



Tomasz Wielicki

Craig School of Business
California State University,
Fresno

Role of ICT Training in Closing Digital Divide among SMEs

Received 2 October 2007; accepted 9 November 2007

Introduction and Literature Review

Study of Digital Divide spans across many disciplines - from sociology and political science to economy, business and information systems. Consequently, some of the most popular definitions of the Digital Divide concept are very broad. Holmes defines it broadly as "the great disparities between and within societies in the use of digital technology" – (Holmes, 2003). This is also a definition used widely with United Nations literature. There were numerous attempts to create a complex index identifying an overall scale of Digital Divide. Dolnicar, Vehovar, and Sicherl (2004) proposed two forms of advanced methodological measurements: a composed measure - the digital divide index (DIDIX) and the time distance methodology, which offers a significant improvement at both conceptual and application levels. In another study completed in Germany (Husing, Selhofer, Korte - 2001) attempt to measure Digital Divide was based on four dimensions: gender, age, education and income. Authors concluded that education was an area of the largest discrepancy whereas gender had a negligible impact. Digital Divide was defined in this study as "the gap between individuals, households, businesses and geographical areas at different socio-economic levels with regard to both their opportunities to access information and communication technology (ICT) and to their use of Internet for a wide variety of activities."

Out of three major levels of Digital Divide discussed in the literature: individual, business, and region (Warschauer – 2003), it is business aspect that is the focus of this paper. It has been shown in many studies that existence of Digital Divide may have a profound impact on operations of business in this information driven century. A typical example could be possible failure or limited growth of e-commerce ventures due to the limited level of computer literacy of broad market participants. Dynamic growth of e-commerce economy which we have enjoyed over the last

decade could turn out to be very deceiving. Its growth is still fueled by specific section of society that is positioned on the right (knowledgeable) side of Digital Divide. However, as it was discussed by Gregorio, Kassicieh, and De Gouvea Neto (2005) drivers of e-business activity in developed and emerging markets may encounter a major limitations and barriers associated with existence of Digital Divide in terms of large sections of the market incapable to utilize this technology driven offer.

As globalization is leveling the field for economic opportunities opened to variety of businesses, it uncovers at the same time a great disparity between IT driven productivity levels attainable by these businesses – especially between small business and large corporations. We will call this disparity – a business Digital Divide. Increasing number of research studies (Wielicki, 2006) attribute this disparity to lack of knowledge and education among small and mid size business (SMEs) and not to lack of funds and access to technology. As computer hardware and software becomes more affordable, and at the same time more powerful – it is knowledge (both – business and IT related), which becomes a key to closing business Digital Divide between SMEs and large corporations.

Knowledge has been for years recognized as a key resource of a modern company (Peters - 2004). Knowledge Management concepts and tools have been designed and implemented in many large corporations contributing significantly to enhancement of business processes. Knowledge capturing, codification, storing and distribution usually require sophisticated IT driven system. This is where most of SMEs were left behind. Two primary ways in which SMEs may acquire knowledge are through hiring of knowledgeable employees (which is usually very expensive) and by initiating internal learning process.

Therefore, it is learning that became a focus of this study and its impact on different aspects of SMEs' performance. Since learning can be performed at many levels and in different forms – as it was shown by Ackoff and Rovin (2003), we have looked at variety of formats in which training is delivered among SMEs – from 1-one-1 training, through traditional classroom session to e-learning. Our study looked at the subjective evaluation of learning outcomes as perceived by the employees but compared it with more subjective measure of level of knowledge exhibited by number of business processes supported by IT based solutions. A new measure of IT competence proposed in this study with respect to SMEs is relying on a count and proportion of business processes, which are clearly supported by IT solutions and moves away from simplistic measures like number of PCs or number of hours of class training delivered to employees. As it has been shown in some recent studies (Bassi and McMurrer, 2007) plain number of hours of employed training turns out to be a very bad predictor of overall organizational performance.

Research Problem and Methodology

Our study of Digital Divide between SMEs and large corporations was clearly focusing on major barriers to implementation of IT identified by the respondents (Wielicki - 2006).

In the first survey of over 600 SMEs in the Central California top three barriers identified were:

- lack of IS plan
- lack of knowledge and skills
- lack of funds

Since the top two identified barriers were clearly associated with lack of knowledge and understanding of business processes and lack of funds was only number three barrier, the focus of our search for roots of business Digital Divide shifted naturally from capital based factors to knowledge based factors.

