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North Central Regional Center
for Rural Development

Policy BRIEF

Intermediary Perceptions of Rural Firm Tech Adoption

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Executive Summary

The goal of this project was to use key informants to identify the barriers that restrict rural firms' success in regards to technology adoption, and the strategies they can use to avoid or overcome those barriers. We do this from the perspective of a range of intermediary organizations providing different support to and working closely with rural firms. Technology adoption is a key component of a firm's competitiveness and long-term success, and affects the economic health of the community in which it resides. Thus, it is critical to identify obstacles and opportunities firms encounter in this endeavor. This study is part a larger, grant funded project that has the overarching goal of increasing innovation diffusion in Rural America.

For the purpose of this study, innovation is defined broadly to include formal and non-traditional considerations. Technology is defined to include anything that increases efficiency, and is not restricted to computer or internet-based tools. Firms of interest ranged in size from a small coffee shop to a large manufacturing facility.

The findings and recommendations in this report are based on fifteen interviews with staff members from six types of organizations in Michigan that provide support to firms. The selected organization types include: 1) Michigan State University Extension; 2) local chambers of commerce; 3) economic development corporations; 4) small business development corporations; 5) United States Department of Agriculture Rural Development; and 6) incubators. Participation in this study was voluntary and each participant was selected through semi-random process while also ensuring equal representations among organization types.

Representatives interviewed identified four broad types of obstacles to rural firm technology adoption: 1) resistance to change; 2) human capital barriers; 3) internet access; and 4) access to financial capital. Resistance to change occurs when established businesses develop habits leading to a mentality of "we've always done it this way" culture. Openness to change and/or risk can often alleviate this, but can be limited due to other obstacles such as restricted access to financial capital. Human capital barriers included the struggle to recruit and retain employees in rural areas, challenges with the local rural workforce, and small business owners faced with "wearing many hats." Respondents also reported that internet access helps address many of the isolation-related concerns faced by rural firms, but may not always available. The finding in this study findings support other research on the challenges of rural firm innovation in regards to human and investment capital issues, risk-aversion and resistance to change. Our findings also expand the existing literature by honing in on the issues of internet access, and the impact of technology adoption within community-serving agencies.

Introduction

The health of regional innovation ecosystems impacts the rate at which innovations are commercialized in the private sector and is affected by a wide range of factors such as availability of resources (e.g., human, physical, and financial capital) and firm characteristics (e.g., size, number, industry and concentration). Jackson (2011) explains that like biological ecosystems, these innovation ecosystems model “the complex [economic] relationships that are formed between actors or entities whose functional goal is to enable technology development and innovation” (p. 2). One major benefit of an innovation ecosystem is the opportunity for new technology to enter industry where private sector R&D investment gaps exist (e.g., enter from university spillovers), and these gaps are especially prevalent in rural regions (Festel 2013; Renski and Wallace 2012; Yu, Orazem, and Jolly, 2011). It is generally understood that there are differences in rates of innovation adoption based on a wide range of firm characteristics, such as firm industry, urban vs. rural firms, firm age, experience of firm creators, firm size and technological regime, and firm proximity to universities (Kenney and Mowery 2014; Renski and Wallace 2012; Revilla and Fernandez 2012; Yu, Orazem, and Jolly, 2011).

One characteristic that has been the focus of much discussion is the distinction of firms operating in rural versus urban areas (Goetz, et al. 2010; Markley, 2001; Renski and Wallace 2012). For decades, many rural areas have been economically disadvantaged relative to urban areas due to limited access to resources that encourage the creation and growth of innovative firms. Examples of these resources include low interest loans, investment capital, technology spillovers, human capital, and agglomeration economies (Markley, 2001; Mowery, Nelson and Martin, 2010; Renski and Wallace, 2012; Yu, Orazem, and Jolly, 2011). Further, rural firm ownership culture is more risk-averse than that of urban firm owners and the resulting effect is that rural firms have been much slower to incorporate new innovations into current practices (Markley, 2001; Renski and Wallace, 2012; Smallbone and North 1999). Rural firms have lower per-firm rates of conventional innovation creation compared to urban firms (such as patenting and licensing new technology) which reduces new innovation launch opportunities (Kenney and Mowery, 2014; Renski and Wallace, 2012). Rural firms, which are often agricultural firms, have historically been viewed as technology adoption laggards (Diederer, et al. 2003; Renski and Wallace, 2012; Smallbone and North 1999). At the same time, many of the innovations that are adopted by these firms only provide marginal changes to current practices (Mowery, Nelson and Martin, 2010; Renski and Wallace, 2012). These factors may contribute to the perception that rural firms foster a general resistance to change. To compound by these issues, university innovation spillovers and the infrastructure encouraging spillovers leading to technology commercialization interact mostly with urban firms (Mowery, Nelson and Martin, 2010; Nelson, 2012; Renski and Wallace, 2012).

