

ICT diffusion and usage among Asian small and medium sized enterprises: Institutional factors, infrastructures and post-adoption behaviour

Paper for the conference: “*SME – Entrepreneurship Competitiveness, Challenges and Prospects in the New Global Environment*”. Sunway Lagoon Resort Hotel, Selangor, Malaysia, 17-18 October 2006.

John Willy Bakke, Marianne Jensen, Siri Johanne Nilsen, Petter Nielsen, Gjermund Hartviksen, and Kristin Thrane.
Telenor R&I, Snarøyveien 30, N-1331 Fornebu, Norway.

Corresponding author: John W. Bakke: Phone: +47 900 13 621; E-mail: john-willy.bakke@telenor.com

Abstract

The paper argues that the study of ICT usage among small and medium sized enterprises benefits from a combination of methods, including diffusion studies, institutional analyses, and studies of post-adoption behaviour.

Keywords: Diffusion models, infrastructure, domestication, small and medium sized enterprises, SME, ICT.

Introduction

It is generally accepted that small and medium sized enterprises (SMEs) have a vital role in national and regional economies. The SMEs constitute an important sector in its own right, embedded in regional, national, or even international networks of activities; they are providers or subcontractors for large companies; they serve as hot-beds for entrepreneurship; and they are seen as vehicles for development. Studies show that SMEs are important within national economies: Numerically, SMEs dominate the population of companies, and they tend to employ a major share of the working force, although their contribution to measures like the gross national product tend to be at a disproportional lower level.

It is further acknowledged – almost as a truism – that information and communication technologies (ICTs) are central for the functioning of companies, including the SMEs. These sets of commonly accepted truths are, however, at a very high level of generality, and only of modest help for an understanding of actual processes within populations of enterprises. There is a range of studies showing that diffusion processes and usage patterns differ considerably. To get an explanation of the widely different diffusion processes observed, and a better understanding of the mechanisms whereby ICTs are important for the companies, it is necessary to go beyond aggregated data analyses, and explore in greater detail how ICTs are deployed within and among companies, and to study the institutional framework within which corporate decisions of adoption and usage are made.

The goal of this paper is to explore factors and mechanisms for ICT diffusion and usage processes, with an emphasis on institutional factors, infrastructures and post-adoption behaviour. The discussion is methodologically oriented, providing empirically motivated arguments for the combination of perspectives. It is based on case studies of ICT usage among SMEs within three Asian markets: Bangladesh, Malaysia, and Pakistan. In all of these markets, representatives from selected SMEs were interviewed, in order to get a richer picture of usage patterns, reasons for choice of telecom subscriptions, and use of ICTs in their value chains. Further, representatives from selected governmental and non-governmental institutional actors are interviewed, to get a picture of supportive measure for the SME segments.

Small and medium sized enterprises and ICTs

Small and medium sized enterprises are getting recognition for being key elements in national and international economies, as expressed in the *Proposed ASEAN Policy Blueprint for SME Development*:

SMEs remain the largest source of domestic employment in most developed countries, and of non-agricultural employment virtually in all developing economies. (...) Moreover, they are an important vehicle for empowerment and participation -- especially of women, the young and other disadvantaged social segments. (Asasen, Asasen, and Chuangcham 2003).

Information and communication technologies are seen as crucial for the further development of SMEs – as for other companies – since ICTs to an ever increasing degree are being incorporated in the corporate infrastructure for

ordering and marketing, and as instruments for organizational functioning. This acknowledgement has also been translated into plans and activities for the dissemination of ICTs, both in the form of ICT vendors' offerings to the SME segments, and in public programmes for SME development, as exemplified in the quote from the *Ninth Malaysia Plan*:

[P]rogrammes will be expanded to help boost the entrepreneurial and technical capability of SMEs including through the application of ICT and e-commerce. (Ninth Malaysia Plan. Issue 1.16)

In these general, policy-oriented statements, it is, however, rarely elaborated what to be included in the 'ICT' - category. Neither – and most importantly – are the mechanisms elaborated whereby ICTs influence the ways SMEs function and prosper.

Diffusion perspectives

ICT usage at an aggregate level is often described through penetration rates and other figures provided within the perspective of *diffusion studies* (see Rogers 1995). Rogers defines diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers 1995: 5), where the ‘innovation’ can be anything that is seen as new, from the perspective of the adopters.

