

## **Role of Cloud Computing Interventions for Micro-Enterprise Growth: Implications for Global Development**

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### **ABSTRACT**

*While the majority of businesses around the world are micro-enterprises, they are the most vulnerable and are often run by people with limited resources, and skills to be able to avail the benefits of Information and Communication Technologies (ICTs). These are a form of small business which employs between 1-5 people and face challenges of limited resources, skills and ability to grow. When they do adopt IT their potential to survive and grow increases as they are then able to participate in the global economy. The challenge for global development lies in enabling these micro-enterprises to adopt the appropriate IT solution that fits their needs. Often the tools available to them are either too expensive or require more resources than they have available. Cloud computing offers an opportunity to support the growth of micro-enterprises by enabling low cost IT solutions to be made available to them so that they may adopt with little effort or skill. Since their ability to adopt technology depends upon the unique conditions in which they find themselves, we apply the extended information architecture framework to assess the impact of Cloud computing intervention on micro-enterprise growth. The analysis using this framework enables an understanding of the ways in which Cloud computing functionality and processes may support the growth of micro-enterprises. Following an analysis of these results, this paper also provides recommendations for the use of cloud computing interventions to enable growth of micro-enterprises. The contribution of this paper is in the extended information architecture framework through which cloud computing interventions may be developed and assessed to suit local conditions.*

## Keywords

Development, Cloud Computing, Information Architecture, Zachman Framework, Interventions.

## INTRODUCTION

According to the Association for Enterprise Opportunity (AEO), “..there are more than 24 million microenterprises in the U.S., representing 18% of all private employment and 87% of all businesses.” One out of six U.S. private sector employees works for a microenterprise. Historically, microenterprises have been considered the backbone of the U.S. economy. Studies have shown that microenterprises are critical to the success of an economy (Servon and Doshna, 2000; Mathews, 2007; Qureshi, Kamal, & Wolcott., 2009). However, due to the challenges they face in terms of limited resources, skills and access to IT infrastructure, these businesses are the least likely to succeed. Studies have shown that when microenterprises adopt information technology, their growth increases by a factor of 3.5% (Qiang et al., 2006). Most microenterprises are sole proprietorships, which create employment for the owner and, often, other family members; they are commonly called "mom and pop" businesses. Some grow into large enterprises employing other members of the community. Microenterprises include a variety of businesses in the products and service sectors such as repair and cleaning services, specialty foods, jewelry, arts and crafts, gifts, clothing and textiles, computer technology, child care, and environmental products.” Only a small portion of microenterprises survive or grow to become creators of jobs and income in a region. These businesses - a form of small business - employ between one to five people and have an annual income of less than \$35,000 US. Unlike their larger corporate counterparts, these businesses rely on community networks for assistance and access to necessary resources. While a number of microenterprise development programs provide technical assistance and loans, little is known as to how microenterprises succeed.

While human, social and economic development perspectives are important and ICT adoption has the potential to enable those outcomes to be achieved, little has been done to find the connections between these concepts (CÃ¡mara et al., 2006, Davis Jr and Fonseca, 2006, Lance and BassolÃ©, 2006, Puri, 2006). This paper suggests that when ICT implementations address all three issues, they increase the chances of success of those implementations, particularly with regard to micro-enterprises. Small and medium sized businesses that have adopted and used ICTs have seen positive outcomes related to operational efficiencies, increased revenues, and are able to better position themselves within their market niche (Raymond *et al.*, 2005, Southwood, 2004). A great deal of research has been conducted in the adoption of IT in organizations by authors such as Davis (1989), Venkatesh et al. (2003) who have considered the cognitive effects of IT adoption in large organizations, and Igbaria et al. (1997), Cragg and King (1993), Brown and Lockett (2004) in small organizations. There is very little research in how IT can support microenterprises that are often run by one or two people. Few educational programs train students to support IT adoption in microenterprises. There is evidence to suggest that use of Information and Communications Technology (ICT) can play an important role in the growth of small businesses (Mathews, 2007; Sullivan, 1985; Qiang et al., 2006; Raymond et al., 2005). In this sense, IT can be employed to bring about increased competitiveness if it enables businesses to create new jobs, increase productivity and sales through access to new markets and realizing administrative efficiencies (Qureshi, 2005; Mathews, 2007). These outcomes can be achieved through measurable improvements in the lives of people living with limited resources to sustain themselves. Duncombe and Heeks (2003) suggest that there is a role for the ICT intermediary in

providing the needed information on markets, customers and suppliers. In their study of 1000 small business enterprises in the U.S., Riemenschneider et al. (2003) found that businesses were prepared to overcome obstacles to IT adoption to achieve web presence. This is because pressures to keep up with competition and promote services to customers are greater than the obstacles to setting up websites. There is a sense that small and medium enterprises hold the promise of growing incrementally on existing capabilities, and provide a seedbed for the emergence of dynamic and efficient larger national firms (Levy et al., 2001; Matthews, 2007; Servon and Doshna, 2000).

However, the challenges facing the adoption of IT in these businesses are many, including the lack of funds, time and training to be able to take advantage of the technology. Little research has been conducted in the adoption of IT in microenterprises and even less is known about the communities that sustain these businesses. Although current literature supporting adoption of technology by small businesses exists, in practice, this is not the scenario – particularly in the case of microenterprises. In a study by Qiang et al. (2006), only 27 percent of microenterprises use e-mail and 22 percent use Web sites to interact with clients and suppliers. The study suggests that if computer use affects firm productivity and IT expands networking within sectors and industries, the microenterprises may not be benefiting from these externalities – benefits from IT. In addition, Bharati and Chaudhury (2006) surveyed micro, small and medium manufacturing firms within the Boston metropolitan area and found that most of the micro firms were using simple technologies such as basic e-mail, and simple software packages as compared to more complex technologies that were being used by the medium-sized firms. Their survey results showed that the micro firms were not aware of most technologies that could be used for improving their business performance.