An important step in the innovation process is firms’ abilities to access financial capital to further develop, implement and commercialize technology. Historically, private sector investors such as venture capitalists typically focus on innovations they believe will receive a substantial payoff (i.e., technology assumed to generate the best rate of return) and in firms that have greater access to resources (e.g., that may help mitigate other sources of financial risk) (Mowery, Nelson and Kenney, 2010). Large firms may be perceived as having lower risk,

thus easier access to financial capital and other resources. Roughly 95% of firms with more than 500 employees are located within metropolitan statistical areas (Plummer and Headd, 2008), so a large firm bias translates into an urban bias. Additionally, private sector investors may work through established channels, making it difficult for firms, especially those in rural areas, unfamiliar with the process to participate (Knickel, Brunori, and, Proost, 2009).

To aid in addressing some of these challenges, some academics and policy makers alike turned toward “grow your own” entrepreneurial strategies as one means to achieve rural economic growth (Dabson 2001; Drabenstott and Henderson 2006; Goetz, et al. 2010; Hanham, Loveridge and Richardson, 1999; Henderson 2002). One popular movement framed around the concept of establishing a “creative class” within rural communities was the expansion of parks, the arts and other related amenities in hopes they would attract new science, technology, and healthcare industries (Florida 2002; Lee, Florida and Acs 2004). However, there have been many criticisms of such policies as some have argued that many rural areas do not have the necessary resources to establish high-amenity communities or the infrastructure to support growth-oriented entrepreneurs (Goetz, et al. 2010; McGranahan and Wojan 2007; Peck 2005). Thus, one may argue that focusing attention on the current obstacles impeding rural firms accessing more basic resources and information may be insightful.

The goal of this study was to use key informants to identify the barriers that restrict rural firms’ success in regards to technology adoption, and the strategies they can use to avoid or overcome those barriers. We do this from the perspective of a range of intermediary organizations providing different support to and working closely with rural firms. Technology adoption is a key component of a firm’s competitiveness and long-term success, and affects the economic health of the community it resides in, so it is critical to identify what obstacles and opportunities face firms in this endeavor. For the purpose of this study, innovation is defined broadly to include formal and non-traditional considerations. Technology is defined to include anything that increases efficiency, and is not restricted to only high-tech innovations such as computer or internet-based tools. Firms of interest ranged in size from a small coffee shop to a large manufacturing facility.

There are a range of entities that can potentially provide support to rural firms in making technological innovations more accessible to the public, such as branches of companies, universities, and governmental organizations. This categorization includes several of the groups of stakeholders we interviewed for the study. Though this study only focuses on Michigan, the availability of resources varies considerably across regions and states. In addition, interest in innovating varies among rural firms. Though support organizations may try to spur firm interest, they do not always have the capacity to directly aid in the innovation adoption process. The representatives we interviewed are from organizations that provide support to rural firms, and they identified four broad types of obstacles to rural firm technology adoption: human capital barriers, resistance to change, access to financial capital, and internet access. Human capital barriers included the struggle to recruit and retain employees in rural areas, issues with the local rural workforce, and the issue of small business owners “wearing many hats.” Resistance to change was reported to develop when established businesses

become too comfortable in their habits, and creates a “we’ve always done it this way” culture. Openness to change and risk can help, but is sometimes limited by access to financial capital. Internet access can help address many of the isolation-related challenges rural firms face, but is not always available. Our findings support existing research on obstacles for rural firm innovation in that human and investment capital issues, risk-aversion and resistance to change were identified. Our findings expand on the existing literature by considering the issues of internet access, and the impact of technology adoption within community-serving agencies.

Research Methods

Our study sought out the views of the staff members of different types of organizations who provide support to firms. There were six types of organizations who provide support to firms that were included, and the selection of organizations was based on the team’s previous research and experience. The organization types included: 1) Michigan State University Extension (MSU Extension); 2) local chambers of commerce; 3) economic development corporations (EDCs); 4) small business development corporations (SBDCs); 5) United States Department of Agriculture Rural Development (USDA RD); and 6) incubators.

A list of all such organizations in the State of Michigan was compiled with web searches. Separate lists were created based on the type of organization, and each included lists of the staff members in all locations who directly interact with firms. We then developed a strategy to randomly sample staff from each type of organization. To do this, each staff member on this list was coded by the 2013 Rural-Urban Continuum Codes classification scheme from the United States Department of Agriculture Economic Research Service, based on the county in which they work. From each list, two urban-serving staff (codes one through three) and four rural-serving staff (codes four through nine) were randomly selected, and invited to participate in the study. The goal was to have three staff from each organization type agree to participate in the study. For organization types in which not enough staff responded after repeated contact, new staff were drawn through the same random selection process.

