage Office Pro more on the new device.

Outcomes

In this section the outcomes of the interventions performed on *Touch of Omaha Bodywork* are illustrated in terms of the patterns identified, concepts and relationships discovered. These outcomes represent the capabilities that were enabled as a result of the interventions and how they affected the microenterprise's *capabilities*. Figures 2a – 2c and the accompanying discussion summarize how the four simple interventions had a large effect on this microenterprise's *capabilities*. The interventions addressed a need for knowledge and technical integration, resulting in productivity enhancements, increased administrative efficiencies, and human development.

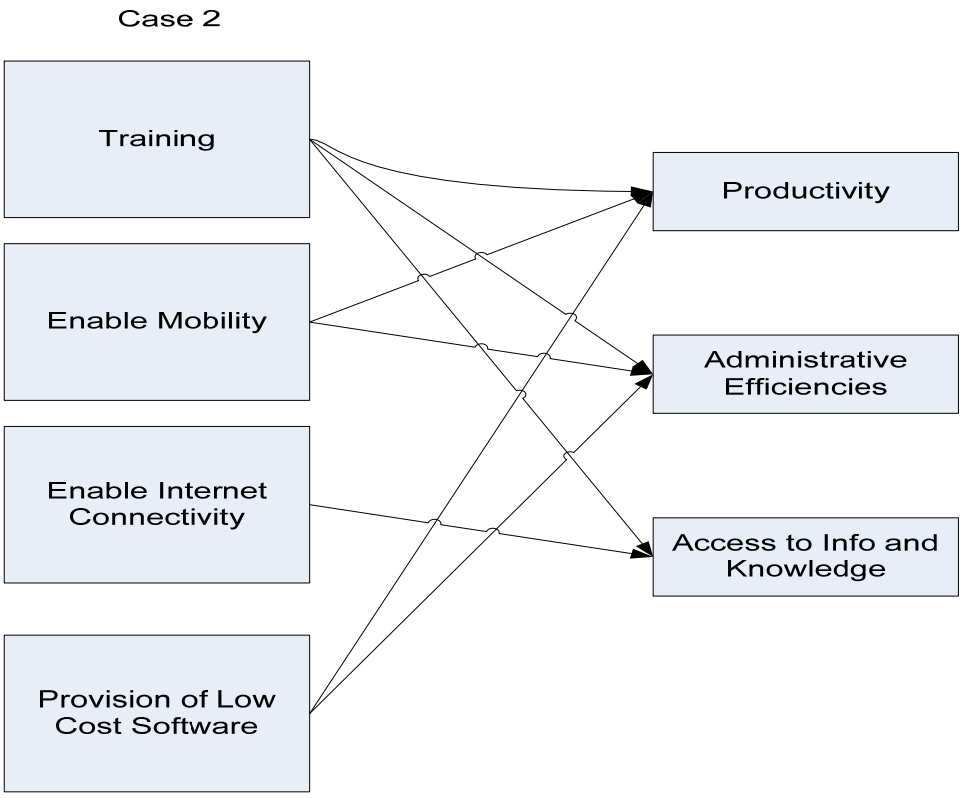

Figure 2a: Outcomes from the IT Therapy Interventions

Figure 2a shows that training AE, making her mobile, and providing her with low cost software enables her to be more productive and have greater administrative efficiencies; training also enables to AE to expand her conceptual model of information technology, thus increasing the accessibility of information and knowledge to her. These outcomes align with AE's aspiration to maintain her existing customer base and relationships (particularly with the referring chiropractor); glitches with her audio, record keeping, and so on were detracting from the otherwise outstanding quality of her core massage work, and thus harming her relationships.

