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Small and Medium-Sized Enterprises in Rural Business Clusters: The Relation Between ICT Adoption and Benefits Derived From Cluster Membership

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This study examines the relationships between information and communication technologies (ICT) usage, the benefits a company derives from membership in a rural business cluster, and the success of rural companies. Analysis of 333 rural businesses located in northern lower Michigan showed a strong relationship between (a) ICT adoption and benefits derived from the membership in business clusters, (b) ICT adoption and self-reported business success, and (c) benefits derived from business clusters and business success. Although analysis indicates that these relationships may be industry specific, results suggest that ICT adoption by rural enterprises may have advantages for the region's social capital and business success and may help reduce the digital divide experienced in rural communities.

Keywords information and communication technologies, business clusters, small and medium-sized enterprises, social capital

One strategy proposed to increase the adoption of information and communications technologies (ICT) in rural communities has been to ensure that rural small and medium-sized enterprises (SMEs) have adequate ICT access, as that would increase the chances of the technology diffusing into the rest of the community (Hollifield and Donnermeyer 2003; LaRose, Gregg, Strover, Straubhaar, and Carpenter 2007). In effect, it is hoped that exposure to the Internet in the workplace would trigger a positive growth cycle, with the widespread diffusion of ICT leading to increased business formation and that in turn enhancing technology diffusion into the rest of the community. The resulting increased in demand would in turn attract infrastructure investment in rural communities and the digital divide would correspondingly be reduced. Using various economic models, Katz and Suter (2009) estimated that approximately 128,000 jobs (or 32,000 jobs per year) could be generated from the deployment of broadband infrastructure.

Within this context, regional business clusters are of special relevance as an economic development strategy for rural areas (Porter 1990; Rosenfeld 2001). There is a vast literature exploring the impact of regional business clusters on economic development derived from Marshall's (1920) groundbreaking work on industrial districts (Breschi and Malerba 2001; Porter 1990; 2000; Pratt 2000). Regional business clusters are typically defined as groups of companies in a common industry located in the same geographic area, often including a range of supporting players such as local trade associations and education and research institutional linkages (Porter 2000). Regional business clusters improve business performance by endowing certain localities with resource advantages and open up opportunities for e-business infrastructure development, while simultaneously sparking innovation through competition among geographically proximate members (Breschi and Malerba 2001; Porter 2000; Pratt 2000). Regional business clusters are also associated with regional *social capital*, defined broadly as the relational and informational benefits that accrue to the region arising from the connections among people in

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area companies (Steinfield, Scupola, and Lopez-Nicolas 2010).

Clustering around common industries may be even more important for rural regions, given that rural areas can lack many of the transaction economies associated with proximity that are found in urban areas where economic activity is concentrated (Leamer and Storper 2001). Moreover, electronic linkages among firms may stimulate the formation of business clusters in rural areas that can improve the performance of firms (Porter 2004) and boost rural economies. Examples of rural clusters span the nation, from an aquaculture cluster on the coast of Maine, to a wood products cluster in Oregon (RTS 2003).

The use of broadband within a business cluster context has not been extensively studied, however, especially in a rural context. There is some indication, however, that firms in clusters derive greater benefit from their use of Internet-related services made possible by broadband connections than firms located outside any sort of business cluster (Steinfield and Scupola 2008). Among the possible explanations for benefits of cluster membership, one plausible one is that diffusion of ICTs may be faster in a cluster due to imitation and learning effects. ICT use in turn facilitates interactions between cluster members and that helps generate regional social capital, which reinforces the positive growth cycle (Steinfield and Scupola 2008). Moreover, when clusters enjoy a strong reputation, this may enhance business success as firms are better able to use ICTs to support transactions with distant clients (Steinfield and Scupola 2008).

In this article we examine the relationships between the adoption and use of broadband-related ICTs in a rural region, the benefits that companies derive from rural cluster membership, and the overall success of rural enterprises. These relationships are investigated in the context of a survey of rural enterprises within three industries clustered in the northern part of Michigan's lower peninsula.