An invitation to participate in the voluntary study was emailed to each of the selected staff members, and the invitation included a list of the interview questions. Upon agreeing to participate, a phone interview was scheduled in which each staff person was asked for their responses to our three research questions:

- I’m trying to identify what factors lead to firms’ success in regards to technology. Can you tell me a story of a firm in your region that successfully adopted a new technology?
- Can you think of a business in your region that failed to keep up with the competition and suffered as result?
- Have you worked with a business that tried to adopt a new technology that didn’t get it done, or did and then found it didn’t work?

Interviews and Analysis

The three interview questions were developed by the research team, revised and finalized. All interviews lasted approximately one half hour. The interviews were conducted and recorded using Free Conference Call, and later transcribed. The transcripts were analyzed using the qualitative analysis software NVivo, identifying common themes and differences across organization types. Quotes that appear in the report are derived from verbatim transcriptions of the interviews.

Results

The results of the analysis are separated into four broad categories: 1) resistance to change; 2) human capital barriers; 3) internet access; and 4) access to financial capital. The section “Technology Adoption in the Community” appears at the end and includes the experiences of one of the fifteen respondents. However, this theme is also woven into the four broad categories identified. Categories with sub-themes were also broken out to highlight relevant views.

The ordering of each category below is based on the proportion of respondents who identified the item as an obstacle, the greatest being resistance to change (80%). It is important to point out that questions were open ended, thus, each respondent did not select from a list of choices. Instead, common themes—broad categories—emerged through the course of the analysis. Another important aspect of these results is that the respondents provide different types of education, training and support, and do not necessarily provide direct access to financial capital. This may be one reason why access to financial capital was not identified more frequently during the course of the interviews. Respondents were likely more attuned to the types of services they are able to directly provide.

Resistance to Change

An attitude of resistance to change among rural firms was the most commonly discussed theme in our study, and was brought up by twelve of fifteen participants (80%). Their general impression seemed to be that established businesses become comfortable in their habits, and sometimes it takes a crisis to bring them to the point where they accept that they must change. Businesses that failed to change were often discussed as examples of those that had failed to keep up with the competition and suffered as a result. In contrast, owners who were accepting of change and risk was often featured in the stories of firms who had successfully adopted new technology. Recommendations for rural firms from this section include not passing up opportunities for growth, keeping an eye on the market at all times, avoiding a “we’ve always done it this way” culture, and trying to embrace a practice of welcoming and accepting change.

Established Businesses Become Comfortable in their Habits

Many interviewees attributed a resistance to change to the comfort established businesses develop in their ways. An MSU Extension employee attributed the underutilization of a new website that matches local producers with restaurants to the unwillingness of the fishermen to add something to their routine. “There may be some [established people] who say ‘I don’t need any more business, and it’s just more work than it’s worth,’ . . . I don’t have time, or I don’t need the extra business or I’m just not interested. Or I’ve got my routine and I don’t

want to change it - that might be an issue.” A staff member of a rural economic development corporation described a similar attitude in a small manufacturing company in his region:

“They make maybe ten of these [units] a week. They have two employees full time, four part time. And we’ve met with them, we’ve talked with them about government contracting, and the attitude is that they’re comfortable in their niche. Would they like to see sales double? Maybe. But we don’t see them engaging actively in doing anything different. They’ll kind of keep their market segment, even though it gets smaller and smaller.”

It seems that the tendency of established businesses to become comfortable in their habits can not only result in missed opportunities, but also complacency and a failure to keep an eye on market trends. When asked to describe a business that was failing to keep up with the competition, a Chamber of Commerce director told us about a longstanding retailer where the owner still rings customers up by hand, makes handwritten receipts, and has not altered her product much over the years. A SBDC staff member described how restaurants must constantly reinvent themselves to accommodate changing clientele, but many restaurants dig in their heels: “Well this meatball sandwich has always been our best seller, and I can’t change that recipe’. Well you know, maybe now, the market doesn’t like to eat meat as much. I’m just using this as a theoretical. Don’t be so married to a particular product that you sink the ship with it.”

Finally, the comfort established businesses take in their habits can result in a “we’ve always done it this way” culture. Three interviewees described this particular phenomenon. A staff member of a rural incubator describes how this culture can become entrenched in a community. The established businesses who are comfortable in their habits are often the same ones who wield considerable influence over other local businesses:

“I do find that in the Midwest, you are sometimes in communities that are ten to fifteen years behind the times. And the reason they’re behind the time is that’s just the culture. There’s regionalism in the United States, and the culture is, ‘Well, we’ve always done it this way’ or ‘It still works good enough’. And looking to invest in capital and take the plunge, many people, the ‘Old Guard’ look at as a risk, so they won’t do it.”