Cloud computing enables microenterprises to access needed computing resources. It is a recent term that is built upon some established concepts that refer to both the applications delivered as services over the internet, and the hardware and the software in data centers in which a pool of virtualized, dynamically- scalable computing power, storage, platforms and services are delivered on demand (Truong, 2010; Ambrust et al., 2010). However, the adoption of IT is dependent upon a combination of economic, social and human factors, all three of which are very limited. Microenterprises often have very little money to purchase equipment or access IT. They do not have the education or training to be able to use IT when they do have access to it, or even sufficient support services. We contend that the most important factor is the ability of the micro-entrepreneur to feel in control of their lives (Sen 1999; Conger and Kanungo, 1998; Bandura 1977). The question being investigated in this paper is: *how can cloud computing interventions be designed and assessed to enable microenterprises to grow?* This question is investigated through multiple case analysis of a number of micro-enterprises to shed light on how a systematic approach to applying ICT interventions may enable them to grow. At the core of the systematic approach that we present in this study, is the application of an Information Architecture for micro-enterprises in developing regions that was developed in an earlier study by the authors. Following an analysis of these results, this paper also provides recommendations for the use of ICTs to enable growth of micro-enterprises.

## INFORMATION TECHNOLOGY ADOPTION BY MICROENTERPRISES

Current research has shown that through the use of information and communications technologies (ICTs), small and micro-enterprises are able to see improved economic outcomes - thus increasing their potential for survival within developing communities. Micro-enterprises play a very important role in generating jobs, developing business skills, and providing needed goods and services to a community (Duncombe and Heeks, 2002). Barriers to starting these enterprises are generally high as households or individuals may engage in more than one micro enterprise, or may use one to augment or temporarily replace wage salaries. It is seen that most developing countries are predominantly comprised of micro-enterprises. Even within developed nations such as the United States, micro-enterprises comprise 87% of all businesses in the country.

Investigation into the effect of ICTs on Human, social and economic development has brought about mixed results. Human development is seen to be a key determinant of successful ICT adoption in developing regions. This concept according to (Sen, 1999) suggests that people need to be in control of their lives in order to take the opportunities presented to them. Authors of past research suggest that human development entails access to services such as healthcare, education and governance (Ezer, 2006, Jacucci et al., 2006, Musa, 2006, Reinhard and Macadar, 2006, Sahay and Walsham, 2006). The research on social development suggests that implementations of technology in eGovernment (Ciborra and Navarra, 2005, Krishna and Walsham, 2005, Shaomin, 2005, Ulrich and Chacko, 2005), healthcare (Chilundo and Sahay, 2005, Kimaro and Nhampossa, 2005, LuÃs Mosse and Byrne, 2005, Mosse and Sahay, 2005), education (Furuholt and Ãrsvik, 2006) and the environment have had the effect of bringing about better lives for people in underserved communities. Economic development perspectives measure growth in terms of income generation, job creation, and/or reduction in poverty (Waverman et al. 2005; Roller and Waverman 2001; Abraham 2007). While these numbers are used in making policy decisions, they often overlook the informal sector where most of the micro-enterprises operate. They do not represent the extent to which actual development (or the lack there of) is taking place within the most underserved communities.

The challenges faced by microenterprises make it even more difficult for them to adopt ICTs for competitiveness, and these effects are very difficult to measure. In particular, Piscitello and Sgobbi (2004) suggest that the key barrier to the adoption of ICTs is not size but the learning processes, followed by the access to networks of similar internet-enabled business services. While a great deal has been written about the challenges faced by microenterprise adoption of ICTs, little has been done to provide business models that enable microenterprises to use ICTs competitively. According to Grosh and Somolekae (1996), barriers to growth of microenterprises are: access to capital, educational level of the entrepreneur, legal barriers and start-up financing. In their study of information systems for rural microenterprises in Botswana, Duncombe and Heeks (2003), suggest that the role of ICT in enabling information and knowledge is important for both social and economic development. They found that rural microenterprises typically rely on localized, informal social networks for their information. Information from these networks was of poor quality and not readily available; it appeared to fail the poorest and most disadvantaged entrepreneurs. In this sense, ICTs can represent an unaffordable addition to costs and their benefits are not always apparent (Duncombe and Heeks, 2003; Matthews, 2007; Southwood, 2004).

At the same time, studies have shown that the use of IT can play an important role on the growth of small businesses (Matthews, 2007; Sullivan, 1985; Qiang et al., 2006; Raymond et al., 2005). Cragg and King (1993) have shown that there is a gradual increase in the number of small firms that either adopt various new technologies or take steps to upgrade what they currently possess. IT can be employed to bring about increased competitiveness if it enables businesses to create new jobs, increase productivity and sales through access to new markets and administrative efficiencies (Qureshi, 2005; Matthews, 2007). Small and medium-sized businesses that have adopted and used IT have seen positive outcomes related to operational efficiencies and increased revenues, and are able to better position themselves within their market niche. Qiang et al. (2006) observed that businesses that utilized e-mail to communicate with their customers experienced sales growth of 3.4% greater than those which did not. Similar outcomes were also observed for productivity and reinvestment. Both these components were found to be greater for more intensive users of IT. Other research in this area also highlights the positive impact of IT use within small businesses. A 4% increase in sales as well as 5% increase in export performance was obtained when e-business techniques were adopted by Small and Medium-sized Enterprises (SMEs) in the manufacturing sector in Canada (Raymond et al., 2005). Specifically, Raymond et al. (2005) mention that by using technologies such as websites, email and telephones to communicate with customers, SMEs can provide better customer service and expand their customer base to reach out to both local and international consumers for their products. In another study, Southwood (2004) found that ICT investments by SMEs in South Africa resulted in profitability gains from cost savings rather than from increase in sales.

It also appears that the promise of IT adoption by microenterprises can potentially provide these businesses with the ability to access new markets and reduce costs through administrative efficiencies (Brown and Lockett, 2004). However, the use of ICT by SMEs remains a challenge in both developed as well as developing countries (Schreiner and Woller, 2003; Sanders, 2002; Lichtenstein and Lyons, 2001; Hyman and Dearden, 1998; Honig, 1998; Piscitello and Sgobbi, 2004). In particular, the opportunities opened up by the Internet are limited in SMEs especially due to the challenges faced by globalization (Piscitello and Sgobbi, 2004). Small and medium sized businesses, organizations that employ less than 500 people, typically have problems adopting IT due to competitive pressures and underestimation of time taken to implement IT (Riemenschneider et al., 2003). A form of small business being investigated in this project is the microenterprise. The microenterprises studied in this project will often be part of a microenterprise development program. Such programs make loans and or provide classes to low income workers to help them start or strengthen their businesses (Schreiner and Woller, 2003).