ICTs AND BENEFITS OF CLUSTER MEMBERSHIP

Clusters possess a stockpile of knowledge built over time based on experience of their members (Barkley, Kim, and Henry 2001). Cluster members can take advantage of this knowledge stock through what Bernat (1999) calls "knowledge spillovers." However, all clusters are not similarly endowed. Therefore, the benefit a company is likely to derive from cluster membership depends on the endowments of the particular cluster to which it belongs. In other words, companies located in well-developed clusters are likely to benefit more from cluster membership than those in less-developed clusters. There are a number of reasons why this should be so. Stronger clusters are more likely to attract a more qualified labor force, enhancing the quality of the information that flows in knowledge spillovers. Moreover, greater reputational advantages may accrue to cluster members in strong clusters; for example, a technology in firm in Silicon Valley may be perceived to be more competent than one in another part of the country, simply because it is situated in the region. The following hypothesis summarizes this expected relationship:

> H1: The benefits derived from cluster membership are positively correlated with the strength of the business cluster.

Continuing with this line of reasoning, the benefits a company derives from a business cluster are likely to be directly related to its integration within the cluster. For example, companies that participate in trade meetings organized by cluster members are likely to have greater opportunities for learning from other cluster members. We therefore hypothesize:

> H2: The benefits derived from the cluster are positively correlated with the strength of cluster membership.

One key difference between rural and urban business clusters is the greater physical distance that can separate the cluster members. These distances limit the opportunities for social interactions in person. Within this context, greater use of electronic communication can facilitate the development of relationships among rural SMEs, which otherwise might remain quite isolated. Although such technologies also facilitate greater interaction with distant partners, and so might weaken clusters, prior research on clusters suggests that ICT use strengthens rather than weakens cluster interaction (Steinfield and Scupola 2008). Hence, the following hypothesis is proposed:

> H3: Adoption of ICTs among rural SMEs is positively correlated with the benefits derived from business clusters.

Decades of research on ICT use in business suggest that greater adoption and use should be associated with improved company performance, despite the many obstacles to measuring productivity impacts of information technologies (Barua, Kriebel, and Mukhopadhyay 1995; Brynjolffson and Hitt 2000; Parker and Benson 1988; Strassman 1985; Zhu 2004). We therefore hypothesize that ICT use among rural SMEs should be positively associated with business success.

> H4: Adoption of ICTs among rural SMEs is positively correlated with business success.

Porter (2000) has provided significant evidence that the set of companies in well-developed business clusters outperform their counterparts in other regions where the same specific industry clusters are not present. We thus expect that companies that report stronger informational and relational benefits from their cluster should experience stronger performance, leading to our fifth hypothesis.

> H5: Benefits of business cluster membership are positively correlated to business success.

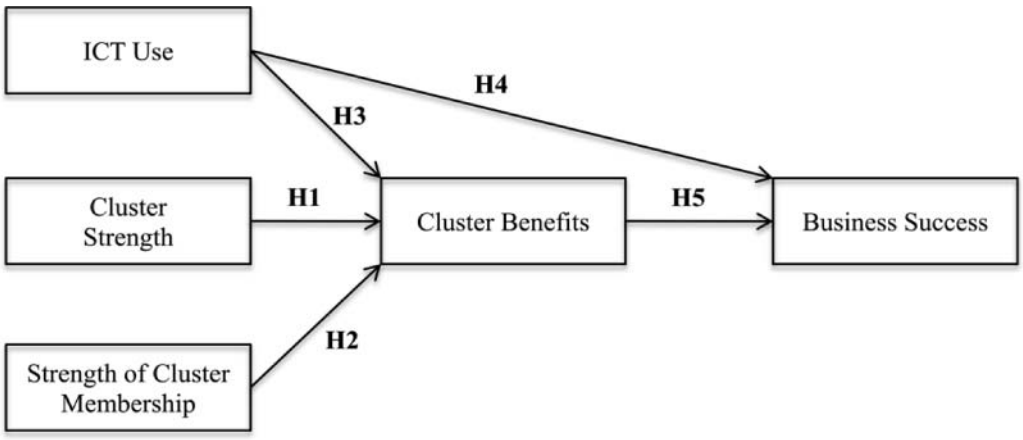

FIG. 1. Conceptual model of ICT use, business cluster factors, and business success.

Social capital and increased ICT use are necessary in order for rural SMEs to develop. Together, they are hypothesized to have both direct and indirect effects on the success of rural SMEs. These hypothesized relationships (H1-H5) and theoretical model are presented in Figure 1.