Two interviewees from MSU Extension discussed at length the need for the whole firm or whole community to “buy-in” on the technology adoption opportunity at hand. This full acceptance and support of an endeavor seems a critical component of not only ensuring the project is a success, but that it is utilized to its full potential. The online marketplace we described earlier in the section, where farmers could sell their food products to local restaurants, had a buy-in issue as well. The Extension staff member explains, “It’s the chicken and the egg - the farmers don’t want to post if there’s not buyers, buyers don’t want to register and keep going on if there’s no product to buy. So it’s like, ‘OK, you both need to do this at the same time!’”

Necessity Can Drive Change

Four interviewees described scenarios in which established businesses were comfortable in their habits, but were forced to change by some event or realization. For example, a firm that had previously travelled around providing in-person trainings found their existing practices too cost prohibitive, and had to migrate their training to an online platform. A contract-filling manufacturing company found that they were getting many requests they could not fulfill for products that required an aerosol production line, and saw building the line as one of their only options for continued growth. A staff member of a rural small business development center saw a third-generation, sibling-owned family business that previously operated “off the top of their heads” realize they had to implement organizational knowledge management system when their father developed signs of dementia and their mother lost her vision.

It seems need can drive change, but the recognition of the need to change does not always take place overnight. A USDA RD employee described a scenario in which the realization of the need to change in a municipality was contested and took decades to sink in. A small community on a river in her service area debated the need for a sewer system for sixty-two years:

“Ultimately, what ended up happening, was the township board, finally decided - they finally got a strong enough board that said ‘We need this in order to move forward, and we’re gonna do it’. And they signed on the dotted line, and then the township board was actually recalled twice To you and me, it probably sounds like a little bit of a no brainer. Our community is based around being on a river, we want to keep our river clean, but yeah . . . it was 62 years. They went from having [originally been offered] a 95% [USDA RD] grant and a 5% loan. And they ended up, by the time we actually closed on it, just due to funding and you know, how things have changed over that many years, they ended up with about a 55% grant. So you know, significantly less than they could have had if they would have just taken the opportunity when it was handed to them.”

Openness, acceptance of change

This report presented stories about firm failure featured a resistance to change. Conversely, many of the stories interviewees shared about exceptionally successful firms involved an attitude of openness and acceptance of change. A rural economic development corporation staff member described the farmers who don’t cling to “the way we’ve always done it”. He said:

“Those farmers understand that in order to be the most productive, that you adopt new technology. You use cell phones to do commodity trading while you’re sitting on your tractor that’s driving itself because it’s using a GPS system. We’ve talked to farmers that are already starting to apply drone technology. And it’s - as opposed to those folks that are saying ‘Ahh, farming hasn’t changed in the last fifty years.’ It’s changed substantially! So it’s a mental attitude of saying, you know, ‘We want to embrace new technology’. Make sure that it makes sense for the company or for the business, but that there’s a willingness to change and understand how change is impacting their particular business segment.”

“I think there’s an attitude of being open to change. The companies that are successful in implementing new technologies are able to understand that the markets change on a regular basis, sometimes fast, sometimes slow. And they’re prepared both mentally and financially to be able to ramp up and access new technology, understand it, and train their employees to work with it.”

We even heard examples of the attitude of openness and acceptance of change enduring after technology adoption failure. A staff member of a rural incubator described a food processing firm that invested a substantial capital in a new process that ended up not working. She said “Because they have the right mindset, they’re going to recover.”

Human Capital Barriers

Human capital barriers were discussed by nine of fifteen interviewees (60%). A key component of these discussions was the issue of recruiting and retaining employees to rural areas. Wages, infrastructure, workplace culture, and isolation seemed to play a role in recruitment and retention. Issues with the local rural workforce were also central. Finally, small firms face unique human capital challenges. Roughly 95% of firms with more than 500 employees are headquartered within metropolitan statistical areas (Plummer and Headd, 2008), so a large firm bias translates into an urban bias. In small firms, employees find themselves “wearing many hats”, and find it difficult to focus energy on components of their business beyond general operations. While this is challenging for all small firms, urban small firms generally have the opportunity to access human capital to alleviate this challenge, even if they don’t take advantage of it. For rural firms, however, this opportunity may not even exist due to human capital constraints. Recommendations for rural firms from this section include paying higher than industry-standard wages, working to address infrastructure issues, adopting a flexible and modern workplace culture, avoiding nepotism to bring in fresh perspective, advocating for local vocational training, bringing in consultants when possible, involving workers in technology adoption, and finding creative ways to create business communities despite geographic isolation.

Recruiting and Retaining Employees in Rural Areas

Six of fifteen respondents identified recruiting and retaining employees to rural areas as an overarching problem. The following factors were identified as contributing to the issue.

