



Entrepreneurs' use of internet and social media applications



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ABSTRACT

While it is recognized that the Internet and entrepreneurial opportunity are linked, the majority of studies analyzing business use of the Internet focus on small and medium-sized enterprises (SMEs). To address a need for adoption studies focused on new ventures, which differ from SMEs in terms of organizational stage and number of employees, this study analyzes survey data from entrepreneurs to understand factors that influence the adoption of multiple Internet and social media platforms, and the role of business incubation facilities in providing information technology assistance to these ventures. Regression analysis of survey data reveal that prior entrepreneurial experience was the most important factor in explaining a diverse number of Internet application and social media use. This finding likely stems from differences in cognitive frameworks between novice and experienced entrepreneurs, which impacts their ability to recognize opportunities and respond to technological change. The location of a new venture within a business incubation facility did not help in the diverse use of Internet applications. This result did vary by gender as model results highlighted that women in business incubation facilities were more likely to use a diversity of Internet applications than those not located in these facilities. These findings point to policy implications regarding the implementation of technology training programs for female entrepreneurs, and digital awareness/ training for novice entrepreneurs.

1. Introduction

National level broadband and entrepreneurship initiatives such as the National Broadband Plan (FCC, 2010) and the White House's Startup America Initiative (White House, 2013) highlight the importance of technological change and entrepreneurship to national prosperity in the global information economy. While it is recognized that the Internet and entrepreneurial opportunity are linked because of the general purpose technology (GPT) nature of the Internet, (Bresnahan & Trajtenberg, 1995), the majority of studies analyzing businesses and the Internet focus on small and medium-sized enterprises (SMEs) (Dholakia & Kshetri, 2004; Sadowski, Maitland, & van Dongen, 2002; Williams, 1999; Parker and Castleman, 2007).

Although prior work has acknowledged that firm age impacts the adoption of ICTs (Dholakia & Kshetri, 2004), new research is needed that separates new ventures from established small and medium sized ventures, which are distinct in three ways. One, SMEs are more likely to have been in operation for several years than are ventures that have not yet survived the critical three-year period otherwise known as the valley of death (Gompers & Lerner, 2002; Zwilling, 2013). Two, SMEs are more likely to have several employees than are newer ventures who are more likely to be managed and operated by one person or a small team of people. The Small Business Administration (SBA) for example defines small businesses as having between 100 and 500 employees, depending on

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the sector (SBA, 2016). Three, prior work has highlighted differences in communication and planning, decision-making, and rewards systems at different stages of the organization life cycle (Smith, Mitchell, & Summer, 1985). Thus, it is necessary to distinguish between new ventures, which are at the inception stage of the organizational life cycle, from established businesses at the high-growth or mature portion of their life cycle.

Given the need for research on newer ventures, this study will analyze the adoption of Internet applications by new ventures, and the role of business incubation facilities in providing information technology assistance to these ventures. In this study, new ventures are defined as ventures less than three years old with few, if any employees. Business incubation facilities are defined as facilities (physical or virtual) that provide physical space, business services, and/or mentoring for new ventures. In the analysis of Internet application adoption by new ventures, three research questions will be answered. First, to what extent are there differences in Internet application adoption in newer compared to older ventures? Two, what are the characteristics of new ventures and the entrepreneurs that adopt a variety of Internet applications? Third, what is the role of business incubation facilities in encouraging the adoption of multiple Internet applications?

Aside from providing much needed differentiation between new and established ventures, analytical results of this study provide two additional contributions to the body of work on SMEs and the adoption of Internet applications. First, this study addresses the need for evaluations of the adoption of multiple applications since prior studies tend to concentrate on one particular type of application (Parker & Castleman, 2007). Two, it evaluates the role of business incubation facilities in promoting application adoption, which is important since prior work has found that formal government policies are not as effective at enhancing adoption as are informal interactions with suppliers and consulting firms (Beckinsale, Levy, and Powell, 2006).

2. Owner-manager characteristics and information and communication technology (ICT) adoption

When evaluating the adoption of Internet-based technologies by small and medium sized enterprises (SMEs), it is important to analyze the characteristics of the owner-manager (Chua, Deans, & Parker, 2009) given the moderating effect of managers on the innovativeness and technology adoption of organizations (Damanpour & Schneider, 2009). Relevant characteristics of owner-managers to consider include: age, education level, attitudes towards technologies, and organizational goals (Chua et al., 2009).

In an organizational context, older managers are believed to have been socialized into existing organizational routines, which makes them less psychologically prone to change (Damanpour & Schneider, 2009). This organizational embeddedness appears to extend to more recent Internet innovations in social media. Studies have found that younger managers are more inclined to adopt social media than are older managers (Wamba & Carter, 2014). In addition to age, higher levels of education are believed to enhance the receptiveness of people to ideas (Damanpour & Schneider, 2006) and the ability to acquire information and reduce uncertainty (Damanpour & Schneider, 2009). It is also believed that educated managers are more capable of promoting an innovative atmosphere (Wamba & Carter, 2014) and are better at problem solving and decision making (Damanpour & Schneider, 2009).

In addition to managerial age, education level, and attitudes towards technology, other managerial characteristics such as gender and race may play a role, albeit less straightforward, in ICT adoption by firms. Men have been noted to use the Internet more intensively and to seek out different types of information on the web than women (Dholakia, 2006). Men are also more likely to contribute web content than are women (Hargittai & Walejko, 2008). Studies have also found gender-based differences in concerns about firm adoption of e-commerce. Macgregor and Vrazalic (2006) found for example that men were more concerned with the difficulties associated with e-commerce implementation while women were more concerned about the suitability of e-commerce for their businesses.