Although it is predicted that an overall increase in productivity is associated with ICT adoption, it is likely that success will vary by the type of industry in which the cluster operates. Service industries and technology-intensive manufacturing firms are more likely than others to benefit from network connections (Windrum and de Berranger 2002). We therefore propose:

> H6: The effect of ICT adoption on productivity will vary by industry type.

METHOD

A list of 4,482 small business firms was obtained from USADATA for a 29-county region at the northern tip of the lower Michigan peninsula bounded by Mason, Lake, Osceola, Clare, Gladwin, Bay, and Huron counties to the south. Businesses were initially screened by SIC code, and firms engaged exclusively in local service businesses that were unlikely to benefit from cluster membership (e.g., beauty salons) were excluded. Following Gibbs and Bernat (1997), wood products, metalworking, and machinery and computer-related goods and services were initially considered. Since USADATA provided SIC codes rather than NAICS codes, it was necessary to search across codes to identify related firms. This selection process resulted in the selection of 388 firms in the wood products industry, 469 in metalworking, and 222 in information technology, for a total of 1079 firms in the sample.

The firms in the final sample averaged 13 employees and had been in business for 19 years. On average they derived 56 percent of their revenue from within the local region, 20 percent from elsewhere in Michigan, 19 percent from other states, and 2 percent from outside the United States. According to data compiled by USADATA, two-thirds reported annual revenues of $500,000 or less.

The tailored design method mail survey methodology (Dillman 2000) was followed, included a prenotification letter, a second mailing with the questionnaire booklet, cover letter, and a $1 cash incentive, and a follow-up postcard. After a period of one week, a duplicate of the first mailing, minus the incentive payment, was sent. Surveys were addressed to the chief executive officer (CEO) of each firm. Of the 1079 surveys, mailed 421 were completed and returned. There were 62 bad addresses and 24 firms were disqualified on being informed that they were out of business, their owner was deceased, and other such reasons. Two surveys had high instances of missing data and were dropped from final analysis. The final response rate was therefore 42 percent or 333 surveys.

Items for the business surveys were selected from prior surveys of Internet adoption (e.g., LaRose and Hoag 1996) and information technology utilization (e.g., Pflughoeft et al. 2003; Riemschneider et al. 2003). The survey included indicators of the financial performance of the firm and factors known to be related to successful adoptions of Internet-based e-business applications (after Windrum and de Berranger 2002). Multi-item additive indices were constructed, with the (Cronbach alpha) internal consistency coefficients indicated in Appendix A. The dependent variable—*business success*—was based on a six-item additive scale for self-reported business characteristics over a two-year period. Items on the scale measured increase in the variety of products, improvement of sales outside of the region, addition of new positions to the payroll, increased profitability, improvement in the relationships with customers, and increased visibility

outside the region. The independent measures were grouped as firm characteristics, ICT scales, and two cluster scales. The strength of a company's membership in a business cluster was measured by summing the number of trade associations to which the firm belonged.

The firm characteristics consisted of the number of employees, the revenue received from outside the state (in percentages), and sources of financing. ICT adoption was measured using three scales (see Appendix A): The *ICT infrastructure* of a company comprised items such as the ease of accessing the Internet, the type of Internet connection, the presence of an internal network and website, and the number of ICT staff. The *ICT reliance* scale measured the extent to which the company used ICT for various operations. The *ICT critical* scale measured the importance the company placed on effective use of ICT and whether it had computer literate employees and up-to-date computer systems. The *strength of the business cluster* was derived from the number of firms in the same industry, their reputation for excellence, and the degree of cooperation among them. The *benefits* measured the access to business relevant information, networking with business partners and customers, and other such benefits derived from cluster membership.

RESULTS

Table 1 shows the Pearson product–moment correlations among the dependent and independent variables. Data were consistent with H1: The benefits derived from cluster membership are positively correlated with the strength of the business cluster, $r(331) = .24$, $p < .01$. Data were also consistent with H2 with results showing the benefits derived from the business cluster are positively correlated with the strength of a firm's membership in trade associations, $r(331) = .12$, $p < .05$.