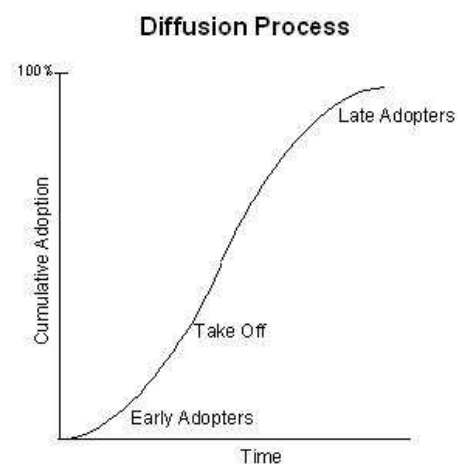


Figure 1: Diffusion curve. Based on Rogers (1995).

This understanding of diffusion processes, with the associated S-curves of the cumulative adoption of the innovation, has become a successful, almost pervasive perspective on how ‘things’ are adopted – in particular within mass markets; and ‘diffusion curves’ (see Fig. 1) and ‘penetration rates’ have become the common language for describing the dissemination of innovations; both through snap-shots of the current state of affairs, as shown in the table of Asian mobile penetration rates (see Table 1), and through time series data, as shown in the figures of penetration rates for digital mobile telephony in developed and developing countries (see Fig. 2). (Here, only the left part of the curve is depicted, as the (assumed) saturation level is not yet reached.)

	Mobile Penetration (2005)
Hong Kong	118.5%
Singapore	97.7%
Australia	96.1%
Taiwan	92.4%
Korea	79.1%
Malaysia	74.1%
Japan	70.3%
Thailand	46.9%
Philippines	42.7%
China	30.2%
Indonesia	22.3%
Pakistan	14.1%
Vietnam	10.3%
India	7.0%

Table 1: Asian Mobile penetration rates. Source: Business Monitor International, May 2005.

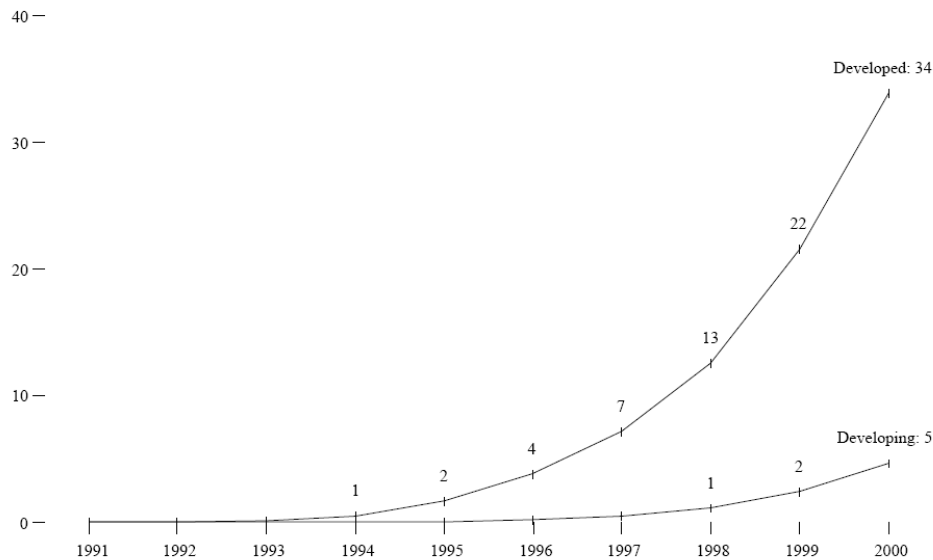


Figure 2: Average penetration rates of digital mobile telephony in developed and developing countries. Source: Rouvinen (2004).

The diffusion perspective is important, since the penetration level provides an important context for further adoption, since there is a huge difference between being an early adopter or pilot user, and being an adopter of a commonly accessible, state-of-the-art innovation. The perspective also represents one major perspective for developing assumptions and predictions for future developments, and thereby serves as a platform for making strategic decisions, e.g. for actors wanting to position themselves as suppliers to the SME market.

The diffusion perspective provides important information about current usage, since it provides a basis for comparisons across time and space. Whereas diffusion rates may be read as purely descriptive figures, there is often an underlying assumption that future diffusion processes, in other populations, will follow similar patterns. This assumption does not, however, fully acknowledge that diffusion processes take place within distinctively different frameworks.

Extending and criticizing the diffusion perspective

The success of the diffusion perspective as a compact way of describing the adoption of innovations has to a certain extent also been a source of misunderstanding, since the assumptions on which the perspective is founded, are often overlooked or forgotten. Hence, it is easy to forget the biases of the approach, and the limitations in terms of what the perspective is able to provide.