Wage Incentives. Two respondents relayed how wages can work positively or negatively for rural firms. A staff member of an incubator in Northwest Michigan said, “A big issue we have in this area is we pay rural wages, like local wages, rather than industry-standard wages . . . we are definitely, I would say, 25% lower than the industry standards across the board.” She tied this to high turnover and low efficiency. In contrast, a staff member of a rural SBDC described how firms in her community have begun to stem outmigration and attract young talent by paying well above the going wage. She said, “Companies have to pay to bring in this young talent so we don’t lose it, because that’s the only way we’re going to stay innovative, and up-beat, and with the pace.” It seems that when possible, paying higher wages can create a virtuous cycle within a firm, and cut costs in the long run as a result of reduced turnover.

Infrastructure. Our respondent reported that rural areas can be severely lacking in infrastructure, in everything from essential services to luxuries. These infrastructure issues can make families question their decision to relocate to or remain in a rural area. An MSU Extension employee in the Upper Peninsula described the low availability of medical services in her region, and its implications. Hospitals in her region often do not have the latest medical

technology (including working CAT scan and MRI machines), lack specialists, and are few and far between. She said, “From my home, even to go to one of our smaller local hospitals, it’s forty minutes in either direction . . . which is something that people who choose to live in rural areas often accept as one of the trade-offs, but yeah, it’s kind of scary to think.”

Though at first glance it may seem frivolous, access to the internet can have a similar effect. A rural incubator staff member noted that she and her spouse returned to their rural hometown after college and sometimes questions their decision. She explained,

“We don’t even have cable where we’re at. There’s no fiber. So there’s no high-speed internet. There’s no way to even access or get high-speed anything. You have companies - it’s just crazy - to think if someone wanted to maybe instead of you know, start a business, or maybe work out of their home - if they live in a rural township, they may not have connectivity . . . My husband and I pay \$130 a month for this stupid Verizon wifi hotspot that hardly works . . . And we almost always go over our data, so it costs more. It’s clunky, and it’s unfortunate. When people talk about economic development, and attracting and retaining good talent, if you don’t have the infrastructure, you’re not gonna get good people.”

Workplace Culture. The same incubator staff member as above tied the outmigration of the younger generation into what she views as a predominantly old-fashioned workplace culture in rural areas.

“I find it so fascinating that we continue to be more efficient and effective [in the workplace], but nothing has changed. So many places are still like ‘We’re gonna have the 8 to 5 work day, you need to be at your desk at 8 and even if you have nothing to do you’re at your desk till 5’. Which, the Millennials, and even the generations after us are like, ‘Why? If I get the work done, what does it matter how much time it takes me or where I’m at when I do it?’ If you don’t balance that out, you’re not going to retain that good talent, because they’re going to go someplace that’s more progressive, and that is flexible, and figure it out there.”

Isolation. A staff member of an urban incubator described how firms in dense urban environments enjoy vibrant business communities and innovation ecosystems, benefiting from face-to-face conversations and networking opportunities. In contrast, employees of firms that aren’t within driving distance to any major population can begin to feel isolated. A staff member of a rural economic development corporation described how his organization attempts to build a business community for the ‘isolated’ firms in his seven county region, but firm representatives are sometimes unwilling to drive to the events and meetings. His EDC responded by holding a greater number of meetings in different locales and inviting smaller groups. A staff member of a rural incubator mentioned how the remoteness of his service area creates higher costs for inventors that are trying to commercialize and sell their product: “it means hitting the road, and having a very big spending budget . . . having to travel is the number one deterrent for business”. An MSU Extension employee in a remote part of the State told us

about a business she works with who would like to provide overnight delivery to their customers but cannot - neither USPS or UPS will guarantee it because of the distance. Firms must find creative ways to create vibrant business communities for themselves in spite of isolation challenges.

Local Rural Workforce

Respondents provided several key considerations and challenges that rural firms face in regards to the available labor pool.

Drug and Alcohol Abuse. Three of our respondents identified substance abuse issues within the local rural workforce as human capital problems. An MSU Extension staff member described a high-tech firm that is always purchasing the latest and most efficient manufacturing equipment, but has difficulty hiring local residents to run the machines because they often cannot pass the drug test. Indeed, rural areas generate several risk factors that promote drug and alcohol abuse, including macro-level stressors such as economic deprivation, and family stress such as unemployment or the outmigration of younger family members (Keyes, Cerda, Brady, Havens and Galea, 2014).

Workforce and Leadership Development. An SBDC employee described the way that a “family business” mentality in the workforce is leading local businesses to fail. A desire to hire family members can cause firms to overlook potential employees with better qualifications or fresh ideas. Firms may be better off in the long run by encouraging people to “intern” elsewhere prior to joining the family business. She said,

“It’s a father and a daughter running this company, and a handful of people, I think twelve employees, that are all local people, and fifty percent haven’t even passed high school . . . They just went straight into the trade. Their workforce is in their fifties or higher, so these people have been with them forever, and so they’re very averse to doing anything . . . We have family-owned shops up here that are on their third generation. But I see all of those situations, and I could quote multiples in that scenario that are failing because they have the same family members working in the business the whole time. Technology wasn’t important to them, the younger generation just went straight into the business, so they only learned what they already knew, and they didn’t bring any new insight in.”