## **CLOUD COMPUTING APPLICATIONS FOR DEVELOPMENT**

Cloud computing offers an opportunity for Development by enabling micro-enterprises to adopt the technology applications they need by reducing the challenges they face when adopting ICTs. Cloud computing applications reside on external servers and are accessed through internet or mobile network connections. This reduces the cost of paying for ICT infrastructure, learning to use the technology and applying it to suit the business needs. Cloud computing is a recent term that refers to both the applications delivered as services over the internet, and the hardware and the software in data centers in which a pool of virtualized, dynamically- scalable computing

power, storage, platforms and services are delivered on demand (Truong, 2010; Ambrust et al., 2010).

Cloud-based services can be categorized into three models: (i) Software as a Service (SaaS), (ii) Infrastructure as a Service (IaaS), and (iii) Platform as a Service (PaaS). In a SaaS infrastructure, service providers make available applications for personal and business use such as MS Exchange and Quickbooks. IaaS on the other hand, offers hardware services which may include virtual and physical servers. And lastly, PaaS provides a framework and tools for developers to build their own applications. Online content management systems and website building services are examples of this infrastructure. Cloud computing offers several technical and economic benefits. In terms of technical advantage, it is possible to use the processing power of the cloud to do things that traditional productivity applications cannot do. For instance, users can instantly search over GBs of e-mail online, which is practically impossible to do on a desktop. One of the greatest advantages is that the user is no longer tied to a traditional computer to use an application, or has to buy a version specifically configured for a phone, PDA or other device. Any device that can access the Internet will be able to run a cloud-based application. Regardless of the device being used, there may be fewer maintenance issues. Users will not have to worry about storage capacity, compatibility or other matters. Cloud computing infrastructure allows enterprises to achieve more efficient use of their IT hardware and software investments: it increases profitability by improving resource utilization. Pooling resources into large clouds cuts costs and increases utilization by delivering resources only for as long as those resources are needed. Aymerich et al. (2008) mentions that cloud computing is particularly beneficial for small and medium businesses, where effective and affordable IT tools are critical for helping them become more productive without spending a great deal of money on in-house resources and technical equipment.

In order to develop applications that suit microenterprises, this paper draws upon an established concept of the information architecture called the Zachman Framework. Information systems architecture has been defined as "a series of principles, guidelines, or rules that guide an organization through acquiring, building, modifying and interfacing IT resources throughout the enterprise" (Boar, 1996, p. 171, in van Vliet 2007). The Zachman framework has been a useful tool to enable the structure and organization of an information system to be described (van Vliet, 2007). This paper uses a modified version of the Zachman framework that is applied to what we know about how ICTs enable growth to take place in micro-enterprises. The concept of information systems architecture has become a necessity for establishing order and control in the investment of information systems resources (Zachman, 1999). In past studies, the Zachman framework of IS architecture has been used to focus and bring clarity to large organizations and their corporate infrastructures (Pereira and Sousa, 2004; DeLooze, 2001; Inmon et al., 1997; O'Rourke et al., 2003; Perkins, 2001). In this research, we utilize the Zachman (1999) Information Systems Architecture framework that was extended by Kamal and Qureshi (2009). The extended framework by Kamal and Qureshi (2009) provides the rules upon which the cloud computing interventions can be developed and then assessed. Based on the extended framework by Kamal and Qureshi (2009), the rules upon which the cloud computing interventions may be developed are illustrated in Table 1 below.

**Table 1: Information Systems Architecture for Microenterprises**  
(Source: Kamal and Qureshi, 2009)

	Basic Zachman frame work			Extended Zachman frame work		
Development	What (data)?	How (function)?	Where (network)?	Who (people)?	When (time)?	Why (motivation)?
<b>Economic</b>	Data on customers, prices, products etc.	Determine business processes that can benefit from automation	Identify which business units may be connected through IT	Micro-entrepreneur , small business development agencies, non-governmental organization	Determine the readiness of the business to incorporate IT	Improved revenue, cost savings through administrative efficiencies, competitiveness.
<b>Social</b>	Understand social ties to business  Map out community needs	Determine opportunities for partnerships through investigation of common IT platforms for facilitating support & training among Microenterprises	Online communities of similar businesses.	Support from family, friends, legal advisors, financial advisors, community development centers.	Know when to ask for assistance.	Improve chances of sustainability through communally oriented microenterprises which are more attractive to investors by virtue of their enhanced stability, size, and cohesion.
<b>Human</b>	Data on owner's Educational background; Understanding of how MC perceives /views technology ; Their learning Style & willingness to learn	Learning how to use the technology for the business	Determine multiple means to obtain the necessary knowledge/training for the IT e.g. online, workshops, seminars, college courses.	Micro-entrepreneur , local universities and community colleges	When to go for help, training.	Skill enhancement, control of business through IT, self-empowerment, learning & labor productivity.  Reduce fear of IT through education & awareness to empower owners to take control of IT for their business.

In interpreting the architecture given in Table 1 above, we see that along each row we have each of the development perspectives, i.e., economic, human, and social development. If we read along each row, we see the descriptions of each dimension for that development perspective. For example, for the economic development perspective, it is necessary before any IT intervention takes place that data on the microenterprises' services, products, prices, customers and markets are obtained to get a sense of the business. An understanding of the processes of the business is also important as it will identify which operations are amenable to the incorporation of IT and also which operations may be connected with each other. The rows in Table 1 represent the different perspectives which may be used to view a business, a situation, an opportunity, or a system. These perspectives represent the points of view of all the participants involved in the planning, conception, building, using and maintaining activities of an organization's IS (Inmon et al. 1997).