Hypothesis 3 predicted a positive correlation between the adoption of ICTs among rural SMEs and benefits derived from business clusters. Analysis showed that all three ICT measures were positively correlated with benefits ($r_{\text{ICT infrastructure}} = .18$, $p < .01$; $r_{\text{ICT reliance}} = .19$, $p < .01$; $r_{\text{ICT critical}} = .53$, $p < .01$). Hypothesis 4 predicted a positive correlation between ICT adoption and business success. Data were consistent with H4. Analysis revealed that all three indicators of ICT use were significantly correlated with business success ($r_{\text{ICT infrastructure}} = .28$, $p < .01$; $r_{\text{ICT reliance}} = .20$, $p < .01$; $r_{\text{ICT critical}} = .38$, $p < .01$). Lastly, H5 predicted a positive relationship between cluster benefits and perceived business success. Results indicated a strong positive correlation, $r(331) = .34$, $p < .01$.

To examine the relationships between business success for rural SMEs and their use of ICT as well as the impact of business cluster membership, a hierarchical regression was conducted. Firm characteristics were entered in the first block, ICT characteristics in the subsequent block, and cluster characteristics in the last block (see Table 2). The results of the regression indicated the predictors explained 31.2% of the variance, $F(3,318) = 17.46$, $p < .01$, $f^2 = .31$. ICT measures had a moderate effect size, $\delta R^2 = .081$, $f^2 = .088$, and business cluster measures had a smaller effect size, $\delta R^2 = .042$, $f^2 = .044$.

TABLE 1
Pearson product–moment correlations among dependent and independent variables

	Firm characteristics				ICT scales			Cluster scales				
Variable	1	2	3	4	5	6	7	8	9	10	Mean	SD
1. Business success	1.000										3.20	0.74
2. Number of employees	.288**	1.000									12.94	31.33
3. Revenue outside Michigan	.351**	.203**	1.000								21.11	31.91
4. Sources of financing	.222**	.126*	.040	1.000							3.52	0.97
5. ICT infrastructure	.277**	.236**	.201**	.083	1.000						7.55	3.60
6. ICT reliance	.197**	.123*	.239**	−.008	.624**	1.000					4.88	2.24
7. ICT critical	.376**	.179**	.183**	.135**	.389**	.440**	1.000				3.86	0.70
8. Strength of cluster membership	.205**	.300**	.086	.134**	.181**	.135**	.179**	1.000			0.24	0.43
9. Cluster strength	.163**	.060	−.022	.269**	−.010	−.150**	.070	.131**	1.000		2.80	0.70
10. Cluster benefits	.343**	.131*	.056	.103*	.178**	.186**	.531**	.123*	.238**	1.000	3.55	0.62

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

TABLE 2
Summary of hierarchical regression analysis for variables predicting business success ($n = 328$)

Model		Unstandardized coefficients		Standardized coefficients, beta	t	Significance
		B	SE			
1	(Constant)	2.510	.144		17.418	.000
	Number of employees	.005	.001	.209	4.090	.000
	Revenue outside Michigan	.007	.001	.301	5.951	.000
	Sources of financing	.146	.039	.186	3.729	.000
2	(Constant)	1.431	.233		6.153	.000
	Number of employees	.003	.001	.159	3.190	.002
	Revenue outside Michigan	.006	.001	.252	5.092	.000
	Sources of financing	.118	.038	.150	3.130	.002
	ICT infrastructure	.020	.013	.099	1.596	.112
	ICT reliance	–.007	.021	–.021	–.334	.739
	ICT critical	.282	.060	.256	4.706	.000
3	(Constant)	.921	.335		2.749	.006
	Number of employees	.003	.001	.137	2.721	.007
	Revenue outside Michigan	.006	.001	.261	5.420	.000
	Sources of financing	.102	.037	.130	2.735	.007
	ICT infrastructure	.018	.012	.089	1.476	.141
	ICT reliance	.004	.021	.011	.169	.866
	ICT critical	.158	.066	.143	2.395	.017
	Strength of cluster membership	–.054	.084	–.031	–.639	.523
	Cluster strength	.087	.053	.082	1.635	.103
	Cluster benefits	.243	.069	.192	3.505	.001

					Change statistics				
Model	R	R squared	Adjusted R squared	Standard error of the estimate	R squared change	F Change	df1	df2	Significance F change
1	.456	.208	.201	.67344	.208	28.338	3	324	.000
2	.537	.289	.275	.64121	.081	12.129	3	321	.000
3	.575	.331	.312	.62481	.042	6.689	3	318	.000

To test hypothesis 6, which posited that the effect of ICT adoption on productivity will vary by industry type, multiple regressions were calculated for each of the three industries. Results are reported in Tables 3 to 5 in Appendix B. The multiple regressions do, in fact, suggest variation in the relationship between ICT use and business success across industry type. For the woodworking industry, the importance ascribed to using ICT effectively and that of cluster benefits were significant predictors of business success in this industry. For the metalworking industry, the importance ascribed to using ICT effectively was a significant predictor. For the ICT industry, both cluster strength and cluster benefits were significant predictors of business outcomes.

