Potential of Cloud-based Infrastructure for Small Business Development

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Abstract

With all the hype surrounding Cloud computing and cloud-based services, this study puts it to the test. This paper describes an in-depth case study of a micro-enterprise that utilized a cloud infrastructure to adopt technology. The contribution from this study is two-fold: one from the perspective of cloud-based services and how easily and effectively they may be incorporated into the business; and the second contribution is from a small business assistance program perspective in how such an infrastructure may be used to efficiently help businesses with technology. Prior research has shown that when small firms are able to adopt and use Information technology, they can grow faster than firms that don’t adopt technology. A major obstacle to the cause is their inability to utilize technology to its full capability. Findings from the case study shed insight for researchers and practitioners involved in using IT to assist microenterprises in underserved regions.

1. Introduction

According to the Association for Enterprise Opportunity (AEO), there are over 23 million micro-enterprises (MCs) in the U.S making up 87% of all businesses within the country. MCs are the dominant form of business in both developing as well as in many underserved regions of developed countries. Historically, MCs have been considered the backbone of the U.S economy. This form of business has the characteristic of comprising between 1 – 5 employees. Grosh and Somolekae [4] have stated that MCs have the potential to serve as the seedbed for economic development. But it is seen that this potential of many MCs are hindered from growing and functioning efficiently by an inability to use information technology effectively [5]. Although, it is not the primary engine of growth, the micro enterprise sector is very important for broad-based development, and for basic household economic survival [6]. MCs play a very important role in generating jobs, developing business skills, and providing needed goods and services to a community [7]. Barriers to starting these enterprises are generally low, households or individuals may engage in more than one micro enterprise, or may use one to augment or temporarily replace wage salaries. It has been said that when IT is used within the context of small and medium-sized enterprises (SMEs), significant benefits are achieved. In a report by Qiang et al. [8], it was stated that businesses can grow at a rate of 3.4% faster in terms of sales when email is used for customer communication. In the same fashion, 4% increase in sales as well as 5% increase in export performance was obtained when e-business techniques were adopted by SMEs in the manufacturing sector in Canada [15]. It has also been shown that profitability gains can come from cost savings rather than from increase in sales [10]. Although current literature supporting the utilization of technology by SMEs exists, in practice, the scenario is quite different in the case of MCs. Most studies in the field of Information Systems have focused on SMEs. Few studies have focused on issues relating to MC and therefore, are an under-studied topic.

Traditional theories of technology adoption and diffusion do not adequately explain the manner in which these types of businesses adopt and utilize technology [11], [12]. In a study by Wolcott et al. [14] on a set of MCs in an underserved region in North Omaha, it was seen that although the latest state-of-the-art technology was awarded to these entrepreneurs to assist them with their businesses, most entrepreneurs had not even opened the packaging within which these technologies were contained six months after they had received them! Qiang et al [8] also showed that among micro firms, only 27 percent use e-mail and 22 percent use Web sites to interact with clients and suppliers. The few studies that have shown how small businesses may benefit from adopting IT were very restrictive in the nature of the technologies being used. These past studies utilized applications that were installed on stand-alone PCs. These types of technologies may be feasible for SMEs, however, due to tight resource constraints, MCs are unable to afford such applications and therefore cannot incorporate them for their businesses and lose out of any potential gain from the technologies.

A new category of technologies that have recently emerged termed, cloud computing or cloud-based
applications/services may serve as a promising alternative to resource-constrained MCs. Essentially, in a cloud computing architecture, hardware and software services are stored on web servers, the "clouds", rather than spread over single computers. This allows users to access information from anywhere they have internet connectivity. Such architecture has sociological implications by delocalizing hardware and software resources, cloud computing changes the way the user works as he/she has to interact with the "clouds" online, instead of in the traditional stand-alone mode [1]. In this study, we investigate this new opportunity offered by the cloud computing architecture within the realm of MCs. Specifically, we address the research question, How can a cloud-based infrastructure facilitate MC development? Findings from the case study shed insight to researchers and practitioners involved in using IT to assist MCs in underserved regions.