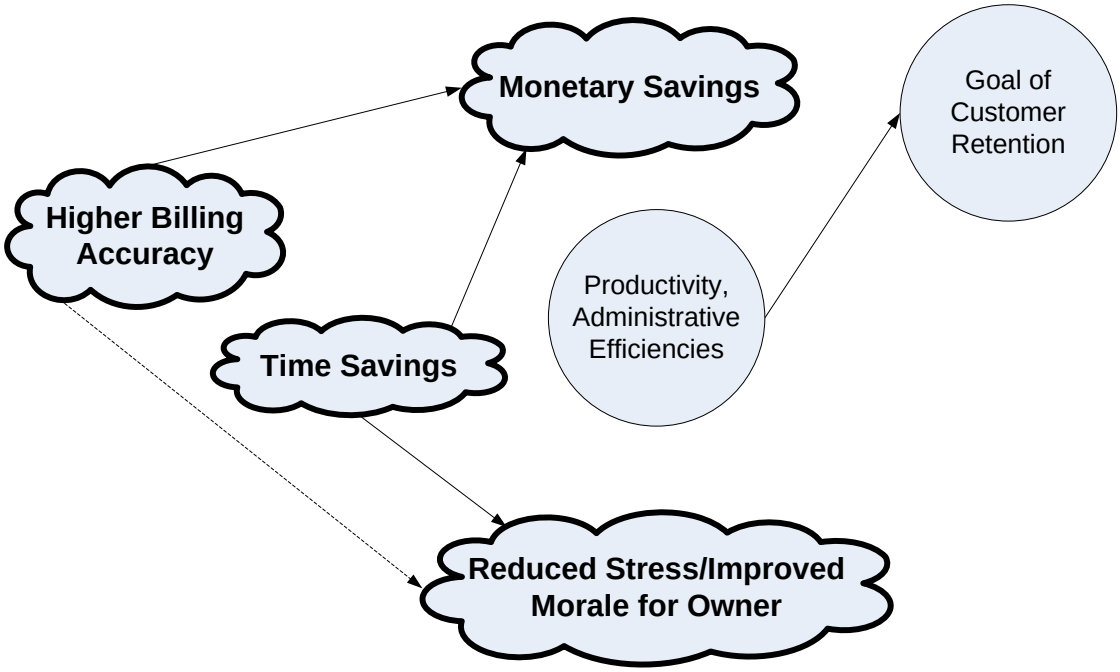

Figure 2b: Conceptual Map of Secondary Effects of Improved Productivity and Admin Efficiencies

Secondary Effects of Increased Productivity/Administrative Efficiences

Figure 2b shows the beneficial secondary effects of the improved administrative efficiency, leading to AE's increased ability to achieve what is important to her (customer retention). These effects were observed over the course of several months worth of interactions. As with EN, AE's saves time, reduces her stress, and improves the accuracy of a core process. Additionally, she saved a good deal of money.

Aside from showing how training and mobility enabled Administrative Efficiencies, Figure 2a also shows that improving AE's connectivity improved her access to information and knowledge. With slow and unreliable Internet service, AE could not previously check her emails on a regular basis, and thus could not respond to queries from either clients or insurance companies during normal business hours. Additionally, the low connection speed crippled her ability to stream Internet radio.

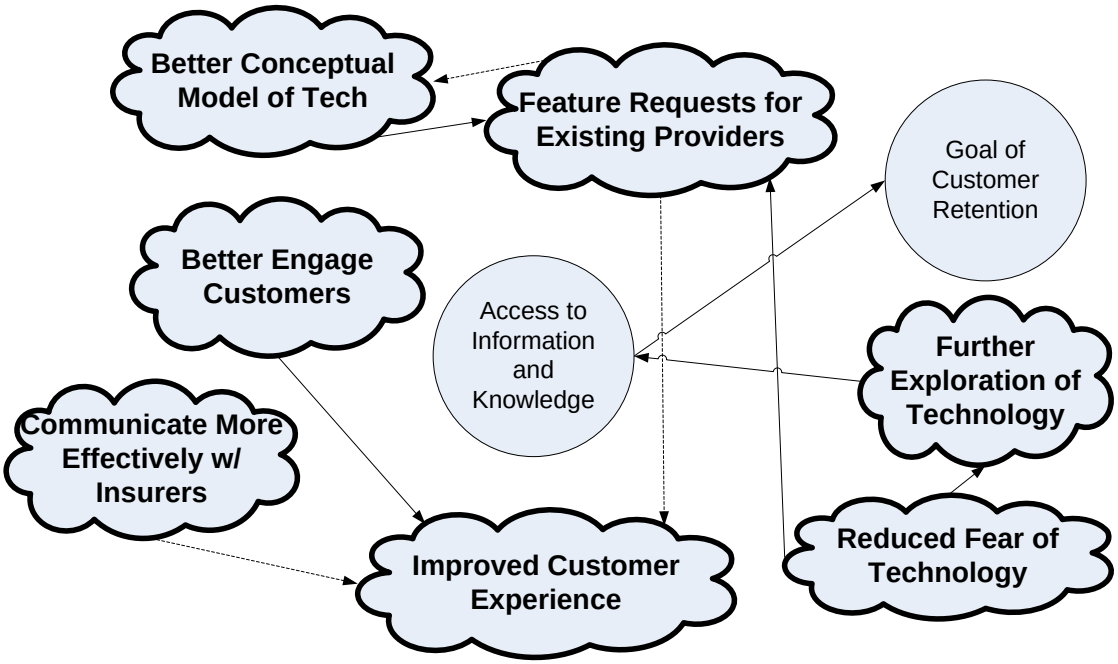

Figure 2c: Conceptual Map of Secondary Effects of Improved Info Access

Secondary Effects of Increased Info Access

Figure 2c, above, illustrates how improved access to information and knowledge allows AE to better engage customers, their insurers, and improve the customer experience, as well as how AE's intervention resulted in her being less afraid of technology and being encouraged to explore its possibilities.