More recent studies of gender and social media find no gender differences in social media adoption (Anderson, 2015; Wamba & Carter, 2014) but rather differences in the type of social media outlets used by men and women. Anderson (2015) highlights that men are more likely to use online forums such as Reddit while women are more likely to use outlets such as Facebook, Pinterest, and Instagram (Anderson, 2015). Social media studies have also found variations in outlet choice by race and ethnicity (Krogstad, 2015). As with gender, this might influence the types of media adopted by an organization via the influence of the owner-manager or the customer orientation of the firm. Recent studies specific to entrepreneurs and ICT use have also found that Hispanic entrepreneurs are less likely to use ICTs in their business processes and for long-term strategic analysis than entrepreneurs of other ethnicities, even after federal level efforts to encourage ICT use to raise productivity and enhance profitability (Middleton & Byus, 2011).

3. SMEs and ICT adoption

In addition to owner-manager characteristics, a range of both internal and external factors to the firm impact the adoption of ICTs by SMEs (Lefebvre & Lefebvre, 1996). Firm size and age are examples of internal firm factors (Dholakia & Kshetri, 2004) as are the perceived benefits of a particular technology (Beckinsale et al., 2006; Grandon & Pearson, 2004; Mehrtens, Cragg, & Mills, 2001; Michaelidou, Siamagka, & Christodoulides, 2011). Irrespective of the potential benefit for a firm, if the perception of the benefit is not there, then adoption will not take place. Therefore, owners need to understand the technology and the benefits associated with adopting the technology before making investment decisions (Lee & Runge, 2001). Notable external factors impacting SME adoption include industry characteristics and trends, as well as macroeconomic trends (Dholakia & Kshetri, 2004).

Once the decision to adopt has been made, firms pass through a series of stages in the process of implementing ICTs (Kwon and Zmud, 1987; Daniels, Wilson, & Myers, 2002; Dholakia & Kshetri, 2004; Durkin, McGowan, & McKeown, 2013). While the number of stages varies across studies, the types of activities at each stage may be characterized generally as the initial decision to adopt, initial implementation and use of the technology, and later stages of implementation. Research highlights that these later

stages of adoption are particularly important to gaining the benefits from technology adoption (Kwon and Zmud, 1987; Dholakia & Kshetri, 2004; Forman, Goldfarb, & Greenstein, 2005), however, firms are slow to adopt advanced technology capabilities beyond email and web browsing capabilities (Forman et al., 2005; Lawson, Alcock, Cooper, & Burgess, 2003). Reasons for decisions not to adopt include cost, the technological complexities associated with adoption, and security concerns (Lawson et al., 2003; Levy, Powell, & Worrall, 2005).

The rise of Web 2.0 applications and the ability for users to generate content has changed the nature of online interactions, how customers learn about products, and how marketing is done (Constantinides & Fountain, 2008). Since the rise of social media platforms after 2008 (Bulearca & Bulearca, 2010), studies have expanded their analyses of ICT adoption to include social media (Meske & Stieglitz, 2013; Wamba & Carter, 2014). These studies find that SMEs use social media for a variety of purposes ranging from branding and marketing (Gummerus, Liljander, Weman, & Pihlström, 2012; Michaelidou et al., 2011) to observing customer behavior (Fischer & Reuber, 2011) especially browsing and purchasing strategies (Hennig-Thurau et al., 2010). Research also suggests that in order to realize the benefits of company to customer interaction via this medium, companies need to understand the extent that customers want to engage with companies on social media (Durkin et al., 2013).

While social media does have several potential benefits for SMEs, use of this new medium is not without challenges. As with other innovations in ICTs, studies have found that a barrier to use is the amount of time this type of online engagement requires (Moyle, 2012). Companies also struggle to convert online interaction with customers in the form of likes and comments into company profits (Mitic & Kapoulas, 2012), as well as the effectiveness of social media engagement on increasing brand awareness and sales (Michaelidou et al., 2011). In fact, recent statistics on social media metrics highlights that only 15% of marketers were able to quantify the impact of social media on their businesses (Moorman, 2015).

In terms of policy mechanisms for influencing the adoption of ICTs, studies have found that local intermediaries (local suppliers, IT firms, and consulting firms), are more influential in Internet adoption than government intervention and competitors (Beckinsale et al., 2006). This finding is in line with more recent work on race and Internet adoption, which uncovered that government efforts were unable to influence the adoption of ICTs by Hispanic entrepreneurs (Middleton & Byus, 2011). This finding perhaps speaks to the informal channels through which people learn about ICTs. It also suggests that the provision of IT assistance by local incubation facilities may be an effective informal mechanism that helps entrepreneurs use ICTs in their new ventures. This type of assistance remains unassessed in the literature however.

4. Study Area

To analyze the adoption of Internet applications by new ventures, and the role of business incubation facilities in providing information technology assistance to these ventures, survey data from entrepreneurs and incubation facilities were collected. This type of data is necessary to collect because existing secondary data sources such as the Global Entrepreneurship Monitor (GEM) and the Kauffman Firm Survey (KFS) do not have detailed information about broadband Internet use. The GEM survey contains general questions about communications infrastructure, but does not provide detailed information about broadband Internet use (GEM, 2014). The Kauffman survey contains questions about whether the company has Internet sales and a website (KFS Survey, 2014), but does not provide higher resolution information on other important uses of broadband such as social media applications.

Per the precedent set by prior work (Korunka, Frank, Lueger, & Mugler, 2003), a purposive sample of entrepreneurs was identified by contacting entrepreneurs at business incubation facilities. A snowball sampling technique was used to identify entrepreneurs outside of support institutions. From this purposive sample, 117 completed surveys were collected from entrepreneurs located in the Phoenix metropolitan area in the Southwest United States. In 2013, it was the sixth largest metropolitan area in the United States with a population of 1.51 million (Scott, 2014). Although not traditionally recognized as a traditional hub of entrepreneurial activity, Phoenix is an important metropolitan area to study questions related to business incubation and entrepreneurship. The metropolitan area has struggled to maintain a viable high-tech presence over the last several decades. In the 1980's Phoenix was a high-tech center dominated by the production of standardized products in branch plants (Glasmeyer, 1988). Thus, while there was a tech presence in the Valley, these activities did not yield new ventures via the spinoff activity one might expect from high-tech companies (Glasmeyer, 1988; Nordquist, 2016). This branch plant, back-office orientation began to change in the early 2000's with increased attention on innovation and entrepreneurship, and the metropolitan area has had more success recently in attracting west-coast high-tech firms (Nordquist, 2016).