As we are dealing with very tiny businesses, the key stakeholder is the micro-entrepreneur that will be responsible for any resulting change in the business. For an intervention to be most effective, a crucial requirement is the timing. It will be necessary to assess if the microenterprise is ready for using any new technology in the business. The last column in this economic perspective (Table 1) deals with the motivation factor. By intervening into any micro-business with IT, common resultant effects would be to increase their revenue and/or cost savings through administrative efficiencies, and also make them more competitive with other businesses. Keeping these issues in mind will enable effective intervention strategies to be tailored for microenterprises to enable economic development. In the same fashion, reading along the rows for human and social development perspectives provides an understanding of the issues that need to be considered as interventions are designed to target those perspectives respectively. As a whole, this IS architecture provides a systematic view of the considerations impacting the design of the architecture. This architecture will be used to analyze the needs of each micro-enterprise and design appropriate technology interventions. The architecture will be used to understand how a potential intervention may impact the specific micro-enterprise in terms of economic, social and/or human development.

## METHODOLOGY

This paper follows a multiple case study methodology carried out in an inductive qualitative manner. The micro-enterprises are sole proprietorships, with less than 5 employees – often run by a single owner. In order to assess the effects of cloud based interventions on the micro-enterprises, three micro-enterprises with limited time, resources and that require customized interventions were chosen. The criteria for selecting the micro-enterprises were based on a set of criteria developed to enable us to select those that were most vulnerable. According to Patton (2002), sampling in qualitative research is purposeful rather than randomly as is the trend in quantitative research. In purposeful sampling, information-rich cases are selected strategically and purposefully. In addition, the specific type and number of cases selected depends on the study's purpose and resources (Patton 2002). Specifically Patton (2002) states that, "The validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information richness of the cases selected and the observational/analytical capabilities of the researcher than with sample size." The following criteria are used to select the micro-enterprises for this research:



1. The size of the business should be between 1 – 5 employees.
2. There should be some form of IT already existing in the business.
3. Micro-entrepreneur should be willing to experiment with IT.
4. Micro-entrepreneur should have the motivation to grow their business
5. The micro-entrepreneur has limited resources for his/her business. These could be lack of time, money, expertise, etc. – which are identified.
6. The micro-business should have one owner who is the decision maker.

Three micro-enterprises were selected for this study based on the above criteria and needed technology and training interventions in order to grow their businesses. Within each of the micro-enterprise cases, an action research approach is utilized to apply context sensitive IT interventions. This process has been referred to as “IT Therapy” in Wolcott, Kamal & Qureshi, 2007 and entails a processes of diagnosing the businesses’ needs, selecting these based on a set of alternatives and implementing technology and training solutions. The selection and implementation of these customized IT interventions enable the effects of these interventions to be assessed within the micro-enterprises selected for this study. Of the three micro-enterprises, only one micro-enterprise was given cloud computing interventions together with the requisite training. The second micro-enterprise’s selection process did not involve cloud based interventions. The third micro-enterprise’s selection process did involve cloud based interventions but these were not adopted. The assessment of the outcomes of these interventions for each of the micro-enterprises is carried out using the extended Zachman Framework to arrive at an understanding of how the outcomes addressed the economic, social and human development objectives.

The following section illustrates the effects of the technology and training interventions carried out and the subsequent analysis section uses the extended Zachman framework to identify areas in which cloud computing applications may enable these businesses to survive and in the long run grow.

## RESULTS AND ANALYSIS

Three micro-enterprises are investigated in this study. The first case involves a micro-enterprise that uses cloud based solutions to grow. The second and third cases report on comparable micro-enterprises that received IT interventions that were not cloud based solutions. These micro-enterprises, like the first one are dependent upon assistance to be able to use ICTs to grow their businesses. In this section we use the extended Zachman framework to assess the ability of the micro-enterprises to grow. For each of the cases, we begin by giving a description of the background and the challenges faced within the micro-enterprise, followed by the specific IT interventions that were applied to address the business challenges. Observations made in each of the cases as the interventions were being carried out are outlined next. Each case ends with a description of the outcomes that resulted in each business. These outcomes were then mapped to the information architecture to show how they impact socio-economic growth of the micro-enterprise.

### **CASE 1 – A Microenterprise case with Cloud-based interventions**

GS is a small gift shop located on the main street of a small town. The shop specializes in the sale of collectibles, novelties, souvenirs, and other various gift items. GS has been in business 14

years. The researchers met with the micro-entrepreneur and asked questions regarding how they perceived information technology and how they thought their business may benefit from technology. They found that he had a positive attitude of IT, was open to adapting technologies and was able to adopt new IT with the help of someone teaching him. They found that GS would like to market his products better, lacks time due to being sole owner, and lacks IT skills. While his objective is to increase sales by retaining customers and establishing new customers, he has advertised in local papers & on radio and would like to get a better return on investment with his marketing funds. He would like to use IT to help market the business. It then appears that the main objective is to better market the microenterprise and increase sales by reaching out to more customers. GS has limited IT skills and the biggest obstacle is lack of time that they can devote to learning IT on their own. However, the micro-entrepreneur realizes the importance of the Internet in being able to facilitate them in reaching out to more potential customers.

### ***IT Interventions***

The following paragraphs describe the interventions that were carried out for GS:

Social media: Facebook. The owner had never used Facebook before but saw the value in having a business page because of the vast audience Facebook has. GS could notify customers about new sales and also link to and from the newly created website. Facebook is also free and provides a very user friendly experience. Establish online web presence: GS owner wants to create a simple static website promoting his business. This website would mainly serve for informational purposes such as giving potential customers information about his store and products or services he offers. The website will have a links to GS owners other media outlets so everything will be connected.

Create a new website: Weebly. The main goal of the website was to provide information to customers about the business such as current sales, product lines, contact information and the location. The first attempt at creating a website was with using Joomla a content management system. The plan was for the researchers to set up the initial site and then the owner could easily update his website without having to code anything, all from within a web browser. The owner did not feel comfortable using the Joomla backend to make updates to the website. He took it upon himself to find an alternative solution. He found Weebly. This is an easy to use, drag and drop webpage creator which is entirely web-based. Weebly has both a free and premium version of its service. The owner was able to form a vast majority of his Weebly based site in only one day.