The diffusion perspective is developed when studying the aggregate results of individual's adoption of innovations. Within this perspective, it is assumed that each potential adopter individually makes the decision whether or not to adopt, that the 'innovation' is distinct and discrete, that it is easy to know whether or not the innovation is adopted, and where the decision to adopt has a degree of permanence (see Rogers 1995).

Some other major challenges for diffusion modelling are:

- The saturation level is externally given. The diffusion process can level out after reaching only a few percent of the population, or one can grow to more than 100% of the population (as in the case of mobile telephones, since people may have more than one subscription).
- The steepness of the S-curve cannot be determined within the model
- The time-frame and the timing of the 'take-off' are externally given. (This may be exemplified by the diffusion of faxes, where the original invention was patented more than hundred years ago – even before the telephone was invented (!), whereas the period of fast growth was in the 1980s and 1990s.)
- The model does not cover the demise of innovations. (Faxes may again serve as a good example, as they now are becoming rare.)
- For technological innovations, the unit of diffusion – the innovation – is typically not unchanged throughout the diffusion process. Mobile telephones, for instance, have changed much during the diffusion period in terms of characteristics, capacity and design, as well as extra features, such as camera, GPRS, 3G, radio, WLAN, ...
- There is no basis for assuming that diffusion patterns observed within one population will be replicated within other populations; since institutional support for the innovations may differ (see below), innovations may become obsolete, and a number of other factors may make diffusion processes distinctively different. Nevertheless, extrapolations of diffusion curves, and assumptions of analogous diffusion patterns abound – *in casu* in assumptions that 'developing markets' will experience the same patterns as the 'mature markets'.

Another challenge for the diffusion perspective is the acknowledged 'pro-innovation bias' of diffusion theory (Rogers 1995: 100ff) – as can be read from the strongly biased category label 'laggards'. Still another challenge is that it has characteristics of the individual adopters (and potential adopters) – in particular their innovativeness – as main explanatory variables. In applications of this approach, it may be difficult to know if the degree of innovativeness is externally given, or if the pro-innovation bias is taken to the extreme, where the willingness to, or reluctance against adoption of the innovation in question is taken as indicator of innovativeness.

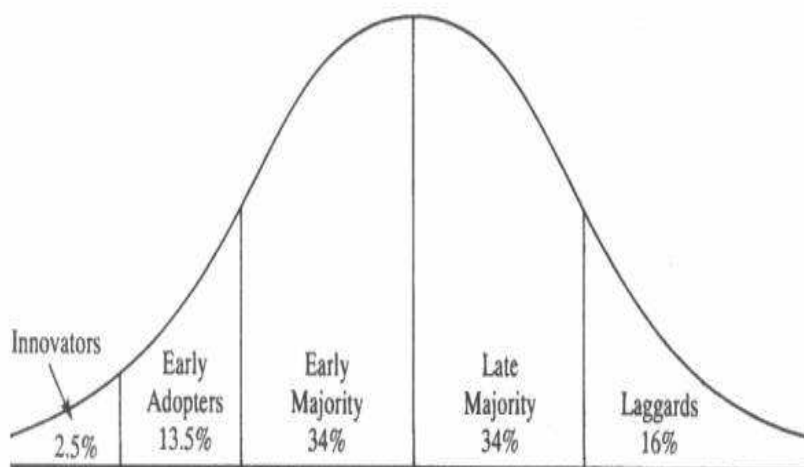


Figure 3: Adopter categorization on the basis of innovativeness. Adapted from Rodgers (1995: 262)

Beyond the diffusion perspectives: Towards an institutional understanding of diffusion processes

When studying diffusion processes among individuals, there may be challenges in identifying the ‘unit of adoption’, since adoption decisions are not taken in isolation. Identifying the ‘unit of adoption’ and describing its characteristics is even more difficult when the units are companies, not individuals; since companies are so different in size, turnover, and type of industry, and since decision makers in companies make decisions on behalf of others. There are also a large number of other institutional bodies that make active efforts to influence and shape the diffusion processes:

A realistic view of how information technology spreads in a society has to draw upon the institutional matrix in which such technology is created, standardized, justified, deployed, modified, priced, and promoted. (Dholakia, Bakke, and Dholakia 1996).

One crucial factor for the diffusion of certain classes innovations is the existence of a necessary infrastructure, since a large number of innovations cannot be used (and hence cannot be diffused) without the proper network of support. – An illustration from the car industry is that it is difficult to conceive the success of private car usage without the standardization of cars in terms of user controls (accelerator, brake pedals, switches for lights, and so on), or the existence of an extensive network of car outlets, high quality roads, petrol stations, car repair shops, car driver training schools, and a myriad of other factors.