The second survey of 160 SMEs in addition to levels of used IT and barriers investigated also issues of number of hours of training, training formats and learning outcomes.

Statement of a Research Problem

There were two specific problems that we focused on in this study. The first one had to do with the size of the business and its impact on actual learning and training process going on within the business. Since we had determined already that surprisingly many SMEs had come to conclusion, that it was lack of knowledge and skills that kept them from reaping benefits of ICT supported business solutions and not just access to technology, we wanted to find out how this translated into their real commitment in the area of professional training.

The second problem was related to more reliable measure of ICT application involving detail count of specific business processes supported by ICT within a small business. It was expected that an SME with more extensive record of internal training and education both in terms of hours as well as variety of forms and more positive learning outcomes would exhibit significantly higher level of ICT implementation across its business processes.

Two null hypotheses have been formulated:

Ho: Size of a business (measured in number of employees and revenue) has no impact on ICT related professional training and learning activities measured in hours of training and diversity of formats.

Ho: There is no correlation between intensity of ICT training and number of business processes within SME supported by Information Technology.

We have collected our sample and conducted statistical analysis with hope of rejecting both null hypothesis and prove a strong relationship.

Sample: SMEs of Central California

The focus of this study was on SMEs – Small and Mid size Enterprises. Small and medium sized enterprises count for 99% of all businesses in the EU and about 98% in the US, and the term ‘SME’ consequently covers a wide range of business types, from the self-employed through to multinational public limited companies with up to 250-500 employees. This definition is not yet well developed and is used here in a broad term.

For instance – there are some difference between SME definitions used in EU countries and US. Also, the World Bank Group is defining SMEs in the following way: “micro enterprise-up to 10 employees, total assets of up to \$100,000 and total annual sales of up to \$100,000; small enterprise-up to 50 employees, total assets of up to \$3 million and total sales of up to \$3 million; medium enterprise-up to 300 employees, total assets of up to \$15 million, and total annual sales of up to \$15 million.”

Our sample included also some local businesses with number of employees above 500 even though they did not really qualify under above mention definitions of SME. We have decided to include them, especially when they constituted quite independent economic entities and were clearly not a part of a large corporation. This decision has been made for the purpose of better capturing impact of such variable like size of the business on company’s learning and training activities.

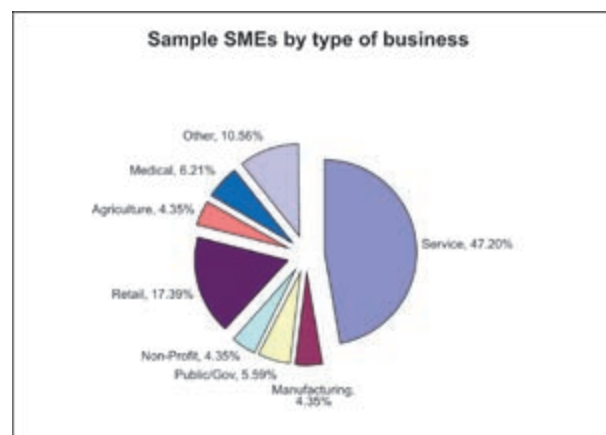


Fig. 1 Types of businesses represented in the sample of n=161 SMEs



Our sample included n=161 small and mid size enterprises located in the Central California. It represents a relative broad intersection across different type of business with Service (47%) and Retail (17%) as two largest categories (see Fid. 1 above).

Research Methodology

An instrument has been designed as an extension of a previously used ICT survey of SMEs where specific questions were added regarding: number of hours of training per employee per year, perception of learning outcomes, and forms of professional training used by the company. The survey was conducted as a mandatory assignment of business students during a graduate MIS course. This resulted in a response rate close to 95%.

In addition to learning and training related questions the survey included also numerous questions about the overall level of used ICT. Those included simple questions about number of PCs as well as questions about list of business processes supported by IT.

Descriptive statistics was used to get an overall picture of collected data. The sample was then divided into three categories by size of SMEs (micro, small, and medium) and Chi Square Analysis has been conducted to verify statistical significant of relationship between variables defined in the hypothesis described above. Correlation test was also used in this analysis to determine the strength and also type (sign) of relationship between such variables as size and quantity of provided training.