2. Background

Micro-enterprises are a form of small business. Small firms differ from large firms in various ways. In terms of technology, micro firms tended to primarily use technologies such as email, web and simple accounting packages as opposed to medium and larger sized firms that used more complex applications such as CRM, and other similar technologies [3]. Dandridge [16] mentions that organizational theories that were developed as a result of studying large organizations, do not explain the true structure and management principles actually encountered in small businesses. Welsh and White [17] state that “a small business is not a little big business” and show that with respect to financial management practices (cash flow, break-even analysis, return on investment, and debt-equity ratio), the analytical models applicable to large businesses do not apply. Small businesses also face greater risks when investing in technology [18]. The skills, time, and staff necessary for planning are not major issues in large businesses, yet these same issues represent most of the difficulties in small businesses [19]. Subsequently, these issues are more prevalent in MCs. A study by Street and Meister [23] has shown that Information Systems (IS) play a major role in small firms looking to grow. One of the key findings in that study is that in order to support the internal transparency of the firm during its growth phase, there is a need for an appropriate IS to be incorporated at a very early stage – even before many of the other structural or organizational changes are initiated. Small businesses can also harness the power of IT as a source of strategic advantage to help them become competitive and obtain a favorable position in their sector of activity [20]. In a study by Matthews [24], it was shown that ICTs play an important role in the expansion of SMEs. The results showed that there is an increasing awareness and desirability of small firms looking to grow to use the potential of internet communications to reach a larger market for their products and services. Matthews [24] also discovered that lack of confidence in technology was a major inhibiting factor for SMEs looking to grow and suggests that training along with making small business owners aware of product and solution knowledge will improve their confidence in the use of ICTs to help support their business. There have also been some studies that have investigated the effects of vendor-approach as opposed to consultant-vendor approach in the implementation of information systems in small businesses and found that small business owners favored the vendor-approach in implementing operational systems such as accounting systems, inventory control, sales order processing, sales analysis, payroll, and purchasing [21], [22].

There is an emerging category of technology, termed cloud computing that may have the potential to benefit small and micro enterprises. A cloud computing architecture has hardware and software services stored on web servers, the “clouds”, rather than spread over single computers [1]. 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. [1] 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. The following section outlines the research design used to investigate the adoption of cloud-based applications in MCs.

3. Methodology

This study used an inductive interpretive case study [13] to understand how MCs may adopt IT. An action research methodology [2] was used to apply IT interventions within an MC in Western New York and the results analyzed. The research design used is shown in figure 1 below.

![Figure 1. Research design](image)

As seen in the figure above, there were four distinct stages at which activities were conducted. At T0, the researchers interviewed the micro-entrepreneur to understand their past, present, and future use of technology and how the owner thought IT could benefit the business. Stages T1 through T3 comprise the action research cycle that was conducted. At T1, the researcher once again met with the micro-entrepreneur to inquire about any of the immediate IT needs and also got an in-depth understanding of the business. Equipped with that information along with the information obtained from the interviews at the T0 stage, the researcher then planned what type of IT intervention was appropriate to apply to the MC. At T2, the actual IT interventions were applied. At stage T3, the researcher evaluated whether the IT interventions applied to the MC actually met and/or solved the needs expressed by the micro-entrepreneur. If not, then modifications were made and additional IT interventions were applied. Iteration between stages T1 through T3 represents the cyclical nature of the action research approach. The researcher then integrated all the data from the interviews and observations and carried out a case analysis to discover how IT may be adopted by the MCs.

4. The Case

TF is a health food store located on a main street in a small town in western New York. They have recently just held a grand opening for this store. The retail store specializes in organic and health foods, as well as vitamins and supplements. They even have their own private label, store brand products available in their store. A husband - HA and wife - WA are the owners and they are very experienced in owning and operating businesses, as they have owned other types of businesses for a number of years. Their other primary business involves document storage and certified document destruction. As technology continues to grow it pushes more things paperless. The owners have witnessed a decline in business as a result and that is one of the many reasons they decided to open up an organic health food store. WA has the vast product knowledge needed to run the store. WA also blogs and uses Facebook to promote the store. HA provides the backend support needed for the business. HA does the accounting for the store using QuickBooks. The owners have a positive view of IT, but HA feels more comfortable with technology. He provides any technical support that TF may need. Since TF is a new business, it really feels the need for a website. The owners would eventually like to sell their products online. This would provide tremendous growth to their business.