Research a method to manage promotional email to customers: Mail Chimp. GS had purchased a software package with several applications for small businesses. This package was inexpensive and the owner never got the email marketing software to work properly. He had investigated Constant Contact himself but found that it could be very expensive. Mail Chimp was the best solution. Once again, this service is managed entirely from a web-based interface with several options for integration with other email services and applications. The service is free when there is 1000 or less subscribers and less than 6,000 emails are sent a month. After that, plans just start at \$15 a month. This is an affordable and scalable way for GS to send and manage his email marketing campaigns.

### **Observations**

Following is a description of the observations made in GS as the interventions were being carried out. GS was very enthusiastic about these interventions at first. The first intervention carried out was having GS set up a Facebook page in which he was able to do on his own. The only minor issue he had was uploading pictures to Facebook. He was able to take pictures of his business on a digital camera and then, with some help, get the pictures and put them on Facebook. Within days, GS uploaded more pictures on his own and became friends with a neighboring business on Facebook. He really liked the ease of use Facebook provides.

A basic website was created with Joomla for GS. When the owner was shown how to update the site from the backend interface, he seemed somewhat lost. Further training on Joomla yielded more resistance. GS wanted a website service that was simpler to use. He felt that he would not be able to use Joomla on his own without any support in the future. He took the imitative and found a tool he feels more comfortable using. GS found Weebly.com which provides a more user friendly interface and simple drag and drop webpage creation. He was able to create a website over the course of one day on his own. GS is very excited with what he was able to do by himself already. He is really seeing the true potential in what he can do with his website and is gaining confidence sustainability.

The owner was shown MailChimp.com for addressing his email marketing campaigns. He seemed somewhat interested but a little hesitant at first. GS was given a walkthrough of an email campaign in mail chimp. He even said "Mail Chimp seems very user friendly." It was not until after the walkthrough that GS performed a mail campaign on his own. This shows that given the proper training, GS was able to apply what he learned.

### **Outcomes**

Following are the outcomes of the impact that the IT interventions created in GS.

Overcame fear of technology: During website intervention, GS demonstrated that he was able to overcome the little fear of technology that he had. He was afraid he would not be able to use Joomla on his own and took it upon himself to find a suitable alternative. When he found what he wanted; Weebly, he was able to quickly adapt it to his business and the fear was gone.

Eagerness to learn: From the first session, GS was always eager to learn. After each successful intervention, the trust and eagerness grew more.

Improved attitude towards IT adoption lead to IT acquisition: After GS was able to create a website on his own with Weebly, he felt like he could be more in control of his website and felt he could be able to update and maintain the website on his own. He is considering purchasing a domain name and possibly upgrading to Weebly's premium service in the future.

**Case 1: An Information Architecture for the Microenterprise case with Cloud-based interventions**

**Table 2. Information Architecture for GS**

Development	What (data)?	How (function)?	Where (network)?	Who (people)?	When (time)?	Why (motivation)?
<i>Economic</i>	Website to provide information to customers	Use IT to market products better.	Sales and marketing	Micro-entrepreneur	High readiness to incorporate IT	Market access
<i>Social</i>	Social media and website to connect to customers	Connects through social media and email	Social media, email	Part of small town main street	Know when to ask for assistance.	Potential for sustainability
<i>Human</i>	In business for 14 years and has a positive attitude to adopting IT	Learning how to use the technology for the business	Provide hands on training to micro-entrepreneur	Community support	Open to IT training but has little time	IT skills enhanced, increased productivity

**CASE 2 - A Microenterprise case without Cloud-based interventions**

KA is a life coaching business. KA was originally founded as a company that performed educational audits for various school districts throughout the country. Life coaching is taking a person’s goals and dreams and guiding them to meet those aspirations. By assessing what people are trying to achieve personally, professionally and financially, she can create a plan to assist in achieving these goals. The owner would like to eventually coach more businesses. Through seminars, she can reach a wider majority of people who are in similar situations since they work for the same company. By addressing them together, she would be able to build a wider clientele base, and would be able to meet with people on a more individual basis.

KA has an overall positive attitude of IT and sees the role of IT as primarily for administrative tasks. The owner uses only a very limited set of programs – primarily MS word, checkbook function on QuickBooks, and email – all of which she self-taught herself. She mentioned that she doesn’t use any form of technology during her coaching sessions but uses it afterwards for record-keeping and scheduling purposes. In response to whether she feels in control of her business through the use of IT, she stated that technology to her is a tool and with coaching it has to do with personal relationship building with clients and the technology is a tool that can be used for communicating, making appointments, or some question that might come up. She emphasized that it isn’t a matter of being in control – it’s a matter of how you use it as a tool and does it serve her well. The owner expressed her frustration over certain features of technology that are beyond her control to help her achieve what she needs to do for her business (to the researcher the frustrations she talked about seemed to stem from her lack of IT skill capabilities to understand and use the programs to accomplish the tasks the way she wanted to). The owner is somewhat hesitant and is usually the last one amongst her friends to adopt any new technology unless she is sure that it will be beneficial to her business. She talked about her website and the need to upgrade it to look more professional and be able to upload documents to the website so that potential clients could get a better understanding about life coaching. She would also like to increase the visibility of her website on search engines to attract more clients.

She mentioned that she is able to learn IT through a variety of ways: one is by self-experimentation of the program and also by being in a class and being shown how to use the program by a professional – which she says helps increase one's capacity in using the program more efficiently. The owner believes that IT will provide her with more effective ways of operating as opposed to more efficient ways. She gave the example of PowerPoint where there is a lot more now to public speaking than just simple slides – there is the integration of video and audio clips and being able to manage all that technology up in front of a large audience. And so she would like to get her skill level up to where she can do that more. She also mentioned how the Internet offers the possibility to be able to locate and connect with coaches all over the world to tap into their experiences.