Research Results

The first part of hypothesis No.1 implying no increase in intensity of ICT training with increase of the size of the company has been partially rejected with analysis of descriptive statistics obtain from our data (see table below). No detailed test for independence has been conducted due to substantial difference in size of data subsets with most of data falling into a category "small business" with under 100 employees. Nevertheless, analysis of descriptive statistics presented below indicates almost 50% increase in the mean number of applied ICT training hours between small and mid size businesses, with less significant increase in the number of ICT supported business processes.

Tab. 1 Analysis of IT supported BP and hours of Training by Size of Business

Size of business	Average Number of Used Business Processes	Number of ICT Supported Business Processes	Hours of Training per Employee / per Year
Small (<100)	4.6	3.67	58.4
Medium (100<n<500)	5.1	4.11	112.5
Large (>500)	6.36	5.5	120

The second part of hypothesis No.1 regarding lack of impact of size of business on diversity of formats in delivery of ICT training could not be rejected. A contingency table has been constructed with two factors: size (S, M, and L) and format of training (with 5 categories from most traditional one-on-one training to e-learning).

Tab. 2 Chi-square Contingency Table for Business Size and Form of Training

	E-Learn	Workshops	Hiring	Ed. Institute	1-on-1	Other
S	41	47	42	22	103	11
M	8	9	8	5	13	1
L	7	5	6	4	9	2
Total	56	61	56	31	125	14

Performed Chi-square analysis yield value of Chi-square = 4.40 with the p-value = 0.927 and the coefficient of contingency merely 0.113. Even though one-on-one training seemed to be more typical of smaller businesses, the difference was not statistically significant. This could be caused by today's universally broad access to a diverse professional training offer.

The second hypothesis implying lack of correlation between number of hours of training / learning offered by the small business and intensity of ICT applied to used business process had to be accepted due to obtained coefficient R-square = 0.1328 indicating a relatively weak correlation between these two variables (see Fig. 2 below). Even though an increasing trend ICT support for business process is evident as the number of training hours increase, this relationship is far from strong and statistically insignificant. One of the reasons could be that in the process of collecting data nowhere did we ask question about complexity of ICT solutions applied. This would mean that use of a simple home grown website would carry the same weight as sophisticated billing system. Whereas the latter one would most likely required extensive training, the first one could be done without or with

a minimal training. At the same time e-learning form of training, which is very economical but requires certain minimum level of computer literacy among learners was used in only 31.5% cases among small businesses, 42.1% of cases among mid size and 63.3% of cases among large corporations. This puts SMEs at a permanent disadvantage that needs to be overcome with increasing overall computer literacy of their employees to better utilize Internet technology for professional training and development.

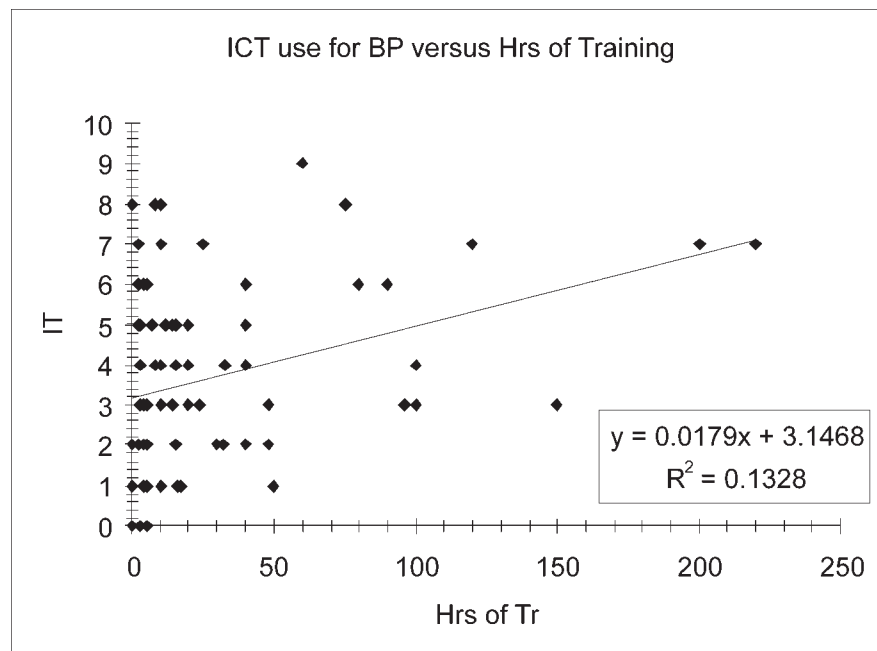


Fig. 2 Relationship between ICT supported processes and hours of training

Finally, it has also been noted that the larger is the number of identified business processes in a given small business the higher is the percentage of processes supported with ICT based solution. Even though such outcome is to be expected, it is worth of noticing that it implies an increasing need for ICT training with the growth of business, since it means often more sophisticated operation covering more business processes.