5. Results

5.1. T0: Baseline Assessment

The responses from administering the baseline assessment in TF revealed that the owners of TF have an overall positive attitude of IT. They already use IT for administrative tasks and some marketing, but would like to further expand upon it. HA predicts that using more IT would double the income of the business. One of HA's businesses, which deals with paper document storage and destructing is suffering a decline. He believes that this is due to the technology growth over the years. After witnessing first hand that
not adopting technology can be fatal to a business's health, he aims to incorporate much more technology in TF.

HA feels somewhat confident in the current technologies TF processes. However, he feels that some of the technologies are not being used to the fullest extent. While opening TF, HA feels that he lacks the time, skills, and funds to make any further progress on the current state of the business's IT elements. With more a little assistance, HA feels that IT could make an even greater impact on TF.

5.2. T1: Assessment of Challenges and Plan IT Interventions

**Historical/Social Context:** HA has owned numerous businesses over the years. He has a high school diploma and has taken some college level business courses and seminars. He had very few problems with the initial setup of TF. As for services to support the business, TF relies on the experience of the owners when it comes to business development. They outsource any legal issues and also outsource the TF's tax filings. HA uses Quickbooks for the day to day accounting. They have no outside help when it comes to IT assistance and education.

The current technology the business possesses is two networked computers. One is a desktop which supports the POS system that integrates with Quickbooks. The other computer is a laptop used to carry out administrative tasks and other business functions. These computers are networked together through a wireless router. The router is password protected and allows the computers to share a broadband Internet connection. HA had purchased an external hard drive to backup the data on both computers, but it is still in the box. As mentioned earlier, TF uses Quickbooks for accounting. They use Royal POS system which helps the business complete transactions and manage inventory. Both owners are familiar with Microsoft Office and use email extensively. HA noted that he has a beginner level of knowledge of Microsoft PowerPoint. The owners feel comfortable with the current setup of the hardware and software in their store. They would like to do more with technology, but they do not really know what to do next.

Although TF is a relatively new business, they have already begun promoting the business. With some outside guidance, they were able to setup a WordPress blog to act as their current website for the time being. The business, also setup a Facebook page in which WA maintains. They have also been featured in the local newspapers. TF also began advertising on the radio and are considering having a television commercial. The owners would now like a website that provides more information to customers and also has the capability to sell TF's products online. The owners feel that a website would bring TF a cost effective way to quickly grow their business.

**Plan IT Interventions:** After understanding the current state of TF it was clear that a website was what the business needed most. The owners had directly stated that they wanted a website but it is equally important to note that the TF had already begun to establish an online presence but needed a place to provide a complete presence to customers. Both of the owners have no prior experience with setting up and maintaining a full featured website on their own. The owners felt that HA would be the best person to create the website with the assistance of the researcher, because HA would also be the maintainer of the website. The owners would like to sell their products online because they strongly believe that it will greatly increase their sales. They view it as another channel to attract new customers from anywhere, not just the local region.

5.3. T2: Apply IT Interventions

The following interventions were carried out for TF:

**Create a new website:** Weebly. The main goal of the website was to provide information to customers about the business such as the current sales and promotions and eventually sell the products through the website. Since the business already has a Facebook page and a blog, it was essential to establish links between these different sites. Furthermore, WA learned how to use Mail Chimp to send out newsletter emails, so an area was also established on TF's new website for visitors to automatically subscribe to the newsletter. Weebly was chosen as the tool to use for creating the website because it provides a drag and drop functionality for web page creation with no coding experience needed. Weebly offers a free version and premium version. The free version provided enough features for TF's needs for the time being. The interventions below were then carried out to further enhance the website. HA was able to learn how to use Weebly at a rapid pace.

**Provide a way for customers to buy online:** Google Checkout. Allowing customers to purchase from TF was something the owners really wanted to do but did not know where to start. Google Checkout has zero set up fees and only takes a small commission when a product is sold. Weebly has built in support for Google Checkout such as a built in shopping cart. The other
benefit was that TF would not have to worry about secure payment processing, because that part of a transaction occurs on Google. The main objective of this task was to get TF set up to sell and show HA how to list products on the website. HA was able to set this up with the assistance of the researcher without any major issues.

*Share events and allow customer to easily integrate these events with their own calendar:* Google Calendar. TF would occasionally have guest speakers at their store, WA would promote this through Facebook and TF’s blog, as another mode of communication to customers, a calendar could also help promote these events. Google calendar was chosen because it provided an easy way for the owners to keep the calendar updated from their Google accounts as well as allow customers to easily add these events to their own calendar. This could then increase the turnout of TF’s future events. HA was able to integrate this into the website without any problems, he just needed to know how to get the custom code from Google to create the element on the webpage.

