

A STUDY OF SMALL BUSINESS TECHNOLOGY ADOPTION AND UTILIZATION

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ABSTRACT

Technology adoption could be a key factor in the ability for a small business to maintain profitability and weather the recession. In particular, green technology could not only reduce environmental impact but also lower energy costs. However, technology adoption costs could be too great for the typical small and medium-sized enterprise. Adoption costs often include changing plant equipment, acquiring new machinery and sometimes payment of intellectual and other property rights. Using a compiled database of small businesses across the country, the researchers developed and sent a survey questionnaire to 2,000 small businesses. Four hundred and fifty questionnaires were returned with 397 usable responses resulting in a 20% response rate. Results of this study could be important in providing information regarding whether small business owners would adopt new energy-saving technologies, not only to benefit the environment but also to reduce business operational costs and increase profitability.

INTRODUCTION

Small business owners across the country continue to seek new ways to improve profitability and remain competitive in the marketplace. At the same time, more small business owners want to be more environmentally friendly; not only to benefit the environment, but also because many grew up during the time when environmental concerns and awareness became more common among Americans.

As green technologies continue to develop, smart business owners recognize investments made today could pay big dividends in the future. Energy prices may be low today, but the long-term outlook suggests energy costs could determine the ability of many businesses to maintain profitability.

Will small business owners adopt new energy-savings technologies on their own or will it take grants, tax incentives and other actions on the part of government? Will small businesses assume debt to purchase these new technologies, recognizing technologies as an investment in the future of their business?

DEFINITION OF TERMS

Gazelles- is a business establishment with at least 20% sales growth every year from 1990 starting with a base of at least \$100,000. (Case, 1996).

Green Technology - Green technology, also referred to as clean technology or cleantech, is new technology and related business models offering competitive returns for investors and customers while providing solutions to global challenges (Bloomberg Business Exchange, 2010).

Energy smart grid - is a form of electricity network utilizing digital technology. A smart grid delivers electricity from suppliers to consumers using two-way digital communications to control appliances at consumers' homes; this saves energy, reduces costs and increases reliability and transparency. It overlays the ordinary electrical grid with an information and net metering system, that includes smart meters. Smart grids are being promoted by many governments as a way of addressing energy independence, global warming and emergency resilience issues. (Department of Energy, 2010).

Neighborhood effect - is one of the contextual variables that explains the tendency of a person to vote in a certain direction based upon the relational effects of the people living in the neighborhood. The voting preference of a neighborhood tends to be formed by consensus, where people tend to vote with the general trend of the neighborhood. This consensus is formed by the personal connections a person forms in a community. There also seems to be some socio-economic correlation to voting patterns, and this has also been used to predict voting behavior. (http://en.wikipedia.org/wiki/Neighborhood_effect).

Smart Meters - A smart meter is a digital device that records the amount of electricity or gas you use and transmits this information to your utility provider. Smart meters allow flexible rates to be applied depending on time of use and ensure your utility bills are always based on actual readings rather than estimates. (http://www.ehow.com/about_6366946_definition-smart-meter.html#ixzz19S4q8BLu)

LITERATURE REVIEW

Small business continues to dominate the U.S. economy in terms of employment and new job growth. The U.S. Small Business Administration reports that companies with 500 or less employees accounted for all net new job growth in the most recent reporting year of 2004 (U.S. Census Bureau, 2007). These small firms employ slightly more than half the U.S. workforce and account for just over half of gross domestic product (U.S. Census Bureau, 2007). Technology

adoption may be a key factor in fueling growth and development of small businesses and possibly provide a means to be more competitive than small business counterparts less likely to adopt certain technologies.

In a study for the U.S. Small Business Administration, the Corporate Research Board examined gazelles, or high-growth entrepreneurial ventures (cited in Henreksen & Johansson, 2010). This study found gazelles exist in every industry category, whether the industry is high-tech or low tech. However, newer, more efficient companies within each industry drive out the older, less efficient companies. Efficiency may be achieved, in part, through technologies that increase quality (thereby reducing waste), faster production of products or services or other efficiencies.