In addition to non-branch, high tech activity, the valley is also making strides in cultivating entrepreneurial activity. In 2011 for example, Phoenix was ranked first in the United States for entrepreneurial activity by the Kauffman Foundation for Entrepreneurship with 520 start-ups per 100,000 adults compared to a national average of 320 start-ups per 100,000 adults (Hoover, 2012). Phoenix also has quite a few business incubation facilities, which are facilities that provide physical working space at low cost or no cost to entrepreneurs, low cost business services, and mentoring and networking opportunities (Marsh, 2015). According to the National Business Incubator Association (NBIA), in 2013 the Phoenix metropolitan area had 23 entities that were operating or developing incubation facilities (NBIA, 2013). As of 2013, there were about 33 business incubation facilities operating in the metropolitan area; this number includes traditional incubators (as defined by the NBIA), accelerators, and coworking spaces.¹

¹ The objective of traditional business incubators is to provide low rent office space and support services to new ventures. Co-working spaces and business accelerators are newer variations on this concept. The goal of co-working spaces is to provide office space, networking opportunities and an overall sense of community for entrepreneurs. The goal of business accelerators is to shorten the time of the venture creation process via a program that trains entrepreneurial teams.

To put this number in perspective, a study of business incubators in the United States highlights that in 2009 Cook County, Illinois (Chicago), New York, New York, and Los Angeles County, California each had eleven, eight, and seven incubators respectively (Qian, Haynes, & Riggle, 2011).

5. Survey Data

Two sets of web surveys were distributed to business incubation facilities and entrepreneurs in the Phoenix metropolitan area between December 2012 and May 2014. The first set of surveys was sent to managers of incubation facilities to collect information about services provided to entrepreneurs, with an emphasis on the provision of high-speed Internet and technology assistance (including website development and programming assistance). 29 completed surveys² were received from managers. Web surveys were also distributed to entrepreneurs in these facilities by sending a link to incubation facility managers who were asked to forward the survey to their entrepreneurs. It was necessary to distribute surveys in this manner because managers expressed concern about solicitation of clients which could detract from the start-up process. Thus, they preferred to distribute the survey themselves. For entrepreneurs not located in support facilities, a snowball sampling strategy was used to identify participants and survey links were emailed to these individuals directly.

Surveys sent to entrepreneurs contained a common set of 43 questions designed to collect information about the entrepreneur, type of business, the types of Internet applications used in their business processes, and their attitude towards technology adoption. For entrepreneurs in incubation facilities, surveys contained an additional ten questions that inquired about: their rationale for locating in an incubator, perception of the assistance provided by the facility, Internet access, and whether locating in an incubator gave them an edge in implementing web applications in their business processes. Appendix A contains the survey questions sent to entrepreneurs in incubation facilities. In all, 117 completed questionnaires were obtained from entrepreneurs; 89 from entrepreneurs in incubation facilities and 28 from entrepreneurs outside of incubation facilities. While interview data are not the main focus of this piece, it is important to note that follow-up interviews with facility managers and entrepreneurs were conducted, which provided contextual information for this paper. Interview respondents fell into one of two categories, survey respondents who indicated they would be willing to participate in an interview or respondents whose information was obtained in a snowball manner from prior interviewees. In all 34 interviews were conducted with facility managers and 76 interviews with entrepreneurs (50 located in incubation facilities and 26 not located in incubation facilities).

6. Survey Results

Tables 1, 2 contain the results of the incubation facility survey. Table 1 highlights that these facilities were about equally divided in their for-profit and non-profit orientation. Traditional incubators and co-working spaces were the most prevalent types of facilities surveyed. Most facilities did not target firms of a specific age or in specific industries. As for technology assistance (Table 2), just over half of facilities provided discounted Internet service to incubatees and the majority provided high speed Internet access as a benefit to locating in the facility. As for other types of business assistance offered, marketing and branding assistance were more likely to be offered than were logo development and website development assistance. An analysis of technology assistance and other types of business support services by facility type (incubator, co-working space, accelerator, etc) did not reveal differences in the types of support offered.

Tables 3, 4 contains some of the salient characteristics of the entrepreneurs surveyed. It highlights that the majority of respondents were white, highly educated males that are technologically competent and open to adopting new technologies. From a validity standpoint, these characteristics are representative of entrepreneurs in the U.S and Phoenix. Nationally, the majority of entrepreneurs are college-educated white males between the ages of 35 and 64 (Fairlie, Morelix, Reedy, & Russell, 2015). While the sample of entrepreneurs examined in this study are somewhat younger than entrepreneurs in Phoenix and across the nation, they are similar in terms of race, gender, and educational attainment.

From a business standpoint (Table 5), most respondents had started a business before. Most of their businesses sold a service and were either less than one-year old or greater than 5 years old. This is not surprising given the survival rates of new ventures. 80% of businesses do not survive the 18-month mark (Wagner, 2013) and most entrepreneurs struggle to cover negative cash flows in their first three years of business, a period of time often referred to as “the valley of death” (Gompers & Lerner, 2002; Zwillig, 2013). Thus, it is not unexpected that information for fewer businesses between the ages of 1 and 5 years was collected. A majority of firms are involved in the provision of services in industries ranging from engineering, data processing and hosting, to biotechnology. In terms of the services provided in these facilities, Table 6 provides an overview of entrepreneurs’ perceptions of business and technology services, as well as their rationale for locating in these facilities. Based on this information, the primary reasons for locating in these facilities are lower rents and networking opportunities, not technology assistance. Entrepreneurs felt they did not have higher Internet speeds in these facilities than they might have at another location. They were also almost equally divided as to whether they felt locating in a facility had given them an edge with implementing web applications in their business processes.

Based on the technology adoption literature discussed earlier, survey results were analyzed with contingency tables to examine whether individual factors indicated in the literature such as age, race, educational attainment and gender impacted entrepreneurs’ survey responses. Entrepreneurs’ age, race, and educational attainment did not produce any statistical differences in responses.