It was apparent that some technological direction was needed in KA. The owner was using three computers for three similar functions. Each one had similar software, so there was no real advantage or disadvantage to one or another. She has one desktop computer in her home office. This computer is used for her work e-mail, as well as personal e-mail. Once the e-mail is downloaded on the computer, it is erased from the server. This presents a problem when she is at work and is trying to refer to client history or e-mails. Outlook 2002 is currently used to sync up her Palm Pilot. She refers to the calendar feature in Outlook when trying to schedule clients. The laptop computer that she possesses is used to take notes about clients. She also uses this laptop computer to keep track of her finances through the checkbook feature in QuickBooks. The owner mentioned that she was concerned about the version of her QuickBooks because she received an e-mail that the version will no longer be supported as of 2009. This was one area where she wanted some guidance and alternative solutions to her support issues. Her work desktop is using Windows XP and Office 2003 Professional. The owner enjoys using this computer because it has Publisher 2003. She does not have any desktop publishing software on either of her own computers (desktop and laptop at home) so it has a small advantage in that respect. The office desktop utilizes a shared e-mail account using Outlook 2003. She does not like to send clients or personal contacts e-mail from this account. She will send her Publisher documents to herself, and then forward the messages from her home desktop computer when she gets home.

### ***IT Interventions***

After learning of the various processes of developing and relaying information in KA, it was clear that there is a need to consolidate processes. By sprawling information over three similar machines, the owner was stretching her personal time without gaining any professional results. This over-kill of redundancy was keeping her from doing what her business is intended to do: focus on organization. Time spent on organizational overhead is something that was an issue for the owner. She spends a lot of time manually taking notes when she is not near a computer, and then re-entering the information into her Word document regarding each client. She does not want to continue to create duplicate information and spending the time and energy that she currently is. She would also like to utilize the current software she has in a better way. Her Word table is not very functional and she does not feel that she is using it to the fullest extent. The owner did not enjoy having to wonder which computer contained which documents and data, as well as trying to gain access to her e-mail once it had been downloaded. The following interventions were carried out for KA:

Consolidate information: The overall goal was to move the owner's existing e-mail from her desktop computer at home that was in Outlook Express to her laptop computer using Outlook. Her Palm Pilot syncs would then be performed with her laptop computer using Outlook. This

would allow the owner to utilize one program and one machine that she could take with her and pull out as needed for reference.

Research new software program: Coach's Console. It is a web-based coaching software tool that can be used to keep track of clients, appointments, billing, scheduling, and advertising. This tool is something that one of the owner's fellow coach uses and was eager to learn more about it, but didn't know how to do so. If she would be able to successfully learn to use a new technology, she would be able to set an example for her clients in their coaching experience.

### ***Observations***

Following is a description of the observations made in KA as the interventions were being carried out. During the consolidation process which involved migrating data from the home desktop to the laptop, one of the issues was to get the owner to use her laptop for e-mail. In creating the two e-mail accounts on her laptop, she will be able to take her e-mail with her where she goes. She currently received about 200-300 e-mails per week and would soon fill up her allotted space because she does not like to delete her e-mails. The first step was to move her e-mail from her desktop Outlook Express to her desktop Outlook. This process took about 3 hours for her inbox alone. She does not have a desire to keep her deleted objects, but would like to move the sent items as well.

Process/task improvement: After seeing first-hand how long it could potentially take to migrate all the emails from her desktop to the laptop, the owner realized that she needs to focus on deleting a lot of the old e-mail she does not need to move. She understood that doing this would ensure that she wasn't wasting any time and keeping old data. Deleting old data that is not needed has direct implications for task improvements through time savings and task efficiency.

Overcame fear of technology: The second intervention of researching new software, called Coach's Console, had visible effects on the owner. The researchers sat with the owner and watched the demonstration for the Coach's Console software. She was very grateful that someone who understood how software works was able to take the time and explain questions as she watched, and to also just be the driving force to actually getting up and doing it! It was intriguing to see how the owner overcame her fear of the Coach's Console software by sharing the experience of watching the demo together with the researchers. This has important implication for the community aspects of micro-enterprises in adopting and using IT. If a group of micro-enterprises would share their experience in how they were using a particular piece of software/hardware in their businesses, it would motivate other micro-entrepreneurs to use it as well.

Eagerness to learn: After watching the video, the owner was extremely enthused about learning more about the software. She went to a coaching conference and inquired about so many different aspects about the software. She was able to overcome her fear of the software and seemed eager to learn and embrace the software. The demonstration opened her eyes to a world of organization for organizers. She was looking for something easy for her and this seemed to be the solution.

Improved attitude towards IT adoption lead to IT acquisition: Overcoming fear of the software coupled with the owner's renewed enthusiasm about adopting Coach's Console lead to the purchase of the software and felt no hesitation about sitting down for the webinars.

Unfortunately she wasn't able to participate at one of the live sessions during the time the intervention was being carried out and the researchers being present, but felt confident that she could figure it out on her own. Her attitude was completely changed regarding the software and seemed very grateful.

**Outcomes**

KA was contacted 4 months after the interventions were completed. Changes in KA's operations and any changes in the owner's perception and use of IT are given below. These changes have implications for the effects of IT interventions on development.

Effects on business: Consolidation of information resulted in centralizing the owner's needs on her laptop. The owner had expressed that it was difficult for her to keep straight where one thing was versus the other and so the migration was very helpful in getting all of that off of her desktop and into her laptop. The ability of the owner to now have access to all the software programs she uses on the laptop has improved her administrative efficiency specifically through time savings. The purchase of the Coach's Console also has implications for further administrative efficiencies in KA. The Coach's Console interface enables clients to access her calendar for scheduling appointments. It also has the capability of a website and has a lot of different information that can be made available to her clients about what coaching is. It has frequently asked questions on it which clients will be able to refer to before they go ahead and contact her to be their coach. The owner is confident that once this software is fully engaged in KA, it will result in not only improved administrative efficiencies through time savings but also serve as a marketing tool to provide her access to new customers and enable her to be more competitive.

Effects on owner: The owner expressed that the consolidation of programs has given her greater focus and clarity on where everything was and made her more organized. She also mentioned that the decision-making process helped her decide to purchase the Coach's Console. She gained the necessary knowledge to know what questions she needed to ask the vendor before purchasing it and didn't feel that her questions made her feel embarrassed or belittled. The intervention made her more aware as to what IT can do for her business and she was eager to adopt this new program as opposed to before the intervention when she wasn't sure whether the Coach's Console would benefit her business or not and she was fearful of trying the software.