*Help customers find the business:* Google Places and Google Webmaster Tools. There were two aspects to this problem; physical location and web location. Google Places allowed TF to list the business on Google Maps and provide additional information such as hours and pictures to users. This will also increase the business’s local search engine visibility. Google Webmaster Tools focuses strictly on search engine visibility for the website. The main goal of this intervention was to help HA with the initial setup and provide some education on what these products can do and how to use them.

*Measure the success of the website:* Google Analytics. To help see how well the website performs, Google Analytics provides a way for HA to monitor the web traffic to TF’s website. Google Analytics can also provide complex reports if needed. HA really desired to know the number of visitors to the website and other general figures. This could potentially help TF formulate business decisions in the future.

5.4. T3: Observe and Reflect

Following is a description of the observations made in TF as the interventions were being carried out.

The interventions were carried out using a Macbook Pro and an Ipad. The business owner used the Macbook and the researcher used the Ipad which was connected through virtual networking computing technology (VNC) to the Macbook. This enabled the researcher to view and intervene when necessary while the owner attempted a newly learned task. HA was very open to this new way of learning. The major issue the owner had faced when doing the newly learned tasks was getting comfortable with the Macbook trackpad. This mostly occurred when a task involved a drag and drop technique. Although the researcher had demonstrated the drag and drop feature using one hand, HA overcame this obstacle by using both hands. He would click and hold with one index finger and do the dragging with the other index finger. He was already familiar with this technique because his own laptop has two mouse buttons and a trackpad. On the Macbook it was confusing to him at first because there were no mouse buttons, just the trackpad which is also the clickable button.

*Process/task improvement:* Once HA had become comfortable with using the Macbook, he then seemed to become more comfortable using Weebly. By the end of the sessions the time it took him to create a new page or modify a menu had dramatically decreased. He also gained a better understanding of how to place elements on a page in Weebly. These skills proved to be portable to another Weebly website which will be discussed in a later subsection.

*Overcame fear of technology:* Whenever the researcher provided detailed walkthroughs for the interventions, there were little to no fear of technology in HA. However, without any guidance from the researcher, HA seemed hesitant on his own. HA had bought an external hard drive prior to the start of any interventions. The researcher observed that the hard drive sat on HA’s desk for an extended period of time. It was not until the eleventh session that HA setup the hard drive on his own. After he took the initiative of setting up the drive on his own, he then asked the researcher if he had set it up correctly. HA did set it up correctly on his own. This shows that when given enough time, HA is not afraid of technology, even if it is something entirely new to him.

*Eagerness to learn:* At the end of each session, HA always asked the researcher when is the next session. This showed that HA was ready to continue to learn whatever the researcher felt was necessary for him to learn. It also showed that he felt like he was on the right path toward achieving TF’s goal of having a website.

*Improved attitude towards IT adoption lead to new replicable skills:* After becoming very familiar and comfortable with Weebly, HA built another website for a non-profit organization he is a part of. HA is very
passionate about this organization and was very proud of the website he created all on his own. It was clear that HA truly learned from the interventions and was excited that it not only helped his business, but also the non-profit organization. This shows human development of HA’s part and social development since the interventions led to HA helping the non-profit organization. It also has the potential for economic development since the business will most likely benefit from its website. Overall, HA has now realized the endless possibilities IT can provide.

All of the interventions where successfully carried out to the fullest and implemented, except for selling products on the website. All of the pieces to selling online are in place - however the owners want to have a large array of products online before they officially start selling online. This had led to them feeling overwhelmed at the sheer volume of products they would have to list on their website. As a result the owners have decided to hide their products page until they are ready to launch their online store. HA’s attitude of IT is stronger than ever, however he must find the time to list products so TF can sell online.