Another study conducted by Henrekson and Johansson (2010) examined gazelles, fast-growth, high-performing small businesses and found those firms underrepresented in high-technology industries and over-represented in service industries. According to Henrekson and Johansson (2010) gazelles are particularly important as although they are usually younger (newer), they tend to create more net new jobs on average. Although Gazelles can be found in all industries, the authors' study found some striking differences regarding technology versus non-technology businesses.

Further insights into typical small business operations can be obtained through examination of other small business studies. Telenomic Research researched broadband usage among small business and found a rural divide exists between urban and rural small businesses (Office of Advocacy, 2005). This divide suggests rural small businesses do not obtain benefits associated with broadband internet access. Broadband access allows for more effective means to reach the public, thereby more effectively advertising products and services, communicating with their employees and providing customers and prospective customers with product information.

Rapidly changing technologies often pose a financial challenge for small business ventures that may be underfunded and/or have limited power to borrow capital. Technologies common to larger firms such as the internet may not be common or fully utilized among small businesses. The Credit Union National Association developed several innovative ways to assist small businesses regarding their financial services needs (Help Small Business Prosper, 2009). Recommendations include remote deposit capture that provides businesses the ability to deposit checks from remote locations using a scanner and internet connection. This could be especially useful to small businesses that might set up a booth at a county fair, roadside stand, or special event. Other suggestions include online banking and bill pay and using corporate credit cards. Each of these alternatives offers efficiency and convenience in addition to reducing labor time in handling these procedures.

Surprisingly, innovativeness and the personality of the entrepreneur play an important role in adopting innovations. In a study conducted by Marcati, Guido, and Peluso, the researchers

found that despite the view that entrepreneurs are innovative, various personality traits actually determine the degree to which entrepreneurs adopt innovations (Maracti, Guido & Peluso, 2008)

Recently, the Department of Energy announced it will award \$188 million to small businesses to develop technologies that will not only assist in commercialization of those technologies but also assist in creating jobs (Agency Group, 2010). The awards are funded through the Small Business Innovation research (SBIR) program and the intent is to assist companies in reducing energy use. Some examples of the types of research funding include smart grid controllers which can be used to reduce energy use as well as the need to build new, additional power plants and advanced solar technologies that could reduce the cost of solar technology purchases and become more affordable for both consumers and small businesses.

Development of new technologies, however, is only the first step. Small businesses must be willing and able to apply the new technologies in their daily business activities. In addition to the potential energy savings, small businesses might be able to make their businesses more efficient and more effective in how they operate. The bottom-line of course, will be to improve profitability and increase small business success.

Small businesses do not have sizable enough budgets to compete with big businesses; however, with regard to advertising and promotion, small businesses do find ways through technology use to get the word out on their product offerings and specials. Workshops for convenience store owners provide information on how small businesses can utilize web marketing and social marketing media such as Facebook and Twitter to deliver their advertising messages at a low cost and perhaps market to customer groups that would otherwise be difficult to reach (Lisanti, 2010).

Thollander and Dotzauer (2010) studied and reported on a program by the Swedish government designed to audit and evaluate energy programs. Focusing on small and medium-sized enterprises, the purpose of the program is to assist those companies in reducing energy consumption and lowering operating costs. Further, over a three-year period the study examined overall effectiveness of the program in achieving the stated purpose.

Technologies may take a variety of forms. Total Quality Management, or TQM, found its way into larger companies years ago but smaller firms often lag behind in adapting technologies due to financial or other resource constraints. Hoang, Igel and Laosirihongthong (2010) researched small and medium-sized manufacturing and service companies in Vietnam with regard to adopting TQM practices in their firm and found that more successful companies in TQM adoption tended to be a stronger global competitor.

Results and Benefits over Time

Technology adoption often results from the desire for relative advantage over competitors, even among small businesses and this occurs especially with regard to computer

and internet technologies. Green technologies, however, may not provide relative competitive advantage but rather reduce long-term energy costs resulting in improved profitability.