² A completed survey is defined as a survey with a 70% or greater completion rate on questions.

Table 1
Facility characteristics.

Are you a non-profit or for-profit facility?	
For-profit	44.8%
Neither	13.8%
Non-profit	41.4%
Type of Incubator	
Accelerator	6.9%
Coworking	27.6%
Hackerspace	3.5%
Hybrid incubator/accelerator	3.5%
Incubator	41.4%
Did not disclose	17.2%
What age of firms do you target?	
Brand new firms to less than 1 year	34.5%
Do not prefer to target firms based	44.8%
Firms 12–23 months	13.8%
Firms 24–35 months	6.9%
What is the primary purpose of your facility?	
Access to capital	3.5%
Business assistance	17.2%
Networking opportunities	6.9%
None of the above	44.8%
Provide low-cost office space	13.8%
Technology access	13.8%
Which of the following industries do you target primarily?	
Educational support services	7.1%
Engineering	10.7%
Internet publishing, broadcasting, an..	3.6%
Software publishers	3.6%
Specialized design services	3.6%
We do not target specific industries	71.4%

Table 2
Technology Assistance by Incubator.

Question	Yes	No
Do you provide discounted Internet access to the businesses in your facility?	55.2%	44.4%
Do you provide higher speed Internet access as a proposed benefit to entrepreneurs?	69.0%	31.0%
Do you provide website development assistance to the businesses in your facility?	48.3%	51.7%
Do you provide marketing assistance to the businesses in your facility?	82.8%	17.2%
Do you provide branding assistance to the businesses in your facility?	72.4%	27.6%
Do you provide logo development assistance to the businesses in your facility?	48.3%	51.7%
Do you provide on site programmers for assistance with web applications/other technical support?	31.0%	69.0%
Do you offer on-site technology assistance in the form of an IT person?	41.4%	58.6%

Questions pertaining to computer competency, willingness to adopt new technologies, and also the rationale for hiring technology assistance revealed statistical difference by gender. As regards gender, females were less likely to rank themselves as highly computer competent compared to males who were more likely to rank themselves as highly computer competent. Females were also statistically less likely to adopt new technologies than were men. In terms of hiring a person to help them with technology needs, women were more likely to want technology help because they felt they did not have enough knowledge in this area. Male entrepreneurs were more likely to want technology assistance to help them save time. Combined, these results highlight new dimensions of gendered differences in Internet use and contributions to web content touched on by previous research (Hargittai & Walejko, 2008; Dholakia, 2006).

In terms of why and how entrepreneurs use the Internet in their startup processes (Table 7) business visibility and information gathering were the top primary uses. As regards social media use, most entrepreneurs used social media, and Facebook was the most popular social media outlet. Few entrepreneurs used social media for data and information gathering. Instead, most entrepreneurs used social media platforms to market their business.

Table 3
Characteristics of entrepreneurs.

Sex	
Male	71.8%
Female	25.6%
Did not disclose	2.6%
Age (years)	
18–24	10.3%
25–34	35%
35–44	29%
45+	21.4%
Did not disclose	4.3%
Race	
White	70.9%
Black	6%
Asian	6%
American Indian and Alaska Native	0.9%
More than one race	3.4%
Did not disclose	12.8%
Education	
No High School Degree	0.9%
High School Degree or Equivalent (GED)	8.5%
Associate's Degree	8.5%
Bachelor's Degree	49.6%
Masters or Higher	22.2%
Professional Degree	5.1%
Ph. D	5.1%

Table 4
Entrepreneurs and technology competencies.

Formal Training in Computer Science	
Yes	35%
No	65%
Willingness to Adopt New Technologies	
Extremely willing. First to adopt	41.9%
Moderately willing. Buy if others are buying	12%
Pretty willing. Tech savvy and up to date	40.2%
Not very willing	6%
Level of Computer Competency Scale of 1–5	
(1) Can turn on a computer and surf the web	0.9%
(2) Can turn on a computer, surf the web, use office programs like word and excel at a basic level	0.9%
(3) Proficient in programs like Word, Excel and PowerPoint. Also are able to effectively use the Internet to accomplish tasks such as send emails, navigate pages, use search engines, use social media and purchase goods	29.9%
(4) Have mastered programs like Word, Excel and PowerPoint. Not only can you use the Internet but you also understand enough programming code to create your own webpage	41%
(5) Computer genius: You have mastered multiple forms of programming code, can reformat a computer and fix most problems as they arise	27.4%

7. The broadband use diversity index (BUDI)

Overall, the survey results highlighted variability in the number and types of Internet applications that entrepreneurs used in their business processes. These applications included cloud computing, e-commerce, social media use, and websites. Some entrepreneurs used several Internet-enabled applications (e-commerce, social media, Internet-based phone, and video-conferencing), while others relied on basic communications such as email and before web-based research. While it is difficult to disentangle the degree to which entrepreneurs use Internet-based tools effectively and efficiently; a diverse use of online tools can give entrepreneurs an edge in competing with larger and/or more established businesses. This edge stems from the improved visibility online applications offer new ventures and their potential for productivity enhancements.

To summarize the diverse uses that entrepreneurs make of the Internet and social media applications, a broadband use diversity index or BUDI is derived from the survey data. This index is comprised of nine different types of Internet and social media use, which are highlighted in Table 8. An entrepreneur received a “1” if they indicated use of these items in their business (see Appendix A for survey questions). For social media use, three scores were possible: “0” if no social media were used, “1” if one social media outlet was used, and “2” if more than one social media outlet was used. The BUDI has a range of 0–10 where 0 indicates no use of

Table 5

Business characteristics.