**Case 2: A Microenterprise case without Cloud-based interventions**

**Table 3. Information Architecture for KA**

Development	What (data)?	How (function)?	Where (network)?	Who (people)?	When (time)?	Why (motivation)?
<i>Economic</i>	Customer data and advertising material	Consolidating customer information in a centralized location	Marketing and customer relationship management	Micro-entrepreneur	Hesitant to use IT until value is proven	Time savings through administrative efficiencies
<i>Social</i>	Scheduling to connect with customers and peers	Tools for relationship building with clients	Customer relationship management	Customers, Micro-entrepreneur, and experts in	Know when to ask for assistance	To build a community for further growth of business

				same industry		
<b>Human</b>	High education and learns by watching and hands on training	Able to use IT in a variety of ways.	Skill learning through webinars, attending conferences	Micro-entrepreneur	Hesitant to use IT until value is proven	Control of business through IT, self-empowerment, learning & labor productivity.

**CASE 3 - A Microenterprise case without Cloud-based interventions**

SZ is a micro-enterprise owner who runs an online Peruvian boutique to compete with an established store in a trendy part of Omaha. She lacked funds and the ability to secure loans, so she settled on a digital model. Her plan was to advertise her shop at crafts fairs, through the Internet, and on posters. To get her site built, she hired an American web designer. She invested most of her savings in the construction of the site, in hosting it, and in purchasing Peruvian merchandise through family contacts in Peru. She wanted to improve sales and site traffic (there had been decent site traffic). She had heard about the use Google AdWords campaigns and site keyword optimization as approaches to boosting website traffic, and expressed a desire to use these technologies. Unfortunately, she did not understand how search engines worked, or how their functioning connected with her business goals. During the course of the initial discussion, it became clear that SZ had no backup of the site design / materials. SZ also had no knowledge about the use of SSL certificates to secure credit card transactions. SZ, once informed about the importance of backups and certificates, expressed a strong desire to back up her site.

***IT Interventions***

At the beginning of the intervention, SZ had no income from her business, only savings. She performed site chores in cafes and at her small apartment. SZ's site hosting was GoDaddy.com. She paid her site hosting fees monthly. SZ owned a modern laptop, which she used to edit her website content, and which also contained the Microsoft Office Suite; she had no need for an accounting package due to her low sales. She owned a good quality digital camera which she used to photograph products. She had Internet service at her apartment. She owned a cellular phone. She had, in storage, an extensive collection of Peruvian goods imported from Peru. The research team carried out the following interventions: they taught her how to back up her site, clean up her product descriptions, obtain a trust certificate, and launch a Google AdWords campaign. The team followed through and backed up SZ's site, and linked the AdWords campaign they prepared with the site; SZ would have only to press a button to launch the campaign.

***Observations***

In November of 2009, her website went offline. Good (2011) suggests that SZ lacked an IT plan but had not sought any advice, outside of the research team, in relation to what technology steps would be expedient. She had not read websites on technology entrepreneurship, though she



was quite capable of finding such. Given her need to form as many connections as possible to grow her business, SZ's asocial approach to technology also seemed strange. Though aware of their existence, for instance, SZ had not established her business on Facebook, Yelp, or LinkedIn. This combination of fundamental missteps-- passive tech-related social agency, asocial approach to technology, lack of an IT plan, probably undermined any chance SZ had to succeed on her own.

**Outcomes**

Once she was offered assistance, the challenges that prevented SZ from using technology to grow in any way were financial (Lack of Access to Loans, Lack of Savings). By the time that SZ was in a position to exploit the digital advertising campaign set up for her, she had exhausted her savings. SZ could perhaps have compensated for her lack of financial resources by partnering up with other businesses, but she was unable to make those kinds of strong connections in America. SZ expressed to the researchers that ‘she did not have funds to run the AdWords campaign’ they had set up. She indicated that she was not comfortable advertising until she had updated her product descriptions, as well, but she did not have time to do so. After failing to show up for a scheduled meeting, she informed the researchers that she had been hired for a full time job. SZ then disappeared. Her phone number was disconnected and she did not respond to email inquiries.

**Case 3: A MC case with Cloud-based interventions that were not adopted**

**Table 4. Information Architecture for SZ**

Development	What (data)?	How (function)?	Where (network)?	Who (people)?	When (time)?	Why (motivation)?
<i>Economic</i>	Revenue	Sales	Ethnic community	Micro-entrepreneur	Adoption of IT was constrained by lack of funds available and disinterest in looking for other open source alternatives	Market access
<i>Social</i>	Understand social ties to business Map out community needs	Connect with other ethnic businesses to improve exposure of business	Online communities of similar businesses.		Lack of funds prompted micro-entrepreneur to abandon business	
<i>Human</i>	Low experience level				Micro-entrepreneur showed disinterest in investigating other channels to further the business	

**CROSS CASE ANALYSIS**

Of the three micro-enterprises investigated using the extended Zachman framework, it appears that two were successful based on the outcomes assessed. Of the two micro-enterprises, it appears that the one that received cloud based IT interventions was able to take control of its IT function and had greater potential for sustainability without further interventions by the researchers. In order to arrive at an answer to our question: how can cloud computing interventions be designed to enable micro-enterprises to grow?, a cross case analysis is performed here. The three micro-enterprises had similar limitations and challenges that they faced and needed customized interventions in order to be able to use IT to grow their business. Table 5 below illustrates the outcomes of the technology and training interventions that were customized to the needs of the three businesses.