Similarly, ICTs are technologies that typically cannot be used without access to electricity and to fixed line / mobile / internet network. There is also a need to access the infrastructure of support and service, if the ICT product, or the infrastructure fails (see also Curwen 2004). Further, ICTs are often repeat-buy acquisitions, where the access to ‘soft infrastructures’ of retailers (e.g. for telecom scratch cards), of financial services (e.g. for credit assessment), and a well functioning postal system (e.g. for mailing telecom bills) are prerequisites for the dissemination processes to take place. There is also a mutual interrelation between infrastructure development and diffusion, since diffusion depends on infrastructures, and infrastructure development depends on expected diffusion; an interrelation that can lead to ‘catch 22’-like situations, where actors may wait for each other, or where there are investments in over-sized infrastructures.

Still another major institutional issue for the development of SMEs is the access to appropriate financing, as it has been argued: “Improving access to finance for the SMEs is perhaps the single most important limiting factor to the growth of small enterprises in Bangladesh” (Cookson 1998). The need for financial services is addressed through the growth of SME-oriented banks and financial institutions, as well as public programmes and SME funds (see <http://www.smeda.org.pk/>; <http://www.smidec.gov.my/>, <http://www.bscic.gov.bd/>). Within the area of ICT usage for SMEs, authorities and others try to promote the success of SMEs by providing information and other forms of support for entrepreneurship – especially through financial support for entrepreneurship and SMEs – thereby trying to enlarge the population of SMEs within which the diffusion of technologies takes place. They also attempt to establish meeting places for SMEs and their customers and suppliers, and to influence the diffusion processes directly. Examples from the case studies include the aforementioned Ninth Malaysia plan, and the Malaysian establishment of a central coordinating body for SME policy formulation within the central government; the provision of SME loans and funds; and the establishment of web-pages for SMEs and entrepreneurs. Certain measures were aiming at the actual and potential population of general SMEs, others were aiming at specific segments of the SMEs, such as funds for *Bumiputera* SMEs for ethnic Malays and other indigenous ethnic groups in Malaysia (see Bank Negara Malaysia 2006), and the establishment of an information portal for female entrepreneurs in Pakistan (<http://www.win.org.pk/index.php>).

Post-adoption behaviour

Since the dependent variable in diffusion studies is whether or not a unit has adopted an innovation, the diffusion perspective typically does not address what happens after a decision to adopt, or not to adopt has been made. For ICTs and for a series of other innovations, it is the usage *after* adoption that makes the adoption influential. – There is a huge difference between having a mobile phone subscription for occasional conversations, and using it as a main instrument for communication with colleagues and contacts in the distribution channel. And there is a wide range of studies showing that usage patterns after adoption differ considerably.

To get a better understanding of the mechanisms whereby ICTs are important for the companies, it is necessary to supplement the aggregated data analyses, and explore how ICTs are deployed within and among companies, after the

decision to adopt has been made; including studies of how ICTs are incorporated in the SMEs' value chains and their day-to-day behaviour. – This disaggregated approach is grounded in studies showing how ICT adoption and adaptation involves a large degree of user customization and domestication in the processes of making technologies one's own (see Silverstone, Hirsch, and Morley 1992; Bakke 1996; Luff, Hindmarch, and Heath 2000; Ling 2004).

The case study shows fairly simple usage patterns of ICTs, with mobile voice telephony as a major application, together with short messaging (SMS). Further, there was a predominance of post-paid mobile phone subscriptions, often with the pattern of pre-paid subscriptions for employees, post-paid for management. The SMEs showed a lower degree of involvement with PCs.

The case studies also showed that choice of mobile operator was not a decision made in isolation: Often entire networks of companies (suppliers, corporate partners, alliance partners) and family members chose to subscribe to the same operator in order to get lower rates for calling within the operator's network. This pattern of behaviour directly challenges the assumption in the diffusion model of having individual, almost atomized decision makers.

An institutional factor identified within the project is the lack of number portability within the area of mobile subscriptions. Having the phone number locked to the current operator has led to a high degree of – imposed – mobile operator loyalty, due to the perceived costs and expected hassles of with changing phone numbers on business cards and advertisements, informing business contacts and public authorities, and so on and so forth. This lock-in due to the lack of number portability was seen by public authorities as an impediment for competition in the area of mobile telephony, and the formulation of policies for the introduction of number portability as a way of strengthening competition and lowering telecom prices. (Also described as 'lack' from the perspective of the authors from a country where number portability was introduced several years ago, and where a substantial share of the subscribers switch operator each year).