Entrepreneurial Experience	
Started Business Before	71.8%
Never Started Business	27.4%
Did not disclose	0.9%
Business Age	
Less than 1 year	25.6%
Between 12 and 23 months old	18.8%
Between 24 and 35 months old	9.4%
Between 36 and 47 months old	13.7%
Between 48 and 59 months old	6.0%
More than 5 years	26.5%
Product/Service Orientation	
Service	64.1%
Product	35.0%
Did not disclose	0.9%
Industry	
Accounting, tax preparation, bookkeeping	2.3%
Advertising, public relations	3.4%
Biotechnology	7.9%
Data processing, hosting, and related services	3.4%
Educational support services	2.3%
Engineering	10.1%
Internet publishing, broadcasting, and web search portals	6.7%
Life sciences	6.7%
Management, scientific, and technical consulting services	10.1%
Software publishing	2.3%
Specialized design services	5.6%
Other	39.3%

Table 6

Entrepreneurs in business incubation facilities.

Reason for Locating in an Incubation Facility			
Access to capital			7.9%
Services			5.6%
Company of other entrepreneurs			15.7%
Lower rent/costs			27.0%
Networking opportunities			20.2%
Technology assistance			1.1%
None of the above			20.2%
Did not disclose			2.2%
Perceptions of IT support and Internet Access			
	Yes	No	No Response
Does your incubator have an IT person on staff?	28.1%	73.8%	5.6%
Do you have higher speed Internet in your Incubator than you would have otherwise?	32.6%	62.9%	4.5%
Do you feel locating in an incubator has given you an edge in terms of implementing new web applications into your business processes?	47.2%	42.7%	7.9%
Has your incubator provided you access to resources about technology education?	59.6%	31.5%	9.0%
Business Support and Technology Resources			
	Favorable	Unfavorable	N/A or No Response
Quality of business services	73.0%	18.0%	9.0%
Quality of technology resources	67.4%	18.0%	14.6%

any of the listed items and 10 indicates use of all the items listed. The basic idea behind this index is that entrepreneurs using a more diverse range of Internet applications are more likely to maximize Internet visibility and productivity advantages of these technologies than are entrepreneurs with more limited internet application use.

Of the entrepreneurs surveyed in this study, many used between five and eight applications. The average number of applications

Table 7
Broadband and social media use.

Primary reason use Internet	
Business Visibility	34.2%
Collect Information	26.5%
Provide Information	22.2%
Sell Products	16.2%
Did not disclose	0.9%
Use social media	
Yes	78.60%
No	20.50%
Social media use for those who use social media	
Multiple outlets	54.70%
Facebook and Twitter	21.40%
Used one outlet	26.50%
Why use social media	
Marketing	52.10%
Business necessity	20%

was 6.1 which suggests a fairly diverse range of Internet applications used. In order to understand the characteristics of entrepreneurs and their businesses that drive a diverse range of Internet application uses, BUDI scores were split at the mean, and a “1” given to entrepreneurs that had a BUDI score above the mean and a “0” given to BUDI scores below the mean. Based on this split, 47% of entrepreneurs had BUDI scores above the mean. From this categorization of scores, a logit regression was estimated:

$$y_i = \frac{e^{X\beta}}{1 + e^{X\beta}} \quad (1)$$

$$\ln y_i = \beta_0 + X\beta + \alpha \quad (2)$$

where $y_i = 1$ if the index value is above the mean of 6.1 indicating a diverse range or high intensity of Internet use, $y_i = 0$ if the index value is below the mean of 6.1 indicating few application uses or low intensity Internet use, $X\beta$ is a matrix of coefficient estimates pertaining to entrepreneur and business characteristics and α is a constant.

Table 9 contains information about the covariates included in the model which are taken from the surveys conducted about entrepreneur characteristics and their businesses. Based on the adoption literature discussed previously, variables that describe the individual characteristics of entrepreneurs such as education, gender, age, and race are included in the model. Two dummy variables are also used to account for the relative tech-savviness of entrepreneurs. The first dummy variable indicates if an entrepreneur has prior training in computer science. The second dummy variable takes on a value of “1” if the entrepreneur ranked themselves a “4” or higher on a Likert scale of 1–5 with regards to their technology competency and ability. Business age is included in the model, as is business age squared to capture any non-linearities in the impact that age has on diverse Internet uses. Finally, a dummy variable indicating whether the entrepreneur had prior experience in starting a business was included in the model.

Table 10 displays the odds ratios from the logit models estimated, as well as summary information from a confusion matrix about the predictive performance of the model. Based on this table, model 1 predicted 67% of observations correctly, which is better than the benchmark metric of 50% used typically. Key characteristics of entrepreneurs that explain diverse application use include: education, prior computer science training, and prior entrepreneurial experience. Interestingly, prior training in computer science decreased the diversity of Internet use, as did the education level of entrepreneurs. These results perhaps reflect better a priori knowledge of the applications available to businesses, and more select adoption of particular applications rather than blind adoption of several applications irrespective of their potential usefulness. In terms of business characteristics, business age played a role in

Table 8
Broadband use diversity index (BUDI).

	Low-Score	High Score
Website	0	1
Blog	0	1
Ecommerce	0	1
Social media	0	2
Internet phone	0	1
Video-conferencing	0	1
Virtual reality	0	1
Online payments	0	1
Cloud computing	0	1
Total	0	10

Table 9
Regression variables.

<i>Variable</i>	<i>Definition</i>
Education	Number of years of education
Education Squared	Number of years of education squared
Started Business Previously	Dummy variable indicating whether an entrepreneur had started a business previously: “1” if yes and “0” if no
Business Age	Business age in months
Business Age Squared	Business age squared (capture non-linearity)
Gender	Dummy variable: “1” if entrepreneur is female, “0” if entrepreneur is male
Race	Dummy variable: “1” if entrepreneur is a minority, “0” if entrepreneur is white
Computer Science Training	Dummy variable: “1” if entrepreneur has formal training in computer science, “0” if entrepreneur has no training in computer science
Computer Competency	Dummy variable: “1” if an entrepreneur rated themselves a 4 or higher with regards to technology competency
Age Entrepreneur	Dummy variable: “1” if entrepreneur under 45 and “0” if entrepreneur over 45

Table 10
Logit Model Results (Odds Ratios) (standard errors in parentheses).