Vocational Training. An MSU Extension staff member described two high-tech firms in her region that have had great success in regards to technology adoption, but have had difficulty finding employees with the required vocational skills, or that have access to training. These firms and others collaborated with the Intermediate School District to propose a millage that would create some type of vocational program in every school within the ISD, structured around the needs of industry in the community closest to the school. Ultimately, the millage failed.

“Wearing Many Hats”

Six of fifteen interviewees described how small business owners are forced to “wear many hats”, or are overburdened by an abundance of different roles and tasks (43%). A staff member of an SBDC may have said it best:

“If you don’t have the right talent - it really has nothing to do with money barriers - but technological increments have to come with having the right people in place to be able to grow with that change and implement that change.”

- SBDC Staff Member

“An independent small business owner has to wear so many hats. They’re the bookkeeper, they’re the marketer, they’re the operations manager. They wear all these hats, becoming overwhelmed, just keeping the ship floating. To look at a new technology that might make my business, my day easier, oftentimes appears to be unattainable, because, ‘How am I gonna learn this? There’s only 24 hours in a day. I’m already at full capacity and I can’t take on this new thing’ . . . They know that this tool or technology could very well improve their efficiency and eventually lighten their load - it’s just to get to that point, they don’t see how they can get there without a bunch of things falling through the cracks for however long it would take to do that.”

Other interviewees describe the phenomenon similarly, and note how “wearing many hats” often translates to neglecting everything but general operations. An MSU Extension employee described how farmers in her region were consulted in the creation of an online marketplace where they could sell their food products to local restaurants, but it ended up being underused. She said, “During peak season, when farmers finally go inside and it’s already nine o’clock at night, the thought of sitting down and uploading their inventory into a new system is too much.” A Chamber of Commerce director described a similar situation with a farmer in her community who misses out on new opportunities because though he’s very good at what he does, it’s very difficult to reach him through phone or email.

Interviewees suggested that one solution to the issue of overburdened small businesses is to bring in consultants when possible, but noted that many rural firms and small businesses are resistant to this idea. A USDA RD employee said:

“Every business has a three-legged stool for marketing and operations and finance, right? And very few people can handle all three of those independently. Some businesses are reluctant to bring anyone in with expertise to shore them up where they’re lacking. And they think that they can do it all, or that their wife can do all the accounting and they’ll be fine, or whatever. And they don’t - they don’t seek out the people to adequately support them where they have personal shortfalls. I think that’s a very common thread to businesses that don’t succeed, is not getting the right support team on board with them.”

A staff member of a rural SBDC described two companies with similar size revenues and staff that tried to install the same new technology. One succeeded and the other failed, and the main difference between their adoption processes was that one used the in-person training that was included in the price of the technology, and the other didn’t, instead relying on an existing employee to implement the system. Of the company that failed, she said, “They didn’t want anyone in their facility, they weren’t trusting . . . To this day, they’re still not using that software to its full capacity, and they paid just as much as this other company did. They didn’t put the right people there that could help them move that system and that technology forward.” An MSU Extension employee described a similar mistrust that is common on farms: “In terms of the stuff that goes onto the chopper, or the milking robot, the company sends out people to do the training, and the farm is kind of a tight-knit unit mostly. Not a lot of outside labor, usually it’s family-related labor.”

While it seems that mistrust can often prevent the use of consultants, a SBDC staff member points out that sometimes there isn't enough population mass within a rural area for a technical person to "make it worth their while" to deliver services, so consultants can be hard to find. In this scenario, another possible solution is to involve "line-level" workers as much as possible in technology adoption. An economic development corporation staff member shared a technology success story in which the union was "at the table" discussing how to deploy the new technology, how many new workers that they would have to have, and what kind of training would be needed.

Internet Access

Lack of internet access has already been discussed as a factor that can dissuade families from moving to or remaining in rural areas. This section focuses on how internet affects firms beyond its impact on attracting and retaining talent. When available, the internet is a resource for rural firms because it helps connect them with larger innovation ecosystems than they would have access to otherwise. However, there are many parts of Michigan where the lack of internet is a significant infrastructure problem. Related to the internet, is the importance of a firm maintaining a web and social media presence. Recommendations for rural firms from this section include continuing to advocate for reliable broadband in their communities, launching a web presence, and only establishing social media accounts if they plan to maintain them. All that being said, rural businesses should be cognizant of the possibility that locally available high speed internet may open them up to competition, so a "business as usual" approach may be especially dangerous in the months and years following a regional internet service upgrade.