Better Engage Customers, Improve Customer Experience, Communicate with Insurers

AE mentioned repeatedly how much her customers were enjoying the music that she was now able to play through her computer and the IPod dock. She indicated that having the music setup properly reduced her own stress levels as well as those of the customers. Additionally, she mentioned how her relationship with her referring chiropractor had improved due to her improved invoicing capabilities and ability to access patient information 'on the go.'

Better Conceptual Model, Reduced Fear, Increased Exploration

Though AE stated that she preferred the business of massaging people to using technology, she also said:

"In general, working on my computer is a lot less intimidating now, than it was. I feel good about things [usage]."

AE's reduced fear of technology was evidenced during the course of the intervention when she independently researched and purchased an IPod dock; this acquisition illustrates how she was empowered to make tech related purchase decisions in service of her business. That AE is less fearful is further evidenced by one of the researcher's recent

visit to her website, wherein she had, on her own and without prompting, started an active blog about yoga!

AE's learning, like EN's, enabled her to effectively leverage existing resources. Where at the beginning her IPod and Laptop sat in boxes, by the end she had actively and enthusiastically employed both tools. Similarly, AE's increased knowledge permitted her to make feature requests of service providers working for her. She asked the building manager to upgrade the wireless. As well, as indicated by a recent telephone conversation, she independently requested blog hosting from her website provider.

Implications for Global Development

Recent studies suggest that access to information, expertise and knowledge determines who may participate in the global economy. Supported by multiple types of ICT infrastructures, it appears that the ability of people to participate in the global economy depends upon their ability to use these ICTs. In his book, the "Runaway World", Giddens (Giddens 2002) suggests that information literacy is paramount for those wanting to survive in this interconnected world. He suggests that the more science and technology intrude into our lives, the more active or engaged our relationship to it becomes. International development agencies highlight problems of exclusion from the knowledge economy where know-how replaces land and capital as the basic building blocks of growth (Norris 2002).

The levels of literacy in a country can affect the level of utilization of ICT capacity and may also marginalize groups of people from the opportunities made possible by ICT. The concept of information literacy has been used to denote people who are able to interact using ICTs (Queau 2002; Stoler 2001). This suggests that a new culture is emerging of 'information literacy' through online interactions comprised of visual representations and mental images that can potentially increase the disparities between people who are part of this culture in industrialized countries and those who are not, as well as within societies themselves (Queau 2002, Norris 2002). The two cases described in this paper have illustrated how information literacy can be developed in micro-entrepreneurs through training, and technology interventions that enable them to access and use ICTs. In particular, the cases have shown how interventions have the potential of enabling substantial benefits for microenterprises, both direct and indirect. The interventions performed in each of the case studies fell into two categories: Access and Use. This ways in which these interventions enabled Access and Use are illustrated in the **Figure 3**, below.