	Model 1	Model 2
Educational Attainment	0.055 ^{***} 0.056	0.038 ^{**} 0.044
Education Squared	1.085 ^{***} 0.032	1.097 ^{***} 0.037
Prior Entrepreneurial Experience	6.707 ^{***} 5.053	12.046 ^{**} 12.444
Business Age (in years)	1.04 [*] 0.022	1.054 [*] 0.023
Gender	1.382 0.924	0.147 [†] 0.154
Race	0.871 0.548	1.093 0.709
Computer Science Training	0.332 [*] 0.199	0.325 [*] 0.207
Computer Competency	2.545 1.788	2.531 1.947
Age of Entrepreneur	– –	– –
Business Age Squared	1.000 [*] 7.37E–05	1.000 ^{**} 7.58E–05
Facility	– –	0.225 ^{**} 0.163 ^{**}
Facility Interaction with Gender	– –	24.891 ^{**} 37.6917
Constant	5.30E+09 ^{***} 4.42E+10	1.75E+11 1.62E+12
Number of Observations	101	101
Wald Statistic	20.01	18.2
P-value Wald Statistic	0.0178	0.077
Pseudo R-Squared	0.1947	0.2405
Correctly classified	67.33%	79.21%
Positive predictive value	66.67%	80.00%
Negative predictive value	67.86%	78.57%

* 10% significance.

** 5% significance.

*** 1% significance.

application use which speaks to information gleaned from follow-up interviews with entrepreneurs. These interviews suggested that intensive Internet use plays an important role for the company as it enters a growth phase. As with education however, there also appear to be diminishing returns to Internet use as businesses age. This relationship perhaps reflects lock-in and an unwillingness to adopt new applications as ventures age. Perhaps the most important factor in explaining the diversity of Internet and social media use was prior entrepreneurial experience. This finding likely stems from differences in cognitive frameworks between novice and experienced entrepreneurs, which impacts their ability to recognize opportunities and respond to technological change (Baron & Ensley, 2006). Experienced entrepreneurs with richer cognitive frameworks are in a better position to exploit new Internet applications than are novice entrepreneurs with more narrow cognitive frameworks.

Given the large number of incubation facilities in Phoenix, and the technology assistance these facilities provide to entrepreneurs, a dummy variable indicating membership in one of these facilities was added to the model specification (model 2 in Table 10). This addition was made because it is expected that entrepreneurs with businesses in these facilities might be enabled to use a wider range of Internet applications than entrepreneurs not located in these facilities. An interaction term is also included in model 2 that indicates an entrepreneur is a female and belongs to one of these facilities. This interaction term was included because exploratory statistical results indicated some association between a diversity of broadband use, women, and the location of businesses in incubation facilities. The results for model 2 highlight that the location of an entrepreneur in an incubation facility makes it less likely that they will use more Internet applications. However, these results also reveal that this outcome depends upon the gender of the entrepreneur; the dummy interaction term indicates that female entrepreneurs are more likely to use a diverse number of Internet applications if their business is located in an incubation facility. Although women did not indicate disproportionately that their primary reason for locating in an incubation facility was technology assistance or that locating in an incubation facility provided them a competitive edge in implementing new web applications, locating in these facilities may have provided a means of informally learning about web applications and means of overcoming issues assumed with using Internet applications in their business processes.

8. Discussion and Policy Implications

The goal of this study was to leverage survey data to examine Internet application adoption by new ventures, which differ from small and medium sized enterprises (SMEs) in terms of business life cycle stage and number of employees. The analysis sought to answer three research questions: 1. To what extent are there differences in Internet application adoption in new ventures compared to older ventures? ; 2. What are the characteristics of new ventures and the entrepreneurs that adopt a variety of Internet applications? ; 3. What is the role of business incubation facilities in encouraging the adoption of multiple Internet applications?

Survey results did not indicate differences amongst entrepreneurs of different ages, races, and education levels in their Internet, social media use, or technology needs. Older businesses were slightly more likely to use a diverse range of Internet and social media applications than brand new ventures. A regression analysis of the diversity of Internet uses of entrepreneurs, captured via a new metric called the broadband use diversity index (BUDI), highlighted prior entrepreneurial experience as the most important explanatory factor. Although this result merits additional study, it perhaps reflects different cognitive frameworks with which entrepreneurs of varying experience levels perceive and use Internet and social media applications. There were also gender differences in perceived computer competence, willingness to adopt new technologies, and reasons for hiring technology assistance. Females had a lower perception of technology skills and lower willingness to adopt new technologies than did men. They were also more likely to hire technology assistance because of this perceived lack of competence than were men who were more likely to hire technology assistance to save time. Combined, these results highlight important new dimensions of gendered differences in Internet use related to the sphere of entrepreneurship.

The regression results also highlighted incubation facilities as an important informal influence on Internet application adoption for women. While the location of entrepreneurs in incubation facilities lowered the odds of using more Internet applications, this was not the case for women. In fact, women in business incubation facilities were more likely to use a diversity of Internet applications than those not located in these facilities. These results suggest a new means of influencing entrepreneurs that is somewhat in between formal government efforts and serendipitous interactions with consulting agencies and suppliers (Beckinsale et al., 2006). Given the small sample size of this study however, these results merit additional investigation.

While this study represents an initial look at this important aspect of Internet use, it does suggest potential policy levers to enhance the technology capacity, awareness, and use of the Internet and social media by women and novice entrepreneurs, particularly for enhancement purposes. The first policy recommendation regards the implementation of technology training programs for female entrepreneurs. Prior work has highlighted that female entrepreneurs face several obstacles in the startup process including lack of business experience (Carter, Williams, & Reynolds, 1997; Fairlie & Robb, 2009), lower levels of financial capital (Boden & Nucci, 2000; Fairlie & Robb, 2009; Verheul & Thurik, 2001), and a desire to balance family responsibilities (Brush, 1992; Cliff, 1998; Loscocco & Leicht, 1993). This study highlights that Internet-based applications and social media use may be another obstacle women's entrepreneurial ventures must overcome (Boden & Nucci, 2000; Carter et al., 1997; Fairlie & Robb, 2009). Based on these results, digital strategy programs targeted at women could work with business incubation facilities to tackle barriers women have with technology use including confidence with technology competency, as well as increasing awareness of how Internet applications and social media can improve the competitiveness of their businesses.