The Internet as an Infrastructure Problem

Five of fifteen respondents mentioned a lack of internet access as an infrastructure problem for rural firms (33%). A USDA RD employee described a small business owner who lost out on an opportunity to expand her business because her broadband internet connection was not reliable or fast enough for the requirements of the program she had found. This affects large firms, too. An MSU Extension employee in the Upper Peninsula described how a very successful, high-tech business she'd worked with had trouble relocating when it outgrew its original location: "He [the owner] was extremely limited in where he could locate his business if he wanted to stay within a reasonable driving distance of his home because of needing internet connections . . . We just have very limited, reliable high speed internet access for businesses." She also described how the owner has become an advocate about this infrastructure challenge, and joked, "You cannot be in the same room with him for more than ten minutes without him bringing up the internet issue".

The Internet as a Resource for Rural Firms

Several interviewees emphasized that though internet access may be limited in some rural parts of the state, it is a tremendous resource for the rural firms that do have it. A staff member of an urban incubator described how she's seen rural firms use internet marketing to compensate for their isolated locations. Another incubator staff member from the Upper Peninsula discussed how the internet changed the sales game in the U.P., eliminating the bottleneck of sales-related travel. "Back in the day they [rural firms] would have to go out and sell things,

"Broadband access is a very important - it's going to be paramount to having new technologies work in rural communities, because people can go into the communities all they want and say 'You should be online, you should be taking orders online, these systems and technologies can help you do more business,' but if they don't have reliable access to the internet, then it doesn't matter if they can take orders online."

- USDA RD staff member

"You know people like this area and would love to be here because they can live where they vacation, and if they like that outdoor style, winter, summer, fishing, snowmobiling, cross country skiing, what have you, it's a great place to be, but if they can't get the basics of their business, like a workforce and internet, it doesn't matter how forward-thinking they are - you know they're limited by that infrastructure of the region."

- MSU Extension staff member

knock on doors of retail stores, just to convince them to sell their product. Now they can just put their store on Amazon, or have a website, and they can sell their product directly to customers.”

Web Presence & Social Media

With internet access comes the opportunity for firms to maintain a web and social media presence. A rural Chamber of Commerce interviewee described how failing to launch a website or participate in social media may have played a small role in an older retail store becoming “swallowed up” by other shops downtown. She mentioned that if the shop had been a Chamber member, it could have been listed on the Chamber of Commerce’s website, and at least have their address and phone number listed. Another rural Chamber of Commerce participant warns:

“So a lot of our businesses, they’ll dabble in social media, but we tell them: It is not doing you any good to start a Facebook or Twitter or Instagram or any page if you’re not going to be active with it. So we see a lot of businesses that - one that comes to mind is a local insurance company that has an account on probably all the social media, but they never post. And I said, you need to delete those, or you need to be active. And they want to know, why aren’t we getting new contacts through there. And I say well because you’re not doing anything.”

Access to Financial Capital

Though an attitude of openness to change and risk can certainly contribute to the success of a firm, a firm has to have a certain amount of financial capital to be able to afford to withstand risky endeavors. Much of the literature on rural technology adoption focuses on financial capital, but it was only mentioned by four out of fifteen interviewees (27%). This could be reflective of the fact that we were interviewing employees of organizations that provide technical support to firms, so they may be thinking more about the things that firms can do to improve their lot than about the factors beyond their control. Thus, recommendations based on the surveys are not provided in this particular section.

An MSU Extension employee explained why Michigan farmers can afford to be less risk-averse than their counterparts in Appalachia:

“Farm people . . . at least in this neighborhood, they’re extremely aggressive [in regards to technology]. They’re looking for ways to increase their production, decrease their costs. The farming here is generally better here than it is in other places. You know, the soil’s better, the climate’s really ideal. It’s generally better, right, so they have some extra capital to try things out. Whereas, like where I grew up in Appalachia, we have dairy farms that have a whole . . . strategy to try and get along in the dairy industry. Which is low input, no technology. You know, either way, either strategy can be successful if you’re a high quality manager. But out here, people look at it like, ‘Ok, well, if I invest... sixty or seventy thousand dollars in a milking robot, what’s it gonna do for me? How’s it going to make the quality of my life better and still make money, cause I don’t wanna go broke doing this.’ And they’ll thoroughly analyze that. In {state redacted} where I grew up, northern Appalachia, it’s like ‘Yeah, we ain’t gonna do that.’”