Diffusion of new technologies over time can be a difficult process. Difficulties often emerge resulting from adoption costs which may be too great for the typical small business, changeover of plant equipment and even the acquisition of new machinery. If government's goal will be to adopt new technologies, then government should consider tax and other incentives to fuel technology adoption. Just this last year as part of The American Recovery and Reinvestment Act of 2009, the federal government provided tax incentives to purchase new, more energy-efficient automobiles through the "cash for clunkers" program and also provided a \$1500 tax credit for home energy-saving technologies ranging from windows to programmable thermostats, to wood stoves (Agency Group, 2010).

Countries across the globe are making efforts to adopt green technologies. For example, Malaysia, as part of that country's efforts to reduce carbon emissions, provides tax incentives to builders whose projects meet new government standards (Peterson, 2008). The European Union and the United States already began phasing out incandescent light bulbs as part of their energy-savings through new technologies.

Although green technology adoption in Asia and some other parts of the world lags behind the European Union and the United States, the IDC Asia-Pacific poll (cited in Peterson, 2008) reports that 75% of small businesses polled indicated adoption cost as a driver while 60% reported cost reduction as a driver or technology adoption. This condition significantly impacts the competitiveness of the average small business.

Larger businesses, such as energy providers might benefit the most from the American Recovery and Reinvestment Act of 2009 as the legislation focuses much on replacement of energy smart grids and smart meters to help reduce peak time energy consumption usage. Small and medium size businesses however, also benefit as energy consumers when adopting new technologies and those businesses that produce energy efficient products or their components also benefit from the increased demand for meters, batteries and other related products. Hall and Khan (2003) report that new technology adoption performs a significant role in our economic growth, primarily by setting the pace of growth and improving the rate of productivity. Further, economic growth through green technologies causes little or no impact on the environment.

Although this study did not specifically examine family firms, Huang, Ding & Kao (2009) report that family firms are more likely to employ environmentally friendly business practices. Additional research on family firms yields some interesting findings. Based upon the unique values often found in family businesses, Gallo (2004) found the typical family business more socially responsible. Deniz and Suarez (2005) found family firms likely to have a strong commitment to philanthropic causes and activities while Stavrou and Swiercz (1998) report family businesses more sensitive to quality of life issues impacting themselves and employees. Finally, and this is important in this economic cycle, family business values impact business behavior regarding downsizing (Stavrou, Kassinis & Filotheou, 2007).

Some researchers, such as Baerenklau (2005), believe that as small businesses begin to adopt green technologies, a “neighborhood effect” will develop, whereby other small businesses will follow peer businesses to maintain competitive parity. Other fields, including sociology support the neighborhood effect theory and provide numerous examples. For example, Coleman et al. (1996) contended that economically disadvantaged students’ academic performance could more easily be improved through peer group members rather than increasing school budgets.

RESEARCH METHODOLOGY

In this study, the researchers sought answers to the following questions. First, is there a relationship between energy-saving technology and age of the business? Second, would there be a correlation between company debt-to-asset ratio and energy-saving technology utilization? Finally, are companies located in larger cities and towns more apt to adopt energy-saving technologies than businesses located in smaller cities and towns?

The researchers identified 2,000 small businesses from across the country in a compiled small business database. The researchers then developed a survey questionnaire which also included questions seeking answers to basic business demographic data such as age and gender of the business owner. For validity purposes, the questionnaire was first critiqued by a panel of experts and the researchers then sent out a pilot study of 25 questionnaires to small business owners to insure survey tool reliability. No changes were made to the existing questionnaire based upon results from the pilot study.

The researchers then sent the survey questionnaire via email along with two follow-up emails to increase the overall response rate. Two thousand questionnaires were sent to a randomly selected sample of small business owners with 397 questionnaires returned (a 20% response rate).