**Table 5: Comparative Analysis**

Type of Intervention	Case 1: Gift Store	Case 2: Coach	Case 3: Boutique
<b>Economic</b>	Better return on investment with marketing.	Better control of business, marketing and customer relationship management.	Limited financial resources and connection sources of assistance.
<b>Social</b>	Better connections with customers, other stores and community.	Better connections with customers, colleagues and community.	Few connections with customers, other stores and community.
<b>Human</b>	Was able to adapt application to business on his own, overcame fear of technology	Increased confidence with vendors, more aware of what It can do for business	Unrealistic expectations, unable to use IT to grow business
<b>Technology</b>	Cloud Computing: Social media, website and email.	IT: Consolidation mobile email, coaches console	Basic: Adwords
<b>Outcome</b>	Increased market access and sustainability	Increased administrative efficiencies, productivity	Out of business

The Gift Store owner had little time, skill and resources but wanted to use the tools to market to new customers while retaining existing ones. The cloud computing applications he implemented were easy to learn to use and he was able to maintain on his own. This not only increased his ability access new markets through the technology but also get a better return on his investments in it. The Coach was initially reluctant to use the technology and needed more training than the Gift Store owner to overcome her fear of technology and take control of her business using it. Once her data was consolidated on her mobile phone and laptop, she was able to realize administrative efficiencies through time savings and increased productivity by being able to use the technology with increased confidence. The Boutique owner had an opportunity to realize her business goals using the technology but was unable to do so as the economic, social and human factors in her life were not supportive of her business objectives.

The above analysis suggests that micro-enterprises can achieve greater benefits of increased market access through the use of cloud computing applications as these are easier to use and less expensive than regular systems that require hardware and software to be purchased and implemented. This analysis suggests that in order to be able to realize the benefits of cloud computing applications, it is important to consider all three development perspectives, economic, social, and human when developing the interventions for micro-enterprises. As can be seen from the comparative case analysis of cases 1 and 3, which are both store fronts, that simply implementing cloud based interventions in the micro-enterprises does not enable them to grow. We need to analyze them in light of the economic goals of the business, the social circumstances the owner is in. The human interventions address the micro-enterprise willingness to learn, be open to IT and take control. The extended information architecture developed by Kamal and Qureshi (2009), enables us to investigate these impacts. With respect to Cloud-based services, they help to mitigate many of the obstacles micro-enterprise's face. But for true growth to take place, the benefits offered by the cloud should be complimented with the micro-enterprise owner's ability to take control of their business with IT often developed through economic, social and human interventions.

### **CLOUD COMPUTING INTERVENTIONS FOR MICRO-ENTERPRISE GROWTH**

Kamal, Andre, and Augustyn (2011) showed preliminary evidence of the benefits of cloud-based services for small businesses in their study. In line with the findings from the Kamal et al. (2011) study, we see that in this study too, the social media and the email marketing interventions that were carried out in Case 1 clearly conformed to a SaaS infrastructure allowing the business to utilize them as marketing services. In addition, the website development interventions provided the support for a development framework that aligns with the PaaS infrastructure. What is important to note is that neither of the businesses used in the Kamal et al. (2011) study nor the microenterprise in Case 1 of this study needed to purchase any form of stand-alone applications in order to meet their business marketing needs. By utilizing applications on the internet platform such as online social networking sites as well as online content management systems, the micro-entrepreneurs that had very limited IT skills and no prior website development skills, were able to set-up and develop customized website for their respective businesses within a very short amount of time. With cloud based technologies, system maintenance and reliability issues are in the hands of the service provider which has a technical staff whereas in a standalone PC based environment, the technical issues are in the hands of the business owner. The business owner may not have the technical expertise required nor financial resources to provide their business with the much needed security, reliability, and maintenance support. Cloud services also tend to be very cost effective and offer great scalability. This provides small businesses the ability to grow without the need to worry about hardware and software upgrades. With tiered pricing models that many cloud services provide, barriers to entry are reduced thus giving small businesses quality software and services at an affordable rate (Kamal et al., 2011).

The results of this analysis suggest that cloud computing applications may be useful for micro-enterprises when they support specific needs relating to the challenges described above. The specific applications that may enable micro-enterprises to grow, entail a combination of services as well as features that require low levels of IT skills, training and costs of

implementation. The following diagram describes the key features needed in cloud computing interventions in order to enable micro-enterprises to grow:

**Table 6: Specifications for Cloud Computing Interventions**

<b>Development Objective</b>	<b>Functionality</b>	<b>Process</b>	<b>Outcome</b>
<b>Economic</b>	Cash flow, invoicing, sales, scheduling, coordination	Financial management	Administrative efficiencies, competitiveness
<b>Social</b>	Connecting with customers, partners, community members	Communication and coordination	Greater market access, customer satisfaction, competitiveness
<b>Human</b>	Training modules, intervention support	Learning	Increased productivity

The specifications in table 6, illustrate that in order for cloud computing applications to support growth in micro-enterprises, they will need to support the economic, social and human processes that are unique to each micro-enterprise. This suggests that Software as a Service model will have to go beyond the service to incorporate the functionalities described above. As more and more applications transfer to the cloud, costs related to IT purchase and maintenance will drastically reduce thereby facilitating micro and small businesses to have the same advantages as larger businesses. Taking into consideration the various obstacles that micro-enterprises face in adopting technology, cloud-based applications and services serve as a viable option for easy adoption of technology.

## CONCLUSION

Given that the majority of businesses in the world economy are micro-enterprises, supporting their growth could enable development efforts to be successful. While it is known that IT adoption in micro-enterprises increases their growth, it is not clear how this process actually takes place. This paper investigates ICT interventions in three micro-enterprises using an extended Zachman framework to ensure that human, social and economic aspects of the business are addressed. It found that the cloud computing interventions brought about the most sustainable benefits to the micro-enterprise. The analysis suggests that the adoption of cloud computing can enable micro-enterprises to benefit from the advantages that IT can create making them more competitive in the global economy in comparison to the cases in which cloud computing interventions were not implemented or adopted by the micro-enterprises. The contribution of this paper is in the information architecture framework which incorporates the human, social and economic factors when developing technology interventions in micro-businesses and subsequently using it to assess the impact on the growth of the business. This extended information architecture can guide the development of interventions that are appropriate to local conditions while enabling micro-enterprises to participate in the global economy.

This research study was carried out as a qualitative inquiry using a case study approach. Since the issue of technology in micro-enterprises is a relatively new area, this study focused on obtaining an in depth understanding of IT adoption in micro-enterprises. As more cases are

investigated, quantitative indicators will be established to measure the outcomes. Further research is being carried out to develop and study these constructs using a larger sample size, but is beyond the scope of this research.

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