The second policy recommendation deals with digital awareness and training for novice entrepreneurs. While the Internet enhances the visibility and flexibility of new ventures to help entrepreneurs compete with larger companies, we know that *how* Internet-based tools are used matters. Based on the regression analysis of Internet use, inexperienced entrepreneurs are less likely to

use a diverse range of Internet applications, which places their ventures at a disadvantage in terms of visibility. To overcome this disadvantage, funding from federal, state and local entities could be channeled to incubation facilities, which could be important venues for designing and providing training programs focused on digital strategy. Some outreach programs, such as the Connect Ohio program, were funded to educate people about the Internet. However, many of these funds came from the American Recovery and Reinvestment Act (ARRA) of 2009, which are now used and unlikely to be renewed due to budget reduction efforts at both the federal and state levels. Thus, several of these programs have ceased operations. Business incubation facilities could also provide on-site technology assistance in the form of dedicated information technology people. This would provide needed assistance to entrepreneurs in their efforts to implement and experiment with new Internet and social media applications.

That said, it is important to note some limitations of the present study. First, the results are based on a case study of entrepreneurs in one particular metropolitan area of the United States. Future work can expand upon this study by examining similar questions in other cities around the globe. Second, the analysis is based on a limited sample of entrepreneurs. Future work can survey more entrepreneurs to evaluate the applicability of the present findings over a larger sample of entrepreneurs. Three, given the findings about the link between gender and incubation facilities, additional research about the role of business incubation facilities in providing technology implementation assistance to entrepreneurs is needed. Finally, this study did not distinguish between mobile and desktop Internet application and social media use. Given the rise in mobile device use since 2014 (Chaffey, 2016) and variations in user activities across desktop and mobile devices (Lambrea, 2016), this represents an important area for future research. At this time, little is known about the utility of mobile devices for business purposes since mobile studies are often focused on consumer behavior (Brackebush, 2016; Lambrea, 2016; Sterling, 2016).

Despite these limitations, this study represents an important first look at how entrepreneurial ventures, which differ from established SMEs, use Internet and social media applications in their business processes. The analysis also provided a first look at the role of business incubation facilities in enabling use of various Internet applications. An analysis of broadband use in this context is critical to unraveling the economic value gleaned from Internet use of different business types. It is also critical to changing the current policy emphasis in the United States and other countries on broadband Internet availability to the exclusion of important use-oriented aspects of Internet-based technologies.

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Appendix A. Entrepreneur survey

Have you ever started a business before?

- Yes
- No

How old is your current business? (Select only one of the following)

- Less than 12 months
- Between 12 and 23 months old
- Between 24 and 35 months old
- Between 36 and 47 months old
- Between 48 and 59 months old
- Older than 60 months

Which of the following industries best describes your current business? (Select only one of the following)

- Engineering
- Accounting, tax preparation, bookkeeping
- Specialized design services
- Management, scientific, and technical consulting services
- Biotechnology
- Nanotechnology
- Advertising, public relations
- Life sciences
- Software publishing
- Data processing, hosting, and related services
- Internet publishing, broadcasting, and web search portals
- Educational support services
- Other

What is the primary reason you use the Internet for your business? (Select only one of the following)

Maintain visibility of business
Provide information
Collect information
Sell products
Buy products

Do you have a website and/or blog for your company? (Select only one of the following)

I have a website and a blog
I have website but not a blog
I have a blog but no website
I have neither a blog nor a website

If you have a website and/or blog, did you create the website and/or blog yourself or did you solicit help from an outside source? (Select only one of the following)

Had help with the blog and website
Had help with the website but did the blog myself
Had help with the blog but did the website myself
Did both the blog and website myself
N/A. - Don't have a blog or a website

If you created your own website did you also do your own marketing, branding, and logo or did you use a website template? (Select only one of the following)

Used a website template
Did my own logo, branding, and marketing
Did my own logo, but hired help for the branding and marketing
Did my own branding, but hired help for the logo and marketing
Did my own marketing, but hired help for the logo and branding
N/A

If you outsourced either the blog or website, what was the driving factor behind this decision? (Select only one of the following)

Save time
Didn't know how
Don't like to do that stuff
Got a great deal on the cost of outsourcing
N/A

Do you sell a product or a service?

Product
Service

Do you sell your products on-line?

Yes
No
N/A

If you do not sell your products or services on-line, which of the following reasons best describes why you do not do so? (Select only one of the following)

Don't know how to
Don't trust on-line transactions
Don't know how to set up the website
Don't think it will help my business that much
N/A

Do you use social media technologies such as Instagram, Twitter, Facebook, Google+ and Pinterest for your business?

Yes
No

Which of the following social media technologies do you rely on most for your business? (Select only one of the following)

Instagram only
Twitter only
Facebook only
Google+ only
Pinterest only
Instagram and Twitter
Instagram and Facebook
Instagram and Google+
Instagram and Pinterest
Twitter and Facebook
Twitter and Google+
Twitter and Pinterest
Facebook and Google+
Facebook and Pinterest
I rely on Instagram, Twitter, Facebook, Google+ and Pinterest.
I do not use social media for my business

If you do use social media technologies, what is the primary reason you use them? (Select only one of the following)

Marketing
Data/ information gathering
Feel it is a necessity for business success
Everyone else is doing it
Not sure
N/A

Do you use internet based phone, like Skype?

Yes
No

Which of the following video-conferencing programs do you use primarily? (Select only one of the following)

Skype
Ooyoo
GoToMeeting
I do not use video-conferencing at all

If you do use video-conferencing programs, do you pay for the service?

Yes
No
N/A

If you do not use video-conferencing programs, which of the following is the primary reason for not doing so? (Select only one of the following)

Have no one to video conference with
Internet connection is too slow to video-conference
I prefer face-to-face meetings
N/A

Do you pay for email service or do you prefer to use free services such as Gmail or Yahoo?

Pay for service
Free email

Do you pay for basic programs such as Microsoft Office or do you use free software such as OpenOffice?