DISCUSSION

The analysis shows that firm characteristics were correlated with business success and were significant predictors of business success regardless of the SMEs' industry. Firms that are more successful also tended to have more employees, have more business revenue outside of their locale, and have more sources of financing. All three ICT measures were initially found to be correlated to business success and in the subsequent multiple regression; only the importance placed on effective use of ICT was a significant predictor. This suggests that predictors such as the availability of ICT infrastructure and the reliance of ICT at the workplace could be related to

business success via the importance placed on effective use of ICT. Additionally, cluster membership was found to have significant benefits to the overall success of rural SMEs.

The analysis showed the strength of cluster membership was correlated with business success, and benefits derived from business clusters were significant predictors of business success. This direct relation between benefits derived from membership in business clusters and business success supports the premise that rural clusters can be beneficial, corroborating findings from studies in other settings that have investigated value chain clusters that are geographically proximate (Porter 1990; 2000). Being in a business cluster increases the chances that a firm will do well economically.

We also found positive associations between ICT use and cluster benefits. In the case of rural firms that are geographically distant from their business clusters, this could mean that online connections can potentially compensate for the lack of physical proximity. For now, we do not think that ICTs will totally replace the role that geographical proximity plays. Geographical proximity remains important in rural business networks because of potential benefits such as knowledge spillover, a common labor pool, and value chain clusters (Scorsone 2002). What online connections can offer is a compensatory effect when physical proximity is lacking. The strength of this effect would need to be investigated by further research.

Industry-Specific Analyses

The results of the analysis by industry imply that business success is contingent upon industry-specific factors. For example, in the metalworking industry, one reason ICT and cluster measures do not predict business success may be that the firms in this industry are in economic decline in Michigan. With the auto industry in Michigan facing major financial challenges in recent years, small rural firms that used to conduct business with the large automakers may be dying out.

Wood product firms may benefit from the region's reputation for premier products, and our analysis did reveal that the benefits that wood product firms derived from cluster membership predicted their business success.

Finally, success of ICT firms is predicted by both cluster strength and the benefits that the company derives from the cluster. Understandably, ICT companies are more likely to be connected to networks, given the nature of their business. What the results suggest is that the degree to which ICT companies are connected to business networks could influence how successful they are.

Limitations

The generalizability of this study is limited by the use of only three sectors of the economy. The findings may vary for other industries since their products and interconnectivity between firms would be different from those studied here. For instance, with the state government's recent efforts to develop tourism in the region, firms in this industry could be changing their business processes and patterns of ICT use. Further, this study only surveyed firms in northern lower Michigan, and contextual differences may be reflected in other rural regions. Lastly, the cluster measures are not as reliable as the others used in the study. Although reliabilities for cluster strength ($\alpha = .68$) and cluster benefits ($\alpha = .62$) were both acceptable for a new construct, these measures should be verified by future research.

The study is Internet-centric. We believe that broadband was sufficiently important to investigate on its own. Nevertheless, we recognize that ICTs encompass a larger range of technologies. Therefore the implications of our study are limited to broadband.

This study found a significant relationship between ICT and cluster benefits; however, future research should examine the nature of this relationship. It is possible that ICT use would enhance the benefits derived from a cluster membership but the converse is just as likely. It may be that the firms that are already clustered are more likely to use ICT to connect to one another. As such, future research should focus on establishing the causality in this relationship. Time-series studies or experiments to test these relationships are recommended.

CONCLUSIONS

This study contributes to existing understanding of predictors of business success for rural SMEs by examining ICT use and benefits derived from membership in business clusters.

In particular, three of the findings stand out for their potential to inform policymaking.