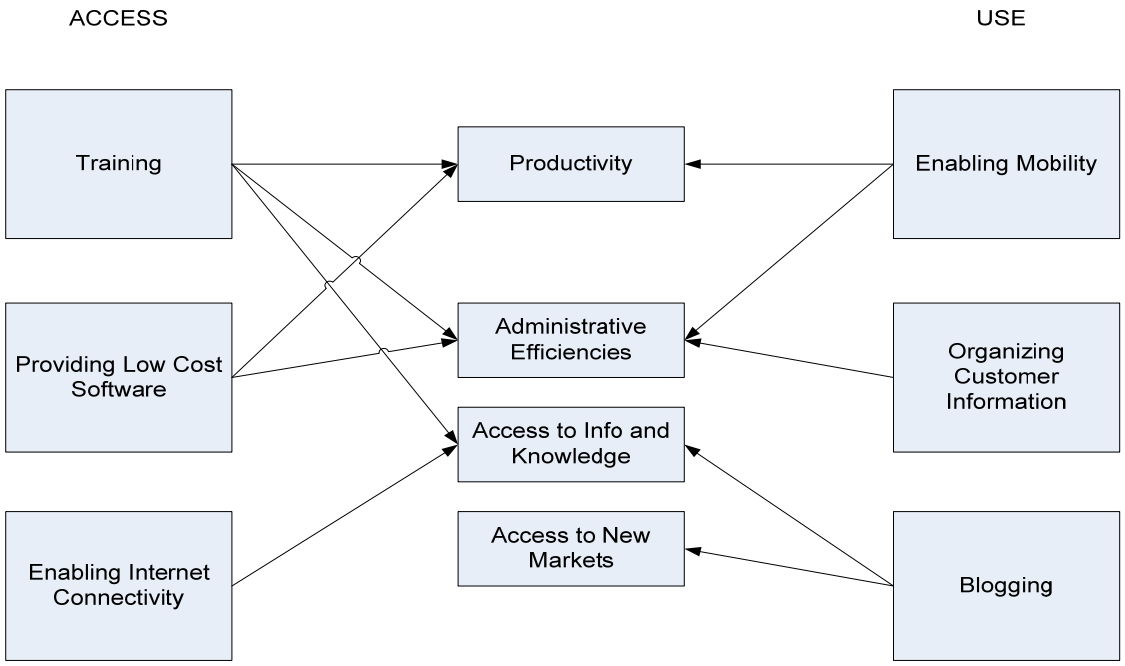

Figure 3: Access and Use of ICTs for Micro-enterprise Development

On the Access side, training (access to expertise applied in the specific business situation), ended up improving productivity and administrative efficiencies; it also made formerly inaccessible knowledge accessible. Provision of low cost software (Open Office and a simple custom application) enabled productivity and administrative efficiencies. Simply improving Internet connectivity permitted a business to access new information and knowledge, in the form of email, informational websites, and streaming web radio.

On the use side, enabling mobility improved both productivity and administrative efficiencies. Organizing customer information permitted greater administrative efficiencies. Encouraging the use of blogging tools permitted not only access to information and knowledge (via awareness of other blogs), but also access to new markets.

A couple of conceptual themes emerge from this 'on the ground' view of ICT interventions. First of all, the case studies suggest that access and use are both important for the achievement of ICT outcomes. Second, the case studies suggest that access and use based interventions interact. Use-type interventions permit an entrepreneur to better engage with the world they can now access. It is noteworthy that free software met basic business needs. An unsophisticated user, a massage therapist with minimal technical education, had no trouble using Open Office. Simply making her aware of, and installing for her, an Open Source alternative to commercial software enabled her to perform all of her business tasks. This success suggests that as part of ICT interventions it may be important to explore with microentrepreneurs whether or not free or low cost software can substitute for more expensive packages. For the marketer, recombination of existing open source libraries with some 'glue' code in a custom application proved sufficient to enable significant productivity gains and administrative efficiencies. This success

suggests that not all interventions need be 'one-size-fits-all'; free software libraries and development tools have progressed to a degree where it may be practical to engage in small-scale software development for individual microenterprises or groups thereof.

It is important to highlight how simply making existing business processes mobile, via the use of ICT, can enable significant positive outcomes. For the Massage Therapist, copying software to a laptop (an hour long process) greatly improved efficiencies. The marketer's use of a Netbook in concert with her website has permitted her to both manage and blog 'from the field.' It should be observed that enabling Internet access need not be an end in and of itself in ICT interventions. Various sites on the Internet now provides free business services. EN has experienced tangible informational benefits from her use of blogging, and may now reach entirely new markets. Social networking sites hold promise for expanding the reach of microenterprises. AE used a popular Internet radio service to the benefit of her business. The introduction of microenterprises to free Internet services holds promise for future development.

We must emphasize that the case studies discussed herein are not definitive. Certainly, it is possible that enabling access and use may have negligible or even negative effects, rather than the positive impacts we have described. Under what conditions such consequences might occur is unclear, since microenterprise adoption behaviors are not well studied. It is hoped, however, that *these* case studies, based on long and careful observation, and presented in structured and unstructured terms informed by Sen's capabilities model, are both practically and conceptually helpful to other researchers attempting to puzzle out the benefits of ICT adoption in microenterprises.

Conclusion

Following a five month long capability-oriented investigation of two micro-enterprises undergoing training and technology interventions, ICT effects and outcomes were identified. In this process patterns of access and use were identified (in structured and unstructured forms) that lead to the discovery of concepts and relationships tied to explaining how ICTs may enable micro-entrepreneurs to achieve what they consider to be valuable. Direct ICT effects that were identified included productivity gains, improved administrative efficiencies, greater access to information and knowledge, and greater access to new markets. Outcomes included better organization, mobility, access to software and connectivity.

The cases showed ways in which ICT can enhance a microentrepreneur's ability to achieve what he or she considers valuable. As has been shown, the indirect effects of improving productivity, administrative efficiency, access to knowledge, and access to markets may be just as important as the direct effects. Properly deployed, ICT interventions can reduce stress and costly errors. They can also help individuals broaden their social networks and become empowered to make strategic decisions in a way not possible before. Furthermore, ICTs show the potential to increase a micro-entrepreneur's business savvy in his/her chosen area to the extent that ICT uptake enables and encourages independent exploration; a reduction in fear of technology facilitates learning outcomes.

As we have seen, the use of relatively simple techniques may have powerful primary and secondary impacts on microenterprises. The results have implications in the sense

that they may both inform global development practitioners working 'in the field' and highlight 'themes' and concepts related to the application of these techniques and the measurement of outcomes.

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