- Pay for programs
- Use free programs

Which of the following virtual reality technologies do you use? (Select only one of the following)

- Second Life
- Active Worlds
- There
- Other
- I do not use virtual reality technologies

Which of the following on-line payment services do you currently use? (Select only one of the following)

- Paypal
- Authorize.net
- VeriSign
- Square
- Stripe.com
- I do not use on-line payment services

Do you pay for your on-line payment service? (Select only one of the following)

- Yes, on per-transaction basis
- Yes for a flat-fee
- No
- N/A

Do you use any cloud computing applications for your business?

- Yes
- No

Do you pay for any of the cloud computing applications for your business?

- Yes
- No
- N/A

What is the primary way you learn about new technologies/ web applications? (Select only one of the following)

- Magazine
- Newspapers
- Websites
- TV programs
- Facebook
- Twitter
- Friends
- Family

How do you primarily go about incorporating new web applications in your business operations? (Select only one of the following)

- I learn on the fly and do it myself
- I seek out training then do it myself
- I ask my friends for help and then implement it myself
- I hire someone to do it for me
- I rarely implement new web applications

If you rarely incorporate new web applications in your business operations, what is your primary reason for not doing so? (Select only one of the following)

Too time-consuming
Don't think it is necessary
Technology changes too fast and there is always something new
Don't like tinkering with that stuff
N/A

Would you like to have an IT person on-staff to assist you with technology-related issues? (Select only one of the following)

Yes, it would be extremely helpful.
Sure, it would help
I am indifferent to an IT staffer
No. I can do things myself

If you could hire an IT staff person, what would be the primary reason for doing so? (Select only one of the following)

Save time for other business activities
I do not have enough knowledge in this area and need the expertise
Adopt new technologies more quickly
Other

How would you describe your willingness to adopt new technologies, i.e. smart phones, Ipods, etc.? (Select only one of the following)

Extremely willing, I am always the first person to buy new technologies
Pretty willing, I consider myself tech savvy and up to date
Moderately willing, I buy these products if everyone else is
Not very willing, I buy these products if I have to
Not willing. I generally do not use new technologies

How important is Internet speed to your business practices? (Select only one of the following)

Extremely important
Important
Moderately important
Not very important
Not important at all

On a scale of 1–5, how would you describe your level of computer competency? (Select only one of the following)

Can turn on a computer and surf the web
Can turn on a computer, surf the web, use office programs like word and excel at a basic level
Proficient in programs like Word, Excel, and PowerPoint. Also able to effectively use the Internet to accomplish tasks such as send emails, navigate pages, use search engines, use social media and purchase goods
Have mastered programs like Word, Excel and Powerpoint. Not only can you use the Internet but also you understand enough programming code to create your own webpage
Computer genius: You have mastered multiple forms of programming code, can reformat a computer and fix most problems as they arise

Do you have any formal training/ education in computer science?

Yes
No

What is your gender?

Male
Female
Do not wish to specify

What is your race? (Select only one of the following)

American Indian and Alaska Native
Asian
Black or African American
Native Hawaiian and other Pacific Islander
White
American Indian and Alaska Native and White
Asian and White
Black or African American and White
American Indian and Alaska Native and Black or African American
Multiracial combinations greater than 1% of the population
Do not wish to specify

What is your age? (Select only one of the following)

18–24
24–34
45–54
55–64
65 and over
Do not wish to specify

What is the highest level of education you have completed? (Select only one of the following)

No high school degree
High school degree or equivalent (GED)
Associates Degree
Bachelor's Degree
Master's Degree
Professional Degree
Ph.D.
Do not wish to specify

In which branch of the military have you served? (Select only one of the following)

Navy
Air Force
Army
Marines
Army Reserves
Naval Reserves
I have no record of military service

If you have served in the military, did you receive technology training?

Yes
No
N/A

What programming languages do you know? Knowledge of a program is defined as being able to perform tasks desired. (Select all that apply)

HTML
XML
JavaScript
VBScript
PHP
Java
CSS
CSS3
SQL
C

C++
Visual Basic
Lisp
TCL
Perl
Ruby
C#
Visual For Pro
Scheme
Python
Other

What was your primary reason for location in an incubator? (Select only one of the following)

Lower rent/ costs
Technology assistance
Business service assistance (accounting, clerical, etc.)
Access to capital
Networking opportunities
Company of other entrepreneurs
Higher speed Internet
None of the above

Does your incubator have an IT person on staff?

Yes
No

How helpful is the IT person to your business operations? (Select only one of the following)

Extremely helpful
Very helpful
Helpful
Not very helpful
Not at all helpful
N/A- Don't have an IT person

Do you have higher speed Internet in your Incubator than you would have otherwise?

Yes
No

What is your rating of the quality of business services in your incubator? (Select only one of the following)

Excellent
Good
Okay
Not very good
Poor

If you had the option of locating in an incubator again, would you choose to do so?

Yes
No

Do you feel locating in an incubator has given you an edge in terms of implementing new web applications into your business processes?

Yes
No

Has your incubator provided you access to resources about technology education?

Yes

No

How would you rank the quality of all the technology resources provided by your incubator? (Select only one of the following)

Excellent

Good

Fair

Poor

N/A

Which of the following incubators are you a member of? (Select only one of the following)

ASU New Media Innovation Lab

ASU Venture Catalyst

AZ TechCelerator

BioInspire

Gangplank

CEI

Innovations Technology Incubator

Launchspot

Mac6

Queen Creek Business Incubator

SEEDspot

SkySong ASU Scottsdale Innovation Center

Stealthmode Partners

Thunderbird Global Entrepreneurship Incubator

TechBA Arizona

Tallwave

Ideas Squared

AZ Furnace

Accelerator AZ

JumpStart

Assemble AZ

GROWop

West Mesa CDC

The Lab 137

MonOrchid

Spread the Weird Studio

Impact Business Accelerators

Co+Hoots

Heat Sync Labs

Jivemind

Union Workspace

52. In which city is your company located? (Short Answer)

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