End-users do not have corresponding possibilities to formulate policies or impose regulations; instead, certain patterns of individual behaviour may be seen as responses to these rigidities, such as the observed pattern of behaviour of having multiple mobile phone subscriptions (often multiple phones), each with its own SIM card. Thereby, they were able to switch operator according to price plans throughout the day, or according to the operator with which the called party subscribed.

Of great importance is also the finding that the respondents showed different degrees of competitiveness and ambitions for economic performance; what is usually called 'professionalism' or 'entrepreneurial spirit'. Some intended their SME to grow, whereas others reported to be happy with a steady flow of business. This, in turn, has profound implications for the (assumed) impact of ICT adoption and usage for corporate performance, and for their impact on national and regional economies. This serves also as an indication that the population of SME proprietors is heterogeneous, and that different SMEs almost can be seen as different 'species' with different 'lifecycles' in corporate 'ecosystems'.

Implications

This methodologically oriented discussion, based on case studies in three Asian markets, points towards one major implication: The need to study SMEs on their own terms – in their diversity, and within their national and international markets; not as substandard large companies, as irregular (mass market) individuals, or as not-yet mature versions of what is found in Western countries. Another major implication is the need to supplement diffusion figures with studies of actual usage, and studies of the institutional framework within which enterprises make decisions about adoption and usage. These approaches will also inform the interpretation of the diffusion figures.

Instead of looking at the enterprises as isolated units, it seems appropriate to look at them as located within the corporate networks or 'ecosystems', within which they compete and interact. Such an ecological perspective may be developed, where the SMEs show different levels of competitiveness or professionalism, where some aim for economic growth, others are satisfied with upholding a stable economic performance.

There is also a need to strengthen the knowledge base for SMEs within national statistics – as is forcefully addressed in the Malaysian *Small and Medium Enterprise (SME) Annual Report 2005* (Bank Negara Malaysia 2006). More

detailed studies of SMEs, their role in the economy, and their ICT needs and behaviour are also needed; in particular when the goal is to have the SMEs playing a more vital role in the economy.

References

- Asasen, C, K. Asasen, and N. Chuangcham (2003): *A Proposed ASEAN Policy Blueprint for SME Development 2004-2014*. REPSF Project 02/005. http://www.aseansec.org/pdf/sme_policies_1.pdf. (Accessed July 13th, 2006).
- Bakke, J.W. (1996): "Technologies and interpretations: The case of the telephone", *Knowledge and society*, vol. 10. Greenwich: JAI Press.
- Bank Negara Malaysia (2006): Small and Medium Enterprise (SME) Annual Report 2005. <http://www.bnm.gov.my/index.php?ch=103&pg=456&ac=526&yr=2005> (accessed Sept. 25, 2006).
- Cookson, F. (1998): *Credit Information in the Bangladesh Financial System*. University of Maryland at College Park.
- Curwen, P. (2004): *Telecommunications Strategy: Cases, Theory and Applications*. London: Routledge.
- Dholakia, N., J.W. Bakke, and R.R. Dholakia (1996): "Institutional Patterns of Information Technology Diffusion". In: Russell Belk, Nikhilesh Dholakia, and Alladi Venkatesh (eds). (1996). *Consumption and Marketing: Macro Dimensions*. South-Western College Publishing.
- Ling, R. (2004): *The Mobile Connection: The Cell Phone's Impact on Society*. San Francisco: Morgan Kaufmann Publishers.
- Luff, P., J. Hindmarsch, and C. Heath (eds.) (2000): *Workplace Studies: Recovering Work Practice and Informing System Design*. Cambridge: Cambridge University Press.
- Ninth Malaysia Plan*. The Economic Planning Unit, Prime Minister's Department, Putrajaya, 2006. <http://www.epu.jpm.my/rm9/html/english.htm>. (Accessed July 13th, 2006).
- Rogers E.M. (1995): *Diffusion of Innovations*. New York: Free Press.
- Rouvinen, P. (2004): "Diffusion of Digital Mobile Telephony: Are Developing Countries Different?". World Institute for Development Economics Research (WIDER): Research Paper No. 2004/13. <http://www.wider.unu.edu/publications/rps/rps2004/rp2004-013.pdf>. (Accessed July 13th, 2006).
- Silverstone, R., E. Hirsch, and D. Morley (1992): "Information and communication technologies and moral economy of the household". Pp. 15 - 31 in R. Silverstone and E. Hirsch (eds.): *Consuming Technologies: Media and information in domestic spaces*. London: Routledge.