Measures

The initial section of the survey composed of a demographics section (see Table 1 & Table 2 below) that included survey questions regarding race, gender, marital status, age, place of residence, and level of education of the small business owner. Approximately two-thirds of survey respondents identified themselves as female which could be explained by the database used by the researchers which contains primarily women and minority business owners. The age of business owner varied considerably, ranging from age 18 to 82, with 52 years as the mean. Business owners responding indicated their firm employed on average of twenty-five employees.

The second section of the survey questionnaire included questions regarding business ownership such as type of ownership, length of ownership along with questions regarding debt load. In addition, specific questions inquired as to the type and level of energy-saving technologies being utilized within their business.

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---------------------|-----|---------|---------|-----------|----------------|
| Energy Saving Tech | 397 | .00 | 1.00 | .4131 | .49301 |
| # of Employees | 397 | .00 | 1000.00 | 24.8237 | 77.97383 |
| Age | 396 | 18.00 | 82.00 | 52.3409 | 11.54835 |
| Ethnicity | 397 | .00 | 99.00 | 2.4761 | 7.40103 |
| Veteran Status | 397 | .00 | 1.00 | .6196 | .62677 |
| Debt to Asset Ratio | 397 | .00 | 240.00 | 14.9194 | 35.98623 |
| City | 397 | .00 | 250.00 | 21.7003 | 18.10263 |
| Gender | 397 | .00 | 24.00 | .8489 | 2.06151 |
| Parents Business | 397 | .00 | 8.00 | .7859 | 1.13351 |
| Economic Sector | 397 | .00 | 9.00 | 7.0756 | 2.42656 |
| City Population | 397 | .00 | 9999.00 | 1178.9874 | 2743.24681 |
| Valid N (listwise) | 391 | | | | |

| | | Frequency | Percent |
|-------|-------|------------|---------|
| Valid | .00 | 138 | 34.8 |
| | 1.00 | 259 | 65.2 |
| | Total | 397 | 100.0 |

Limitations

Several limitations to this study should be noted. First, women and minority owned small businesses heavily weight the database used by the researchers. This likely accounts for the significantly higher response by women business owners (65.2% female owners compared to 34.8% male owners). Second, only small businesses which provided email addresses could be contacted. Finally, some businesses chose not to respond even after a third email request.

FINDINGS

The first hypothesis tested whether there a relationship exists between energy-saving technology adoption and age of the entrepreneur. The hypothesis posits that younger entrepreneurs might be more open to adopting new (green) technologies. The researchers used a Pearson Correlation to uncover a possible relationship between energy-saving technology adoption and age of the entrepreneur. Results of the correlation analysis found a negative relationship between energy-saving technology and age. A comparison between the two

variables resulted in a positive relationship $r(397) = -.11, p < .05$ with correlation significant at the .05 level (See Table 3).

Hypothesis 2 sought to determine whether energy-saving technology and debt to asset ratio would be positively correlated. Correlation analysis measured the relationship between energy- saving technology and debt to asset ratio among the participants. Statistical analysis demonstrated a positive relationship between energy-saving technology and debt to asset ratio. A comparison between the two variables resulted in a significant positive relationship, $r(397) = .013, p < .05$ (See Table 3).

With Hypothesis 3, the researchers posited energy-saving technology and city/town population would not be related. The authors used correlation analysis to measure and analyzed energy-saving technology and city/town population among the participants. A comparison between the two variables showed no significant positive relationship, $r(397) = -.09, p > .05$ (See Table 3).

Table 2 data indicates approximately two-thirds of the survey respondents as women. On the surface this could appear significant, however, the database the researchers used is heavily composed of women and minority small business owners. Statistical analysis did not reveal gender significance regarding answers to the survey questions.