### 6. Discussion

From the case study described in this paper, it is apparent that the micro-enterprise was able to benefit from a systematic learning and adoption of IT. What is interesting is the notion that the nature of the technology solutions were all internet-based or in other words, cloud-based. The website development intervention provided the support for a development framework that aligns with the PaaS infrastructure. On the other hand, the online calendar and shopping cart applications, clearly conform to SaaS infrastructure. The business did not need 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 content management systems and other applications such as online calendars and online shopping carts, the micro-entrepreneur that had very limited IT skills and no prior website development skills, was able to set-up and develop customized website for their business within a very short amount of time. This case study showed strong preliminary evidence of the benefits of such cloud-based applications to small businesses. 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. 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 join the bandwagon of their larger counterparts in benefitting from the efficiencies that IT can create making them more competitive in the economy. Taking into consideration the various obstacles that MCs face in adopting technology, cloud-based applications and services serve as a viable option for easy adoption of technology.

As mentioned in section 5.4, the interventions were carried out using virtual network computing (VNC) technology. Virtual Network Computing (VNC) is a technology that allows a user to remotely view the Desktop of another computer running a VNC server. The VNC server can be configured in numerous ways. It could be password protected, it could only allow local network connections, and it could only allow the host’s screen to be viewed and maintain complete control of the mouse and keyboard input. This connection can occur over a local network or over the Internet. VNC is cross platform and several implementations have open source licenses available. For the case study described in this study, a Macbook Pro was supplied to the business owner to use while the researcher used an Ipad to view the Macbook through VNC during the interventions. The interventions required Internet access. The micro business in this study had wireless routers with Internet access. The Macbook and Ipad were both connected to the business’s network and then a VNC connection was established through the business’s network between the two devices. The Macbook’s operating system came with a VNC server which needed the proper permissions in order to run properly. The Ipad required a VNC client; there were several different clients to choose from. VNC is cross platform. Someone running a VNC server on their windows machine could be viewed by someone else who has a VNC client running on their Macbook. A vast number of VNC applications are open source. This openness allows VNC to be easily applied in interventions regardless of the platform the business possesses. After some research and trials, the researcher chose to use Pocket Cloud from Wyse during the interventions. This client has both a free and paid version, for this case study, the free version was
used. This provided sufficient functionality to carry out the interventions. Some notable features that this client provided were pinch to zoom on the Ipad and a pop-out mouse that enabled page scrolling. This client also supported the drag and drop feature which was crucial during the interventions using Weebly.

The important issue to note for this kind of a set-up is that during the interventions, it provides a very effective way for the business owner to not feel pressured and intimidated by the researchers. This could occur during an intervention when the researcher has no other option but to look over the business owner’s shoulder. This could cause the business owner to feel nervous as they are being watched. By carrying out interventions using VNC, it was observed that the business owners would sometimes forget that the researcher was even watching on a different machine. Therefore a more comfortable learning environment can be easily established through the use of these technologies. Another important advantage is that with VNC, this research has the potential to reach an even larger audience. Researchers could carry out their interventions using VNC and voice over IP calls. This could be more convenient for both the researchers and the business owners as they would not have to travel to receive technology related assistance for their respective businesses.

It then appears that using similar forms of set-up that are readily available may facilitate business development agencies and NGOs that aim to assist small businesses with their technology needs in a very cost-effective manner. The specific application utilized in this study was the VNC which uses a client server set-up over the internet or cloud-based. Therefore, the manner in which this study was carried out provides a glimpse into how cloud-based open-source applications may facilitate the process of providing technology assistance to small businesses – benefiting both the small business as well as the development agencies.

7. Conclusions

This paper describes an in-depth case study of a micro-enterprise that utilized a cloud infrastructure to adopt technology. This study outlined a very contextualized and systematic approach towards this end. This approach entails understanding first how the micro-entrepreneur perceives or views IT and then understanding the business forms the foundation on which appropriate IT interventions need to be designed and applied to create the most impact. For this study, the IT interventions were fully cloud-based and results from the case reveal that such applications allow MCs to quickly and economically adopt and use IT to bring about efficiencies.

The contribution from this study is two-fold: one from the perspective of cloud-based services and how easily and effectively they may be incorporated into the business; and the second contribution is from a small business assistance program perspective in how such an infrastructure may be used to efficiently help businesses with technology. Findings from the case study shed insight for researchers and practitioners involved in using IT to assist microenterprises in underserved regions.

With more proliferation of cloud-based applications and services, MCs will have a wider variety of technologies to take advantage of moving them towards industrialization. Future research will investigate different MC to address cloud-based application adoption issues such as; whether the type of industry would have an impact, the type of customer base being served, and various risks associated with cloud-based applications.

10. References