One interviewee from a rural SBDC firmly argued against the influence of financial capital barriers, explaining, “If they [the firm] wanted to increase their productivity through technology, the funders here would help them with that. If we could show that robotics would bring their cash flows back into alignment, the funders would be ecstatic with that. If we could show that technology could increase their productivity and allow them to get more business or have a better quality so they could raise their prices, funders would agree with that. It’s really not the funding issue at all.” While this may be true in some areas, a staff member of USDA RD reminded us that different funders have various restrictions, and it can make it difficult for firms to qualify:

“Those grants we talked about for the energy project - they’re twenty-five percent grants, and the other seventy-five percent, the grantee has to come up with. So they have to have that available in their bank account or available on a line of credit to cover the amount that we don’t cover with the grant. And there’s more that we don’t cover than what we do. So if they don’t - if you have a real small farm that’s not making a lot of money that could really use the benefit of supplementing their electricity cost, right, but their problem is they don’t have the funds available to cover the rest of the project cost. So we often are trying to find ways to reach those farmers, but it is a difficult position for us to find them that need our assistance, but that also have enough of their own funds to go with it.”

Technology Adoption in the Community

In previous sections of the paper, there are a few stories of technology adoption in communities or municipalities, not just strictly firms. This is because the research team is also interested in the technology adoption of other rural entities, including municipalities and community-based organizations. Technology can do more than increase the profitability of firms - it can enhance the wellbeing of an entire community.

A MSU Extension staff member shared several stories about how technology adoption created prosperity and community pride in his service area. One such story was about a coastal region in Michigan, which installed a telepresence system so that children can enjoy live presentations from Bob Ballard, a famous underwater explorer, as he explores various shipwrecks around the world. The staff member reflected,

“What that does is it really gets people excited about - makes people feel good about the community and the idea that . . . even though it’s a rural community and off the beaten path, it’s really connected to a broader set of opportunities . . . I think a lot of the stuff we’ve seen is, ‘How do we use technology to get people excited about their community, and recognize that they live in a cool place, and that technology can connect them with people outside of the region?’, and share the {region name redacted}experience with visitors from outside the region but then also get at that question of sustainability too, like ‘How do we get people to come here and really appreciate the resources for what we think they are?’”

“The very same subject we just mentioned [firms’ technology adoption obstacles] is true in municipalities. If you have a city manager that’s unwilling to contemplate another way of doing something, or a new technology that could save so much labor, it’s the same problem as a business owner that won’t change.”

-USDA RD staff member

Conclusions

Four main types of obstacles to rural firm technology adoption were identified by organizations providing support to rural firms: 1) resistance to change; 2) human capital barriers; 3) internet access; and 4) access to financial capital. Resistance to change was reported to develop when established businesses become too comfortable in their habits, and create a “we’ve always done it this way” culture. Openness to change and risk can help, but is sometimes limited by access to financial capital. Firms must do their best to overcome their natural resistance to change and adopt an attitude of accepting change and risk despite potential costs. They may need to pursue increased amounts of financial capital to do so, and are encouraged to seek help from support organizations such as those who were interviewed.

Human capital barriers included the struggle to recruit and retain employees in rural areas, issues with the local rural workforce, and the issue of small business owners “wearing many hats”. To address human capital barriers, rural firms are encouraged to pay higher than industry-standard wages, adopt a flexible and modern workplace culture, bring in consultants when possible, and involve line-workers in technology adoption. In addition, family businesses should encourage the next generation to intern elsewhere before they join their parents. In their communities, firms should actively work to address infrastructure issues, advocate for local vocational training, and find ways to collaborate with other businesses.

Internet access can help address many of the isolation-related business challenges rural firms face, but is not always available. Because the internet has the potential to connect rural firms with larger innovation ecosystems, firms are encouraged to advocate for reliable broadband in their communities. Once they have it, firms should use best practices to maintain an active web and social media presence.

We only focused briefly on the ways that technology directly affects rural municipalities and community-based organizations. However, it is important to remember that a firm’s success in regards to technology not only affects its bottom line, but also affects the economic health of the community it resides in and the families who live there.

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Appendix A

Roles of organizations that support firms, based on interview responses and web search.

Incubator	<ul style="list-style-type: none">• Primarily work with start-up companies, who are launching instead of adopting new technologies• Match inventors/start-up companies with enterprises that can help commercialize their technologies• Help early-stage firms penetrate the market
Chamber of Commerce	<ul style="list-style-type: none">• Coordinate events, networking, advertising and promotion for established firms
MSU Extension	<ul style="list-style-type: none">• Engage with municipalities, community-based organizations and firms to promote community wellbeing through access to university resources and technologies
USDA RD	<ul style="list-style-type: none">• Provide loan and grant programs to established firms, municipalities• Rural community economic development
SBDC	<ul style="list-style-type: none">• Provide counseling, training and research for new ventures, existing small businesses and advanced technology companies
EDC	<ul style="list-style-type: none">• Promote the economic development of a particular area by providing training, resources and financial assistance to new and existing firms