| | | Energy | Population | Age | Debt/Asset | Population |
|------------|---------------------|--------|------------|---------|------------|------------|
| Energy | Pearson Correlation | 1 | -.040 | .109* | .125* | -.091 |
| | Sig. (2-tailed) | | .424 | .030 | .013 | .072 |
| | N | 397 | 397 | 396 | 397 | 397 |
| Generation | Pearson Correlation | -.040 | 1 | -.179** | -.025 | -.026 |
| | Sig. (2-tailed) | .424 | | .000 | .615 | .600 |
| | N | 397 | 397 | 396 | 397 | 397 |
| Age | Pearson Correlation | .109* | -.179** | 1 | .051 | -.052 |
| | Sig. (2-tailed) | .030 | .000 | | .314 | .301 |
| | N | 396 | 396 | 396 | 396 | 396 |
| Debt/Asset | Pearson Correlation | .125* | -.025 | .051 | 1 | -.040 |
| | Sig. (2-tailed) | .013 | .615 | .314 | | .431 |
| | N | 397 | 397 | 396 | 397 | 397 |
| Population | Pearson Correlation | -.091 | -.026 | -.052 | -.040 | 1 |
| | Sig. (2-tailed) | .072 | .600 | .301 | .431 | |
| | N | 397 | 397 | 396 | 397 | 397 |

*. Correlation is significant at the 0.05 level (2-tailed).
 **. Correlation is significant at the 0.01 level (2-tailed).

Demographic data responses indicate 25 as the average number of employees. Age of the business owner ranged from 18 to 82, with 52 as the mean. Some of the businesses were founded by parents or grandparents, though most of the surveyed businesses indicated original startups. Economic sectors varied from small manufacturers and retailers to service related businesses.

DISCUSSION

The first hypothesis tested whether a significant relationship between energy-conserving technology and age existed, which indicated that an age maturity may also significantly improve entrepreneur energy-conserving behaviors. An older entrepreneur might not be willing to adopt new technologies, even though technology might save energy and reduce operating expense. Data analysis shows that the researchers found a significant positive relationship between energy-conserving technology and age.

The second hypothesis tested whether there would be a significant relationship between energy-conserving technology and debt to asset ratio. The authors found a positive relationship between energy conserving technology and debt to asset ratio, which may imply that entrepreneurs borrowed money to invest in new technology which they believed would assist them in operating their businesses more efficiently. Furthermore, their investment would be to their financial advantage.

In the third hypothesis, the researchers examined whether there could be a relationship between energy-saving technology adoption and area population. Would entrepreneurs in larger cities and towns be more likely to adopt technology? Statistical results from hypothesis 3 found no relation between energy-saving technology adoption and population (urban vs. rural location).

SUMMARY AND CONCLUSION

Younger entrepreneurs appear to be more interested in adopting energy-saving technologies in their businesses. This could be due to their generation growing up with the green technology paradigm. Or, younger entrepreneurs might view their business on a longer time horizon and thereby would benefit more from energy savings payback. Additional study in this area could provide a clearer picture of what actually motivates younger entrepreneurs with regard to technology adoption.

The higher debt-to-asset ratio among small business owners suggests a willingness to assume debt in order to invest in new technology. An important implication here, especially as government attempts to restart the economy, might be to provide tax incentives, low-cost loans and grants to SME's (small and medium-sized enterprises) for green technology adoption.

Survey responses indicate no significant difference between urban and rural business location. Some might find this finding surprising, as it might be presumed urban business owners

to be more open to technology adoption. The real answer could be the “energy-savings” aspect of new technology adoption.

Results of this research could provide the impetus for smaller businesses to adopt energy-saving technology, not simply for benefitting the environment, but for the practical purpose of reducing cost and improving profitability. As we continue to study this topic we can develop “best practices” that might enable small and medium-sized enterprises to improve their chance of success in the increasingly competitive marketplace.

This study uncovered some interesting and useful information regarding small businesses and technology adoption. However, findings of the study raise new questions and further research could help provide clarity to the motivational factors why a small business would or would not adopt energy savings technologies. Future research could also identify which technologies small business owners attach higher priority based upon adoption cost, potential cost savings, or motivational factors.

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APPENDIX

| | | |
|------------|---------|-----|
| Statistics | | |
| VAR00007 | | |
| N | Valid | 397 |
| | Missing | 0 |

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