Conclusion

It seems evident that in this knowledge driven economy small and mid size enterprises (SMEs) are being left behind on a wrong side of Digital Divide. A shift in identification of main barriers from lack of funds and access to ICT toward lack of knowledge and education is likely to put learning and education in the center of SMEs' attention. There is some evidence of increased interest in providing learning and training to SME's employees with the business size increase but surprisingly, it does not necessarily transfer into statistically significant increase in number of business processes supported by ICT. This could be caused by the general definition of ICT supported business process, which does not measure level of its complexity. Additional study may be needed to explain further this relationship.

Additionally, as modern formats of learning such as e-learning are becoming increasingly popular and economic – it seems that SMEs are lagging behind in embracing it. Even though smaller samples of data about mid size and large companies prevented us from showing statically significant dependence between size and a format of training, difference in percentage use of e-learning between small and large companies warranties a need for additional detailed study.

Finally, it seems necessary to shed some light on an issue of a gap between SMEs self-admitted realization regarding lack of knowledge and education as major barriers to implementation of ICT and lack of commitment to follow up with action. Whereas education and training seems to be the major means for SMEs to close Digital Divide and dramatically increase their productivity, we yet have to see some evidence of a strong commitment to continuous employees learning and training effort, which would be independent of size of the company.

References

- Ackoff, R., Sheldon, R., *Redesigning Society*, Stanford Business Books, 2003, p.84
- Bassi, L., McMurrer, D., "Maximizing Your Return on People", *Harvard Business Review*, March 2007, pp. 115-123
- Dolnicar, V.; Vehovar, V.; Sicherl, P., "Benchmarking digital divide: definitions used and methods applied," *Information Technology Interfaces, 2004. 26th International Conference on*, vol., no.pp. 421- 426 Vol.1, 7-10 June 2004
- Extract from the 96/280/EC: *EU Commission Recommendation of 3 April 1996 concerning the definition of small and medium-sized enterprises*, EU Reports Publishing

- Gregorio, D.Di.; Kassicieh, S.K.; De Gouvea Neto, R., "Drivers of E-business activity in developed and emerging markets," *Engineering Management, IEEE Transactions on*, vol.52, no.2pp. 155- 166, May 2005
- Hodgins, W., 2002. "Learnativity: Into the Future", in *The ASTD e-Learning Handbook*, edited by Allison Rossett, McGraw Hill, NewYork, pp.38-57
- Holmes, N., "The digital divide, the UN, and the computing profession," *Computer* , vol.36, no.12pp. 142- 144, Dec. 2003
- Husing,T.; Selhofer,H; Korte, W.B.; "Measuring the Digital Divide: A proposal for a new index", *Proceedings of IST Conference, Empirica, Dusseldorff*, December 2001
- Jones, A., Issroff, K, Scanlon, E., Clough, G., and McAndrew, P., *Using mobile devices for learning in Informal Settings: Is it Motivating?*, Paper presented at IADIS International conference Mobile Learning. July 14-16, Dublin. (about motivational aspect of m-learning)
- Moran, J.V., Allerton, H., "Top Ten e-Learning Myths", *Training and Development*, American Society of Training and Development Publishing, September 2000
- Papazafeiropoulou, A.; Pouloudi, A., "Applying the normative aspect of stakeholder analysis to electronic commerce diffusion: stakeholder consideration for the elimination of the digital divide," *System Sciences, 2003. Proceedings of the 36th Annual Hawaii International Conference on Systems*, pp. 6 pp.-, 6-9 Jan. 2003
- Peters, O., *Learning and Teaching in Distance Education*, Kogan Page, London, 2004
- Sharples, M., "The design of personal mobile technologies for lifelong learning", *Computers and Education*, vol. 34, pp.177–193, 2000.
- Warschauer, M., "Demystifying the Digital Divide", *Scientific American*, August 2003, pp.45-47
- Wielicki, T." Study of Digital Divide: measuring ICT utilization and implementation barriers among SMEs of Central California", *Proceedings of International Conference on Business Information Systems – BIS 2006*, Klagenfurt, Austria, 2006