One, cluster benefits were found to predict business success. For policymakers and community leaders seeking to develop businesses in rural communities, the received wisdom about the benefits of membership in business clusters should be a key consideration. Persuading rural businesses to band together and creating the opportunities for clustering are strategies that policymakers can fruitfully pursue.

Two, the importance that rural companies place on ICT use in their business processes was a significant predictor of business success. Business owners who have up-to-date computer systems and computer-literate employees also tended to enjoy greater business success. It should be noted that the other measures such as ICT infrastructure

and ICT reliance did not predict business success significantly. The mixed findings with regard to the role of ICT in business success suggest that this relationship needs to be studied further. Mere infrastructure expansion is probably insufficient to improve the economic health of enterprises in the absence of information about the specific roles that ICT can play. However, what our research suggests is that the intersection of ICTs and business clusters could be a meaningful area to explore. Online tools that connect rural businesses may be able to generate the cluster benefits that were found in our study and also prior research.

Three, in their efforts to improve the economic health of rural enterprises, decision makers need to be sensitive to the industry they are working with. While ICT use did not predict business success in ICT industry, this does not mean that ICT is not important. We think that the statistical nonsignificance of ICT use for this industry arises from the fact that there is little variation between firms within the industry. Naturally, firms in the ICT industry would be highly reliant on ICT for their business processes. For the wood products and metalworking industries, the importance that business owners place on ICT use in their business processes predicted their economic success.

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APPENDIX A: SURVEY ITEMS AND RELIABILITIES

Index	Questionnaire items	Scoring	Alpha
Business success (6-item scale)	Over the past two years we . . . Increased variety of our products; improved our sales outside of the region; added new positions to our payroll; increased profitability; improved our relationships with customers; increased our visibility outside the region.	5 = strongly agree	.80
ICTs scales			
ICT infrastructure (5-item scale)	Your ICT infrastructure. .. Access to broadband Internet service in northern lower Michigan; type of connection; internal network; company website; number of employees whose primary responsibility is the management of ICT.	5 = very easy None/Dial-up/ Broadband Yes/ No	.72
ICT reliance (9-item scale)	The extent to which our company relies on . . . Email; leads generated through your website; online payment system; online research; online recruiting for job openings; online training; group collaboration software; making long-distance calls over the Internet; percentage of employees that use computers as part of their daily duties.	5 = a great deal	.88
ICT critical (3-item scale)	Our success as a company depends on more effective use of information technology; having more computer literate employees; we have up to date computer systems.	5 = strongly agree	.71
	Cluster scales		
Cluster strength (4-item scale)	Our industry has a high profile in the region; our regional industry has a national reputation for excellence; there is a lot of cooperation within the region among the firms in our industry; we benefit from having a critical mass of firms in our region.	5 = strongly agree	.68
Cluster benefits (4-item scale)	Our success as a company depends on: access to business-relevant information; maintaining good relations with partners outside the region; exchanging knowledge with our business partners; exchanging information with our customers.	5 = strongly agree	.62

APPENDIX B

Table 3. Regression coefficients of firm characteristics, ICT measures, and cluster measures on success of the wood products industry, with dependent variable "success" ($n = 114$)

Model		Unstandardized coefficients		Standardized coefficients, beta	t	Significance
		B	SE			
1	(Constant)	2.406	.206		11.694	.000
	Number of employees	.005	.003	.160	1.810	.073
	Revenue outside Michigan	.007	.002	.300	3.476	.001
	Sources of financing	.134	.058	.204	2.308	.023
2	(Constant)	1.453	.328		4.429	.000
	Number of employees	.003	.003	.094	1.060	.292
	Revenue outside Michigan	.006	.002	.256	2.911	.004
	Sources of financing	.124	.055	.188	2.231	.028
	ICT infrastructure	.020	.026	.080	.765	.446
	ICT reliance	−.036	.042	−.091	−.853	.395
	ICT critical	.284	.080	.316	3.560	.001
3	(Constant)	.913	.537		1.701	.092
	Number of employees	.001	.003	.042	.439	.662
	Revenue outside Michigan	.006	.002	.263	2.990	.003
	Sources of financing	.132	.056	.200	2.361	.020
	ICT infrastructure	.024	.026	.095	.906	.367
	ICT reliance	−.028	.043	−.073	−.664	.508
	ICT critical	.174	.097	.193	1.787	.077
	Strength of cluster membership	−.008	.139	−.005	−.055	.956
	Cluster strength	.063	.095	.058	.662	.509
	Cluster benefits	.205	.104	.204	1.965	.052

Model	R	R squared	Adjusted R squared	Std. error of the estimate	Change statistics				
					R squared change	F Change	df1	df2	Significant F change
1	.438	.192	.170	.60826	.192	8.695	3	110	.000
2	.543	.295	.255	.57602	.103	5.220	3	107	.002
3	.572	.327	.269	.57076	.032	1.660	3	104	.180

Table 4. Regression coefficients of firm characteristics, ICT measures, and cluster measures on business success for the metalworking industry, with dependent variable "success" ($n = 141$)

Model		Unstandardized coefficients		Standardized coefficients, beta	t	Significance
		B	SE			
1	(Constant)	2.687	.283		9.510	.000
	Number of employees	.004	.001	.227	2.821	.005
	Revenue outside Michigan	.006	.002	.271	3.384	.001
	Sources of financing	.137	.073	.146	1.882	.062
2	(Constant)	1.552	.417		3.717	.000
	Number of employees	.002	.001	.140	1.751	.082
	Revenue outside Michigan	.004	.002	.188	2.288	.024
	Sources of financing	.045	.074	.048	.611	.542
	ICT infrastructure	.036	.026	.142	1.417	.159
	ICT reliance	.003	.036	.007	.073	.942
	ICT critical	.324	.115	.256	2.824	.005
3	(Constant)	1.279	.582		2.197	.030
	Number of employees	.002	.001	.143	1.741	.084
	Revenue outside Michigan	.005	.002	.214	2.540	.012
	Sources of financing	.055	.075	.059	.738	.462
	ICT infrastructure	.031	.027	.121	1.161	.248
	ICT reliance	−.005	.037	−.013	−.143	.887
	ICT critical	.232	.130	.183	1.781	.077
	Strength of cluster membership	−.044	.141	−.026	−.311	.757
	Cluster strength	−.015	.086	−.014	−.173	.863
	Cluster benefits	.213	.140	.144	1.523	.130

Model	R	R squared	Adjusted R squared	Std. error of the estimate	R squared change	F Change	df1	df2	Significant F change
1	.422	.178	.160	.71283	.178	9.909	3	137	.000
2	.525	.275	.243	.67693	.097	5.973	3	134	.001
3	.537	.288	.240	.67835	.013	.813	3	131	.489

Table 5. Regression coefficients of firm characteristics, ICT measures, and cluster measures on success for the ICT industry, with dependent variable "success" ($n = 73$)

Model		Unstandardized coefficients		Standardized coefficients, beta	t	Significance
		B	SE			
1	(Constant)	2.517	.260		9.693	.000
	Number of employees	.026	.008	.331	3.121	.003
	Revenue outside Michigan	.007	.003	.282	2.660	.010
	Sources of financing	.121	.073	.175	1.658	.102
2	(Constant)	1.100	.666		1.650	.104
	Number of employees	.023	.009	.294	2.458	.017
	Revenue outside Michigan	.006	.003	.238	2.227	.029
	Sources of financing	.122	.074	.178	1.652	.103
	ICT infrastructure	−.002	.020	−.010	−.078	.938
	ICT reliance	.059	.059	.129	.986	.328
	ICT critical	.242	.155	.179	1.569	.121
3	(Constant)	.798	.792		1.007	.318
	Number of employees	.021	.009	.269	2.420	.018
	Revenue outside Michigan	.005	.002	.195	1.952	.055
	Sources of financing	.032	.073	.046	.440	.661
	ICT infrastructure	−.009	.019	−.056	−.483	.631
	ICT reliance	.056	.055	.123	1.009	.317
	ICT critical	.131	.149	.097	.883	.380
	Strength of cluster membership	−.187	.190	−.098	−.980	.331
	Cluster strength	.268	.107	.272	2.510	.015
	Cluster benefits	.244	.132	.198	1.844	.070

Model	R	R squared	Adjusted R squared	Std. error of the estimate	R squared change	F Change	df1	df2	Significant F change
1	.495	.245	.212	.65069	.245	7.470	3	69	.000
2	.551	.304	.241	.63883	.059	1.862	3	66	.145
3	.661	.437	.357	.58788	.133	4.978	3	63	.004